NATIONAL INTEGRATED MICRONUTRIENT AND ANTHROPOMETRY SURVEY OF THE KYRGYZ REPUBLIC 2021 (NIMAS)

REPORT
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The National Integrated Micronutrient and Anthropometry Survey of the Kyrgyz Republic (NIMAS) 2021 was accomplished thanks to commitments in the form of technical or financial support from several national and international stakeholders:

- The Ministry of Health of the Kyrgyz Republic (MoH) supported the implementation of the survey through selection and deployment of medical workers, sensitization activities and facilitated access to the MoH's infrastructure.
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ABBREVIATIONS

AG	Adolescent girls
AGP	α-1-acid glycoprotein
BMI	Body mass index
BRINDA	Biomarkers Reflecting Inflammation and Nutritional Determinants of Anemia
CBC	Complete Blood Count
CI	Confidence Interval
CRP	C-reactive protein
DHS	Demographic and Health Survey
ELISA	Enzyme linked immunosorbent assay
HAZ	Height-for-age z-score
HH	Household
HPLC	High-pressure liquid chromatography
ID	Iron Deficiency
IDA	Iron Deficiency Anemia
IYCF	Infant and young child feeding
MICS	Multiple Indicator Cluster Survey
MoH	Ministry of Health
MUAC	Mid-upper arm circumference
NIMAS	National Integrated Micronutrient and Anthropometry Survey of the Kyrgyz Republic
NPW	Non-pregnant women (15-49 years)
ppm	Parts per million
PSC	Children 6-59 months of age
PSU	Primary sampling unit
PW	Pregnant women
QC	Quality control
RBP	Retinol-binding-protein
RTK	Rapid Test Kit
SAC	Children 5-9 years of age
UNICEF	United Nations Children's Fund
US CDC	US Centers for Disease Control and Prevention
VAD	Vitamin A Deficiency
WAZ	Weight-for-age z-score
WHO	World Health Organization
WHZ	Weight-for-height z-score

EXECUTIVE SUMMARY

Introduction

In the Kyrgyz Republic, the overall nutrition situation among children under 5 years of age has improved over the past two decades. Prevalence of stunting, wasting and underweight has decreased by 30-50 percent between 2006 to 2018. Prior to 2021, data on micronutrient status and anemia were either outdated or entirely missing for children 6-59 months of age, children 5-9 years of age, adolescent girls, and women of reproductive age. The limited data available, however, depict a situation of high prevalence of anemia and iron deficiency in children and women as well as a high prevalence of folate deficiency in women. Furthermore, country data on the prevalence of other micronutrient deficiencies, such as vitamin D, were entirely lacking. In order to increase the understanding of the severity of micronutrient deficiencies and help design evidence-based nutritional intervention programs for nationwide implementation, the Ministry of Health, UNICEF and other stakeholders have conducted the National Integrated Micronutrient and Anthropometric Survey in the Kyrgyz Republic (NIMAS 2021).

Aim and objectives

The overall aim of the NIMAS was to obtain updated and reliable information on the current micronutrient and nutrition situation of several target groups living in the Kyrgyz Republic.

The objectives of the NIMAS included assessing the nutritional and micronutrient status of specific subgroups of the Kyrgyz population, evaluating infant and young child feeding (IYCF) practices, assessing the relative importance of selected likely causes of anemia, estimating the consumption of fortified foods and proportion of fortified and adequately fortified foods.

The target population groups of the NIMAS were children 6-59 months of age (PSC), children 5-9 years of age (SAC), adolescent girls 10-18 years of age (AG), non-pregnant women of reproductive age 15-49 years (NPW), and pregnant women (PW). Data was collected from all pregnant women when encountered in selected households, but their small number precluded stratum-specific conclusions. For the other target groups, most of the indicators measured were representative at the national level and for each of the 9 survey strata. Stratification was based on the 7 regions of the Kyrgyz Republic and the two cities of Bishkek and Osh.

Key nutrition and micronutrient indicators were: anemia prevalence in PSC, SAC, AG, NPW and PW; prevalence of iron deficiency (including iron deficiency anemia) and vitamin A deficiency in PSC, SAC, AG and NPW; vitamin D deficiency in PSC, AG and NPW; folate deficiency among AG and NPW; and iodine status in AG, NPW and PW. Other nutrition indicators of interest included prevalence of stunting, wasting, underweight and overweight among PSC; stunting, underweight, overweight and obesity in SAC and AG, underweight, overweight and obesity in NPW and acute malnutrition in PW. Further, adequacy and coverage of iodized salt and of iron fortified wheat flour was assessed.

Design

The NIMAS 2021 was designed as a national cross-sectional survey with 9 geographical strata. The primary sampling units (PSUs) from the 2018 Multiple Indicator Cluster Survey (MICS) served as the sampling frame for the NIMAS 2021. A two-stage sampling procedure was used to randomly select households, and subsequently children, adolescent girls, and women.

In the first stage of sampling, the NIMAS used a sub-sample of the PSUs included in the 2018 MICS. Within each stratum, the number of MICS PSUs selected for NIMAS 2021 were allocated to urban and rural sub-strata proportional to the population of each stratum. Selection of PSUs was done using equal probability simple random sampling. Such proportional sub-stratification increased the precision of stratum-specific estimates. Due to differences in household size and composition between the oblasts, stratum specific sample sizes were calculated based on household size and composition reported in the MICS 2018. Thus, different numbers of PSUs were randomly selected from the MICS PSUs for each stratum: Bishkek: 37; Batken: 22; Chui: 25; Jalal-Abad: 25; Naryn: 23; Osh: 24; Talas: 20; Issyk Kul: 27; Osh City: 28. This resulted in 231 PSUs selected for the entire survey sample. The second stage of sampling consisted of random selection with equal probability of 15 households in each selected PSU. The NIMAS 2021 recruited all PSC, SAC, AG, and PW from all selected households. However, NPW 19-49 years of age were included from 50% of households, as this yielded a sufficiently large sample size.

Results

In this executive summary, only national estimates are presented, and Table 1 refers the reader to the corresponding table in the report for more detailed results.

Table 1. Summary results of the NIMAS 2021

Target group	Indicator[a]	Result	Table[b]
Household			
	Food insecurity	29.6%	Table 11
	Iodized salt	98.2%	Table 15
	Adequately iodized salt (≥15 ppm)	75.6% c	
	Iron fortified flour	24.1%	Table 18
	Adequately iron fortified flour[d]	1.7% c	
Children 6-59 months of age (unless otherwise indicated)			
	Ever breastfed (6-23 months)	96.9%	Table 23
	Early initiation of breastfeeding (6-23 months)	91.8%	
	Exclusive breastfeeding for first two days after birth (6-23 months)[e]	77.1%	
	Introduction of solid foods (6-8 months)	74.5%	
	Minimum dietary diversity (6-23 months)	26.2%	
	Minimum meal frequency (6-23 months)	64.3%	
	Minimum acceptable diet (6-23 months)	15.3%	
	Bottle feeding in the past 24h (6-23 months)	50.0%	
	Stunting	7.0%	Table 27
	Wasting	0.8%	Table 28
	Overweight or obese	7.3%	Table 29
	Underweight	0.7%	
	Small head circumference	1.3%	
	Anemia	20.9%	Table 30
	Iron deficiency	47.0%	
	Iron deficiency anemia	15.0%	Table 30
	Vitamin A deficiency	15.0%	Table 31
	Vitamin D deficiency (subsample)	5.0%	Table 32
	Vitamin D deficiency or insufficiency (subsample)	25.4%	
Children 5-9 years of age			
	Meets minimum dietary diversity	70.2%	Table 40
	Short stature	4.3%	Table 42
	Thinness	1.4%	Table 43
	Overweight or obese	13.8%	
	Underweight	2.6%	Table 44

	Anemia	7.8%	Table 45
	Iron deficiency	29.2%	
	Iron deficiency anemia	4.5%	
	Vitamin A deficiency	16.0%	Table 46
Adolescent girls (10-18 years)			
	Meets minimum dietary diversity	68.6%	Table 52
	Short stature	2.9%	Table 54
	Thinness	2.4%	Table 55
	Overweight	10.8%	
	Obese	3.7%	
	Overweight or obese (combined)	14.5%	
	Anemia	14.6%	Table 56
	Iron deficiency	46.5%	
	Iron deficiency anemia	12.7%	
	Vitamin A deficiency	7.1%	Table 57
	Folate deficiency	83.6%	Table 58
	Vitamin D deficiency (subsample)	8.6%	Table 59
	Vitamin D deficiency or insufficiency (subsample)	39.3%	
	Urinary iodine median (µg/L)	175.1	Table 60
Non-pregnant women (15-49 years)			
	Meets minimum dietary diversity	69.5%	Table 68
	Underweight	5.8%	Table 70
	Overweight	27.2%	
	Obese	17.0%	
	Overweight or obese (combined)	44.3%	
	Anemia	25.3%	Table 71
	Iron deficiency	55.9%	
	Iron deficiency anemia	23.1%	
	Vitamin A deficiency	4.3%	Table 72
	Folate deficiency	83.2%	Table 73
	Vitamin D deficiency (subsample)	15.6%	Table 74
	Vitamin D deficiency or insufficiency (subsample)	51.1%	
	Urinary iodine median (µg/L)		
	Non-pregnant non-lactating women	167.19	Table 75
	Non-pregnant lactating women	134.26	Table 76
Pregnant women			
	Meets minimum dietary diversity	66.5%	Table 83
	Undernutrition (low MUAC)	6.9%	-
	Anemia	49.3%	Table 84
	Urinary iodine median (µg/L)	180.5	Table 85

[a] See text of method section for case definitions.

[b] Refer to the table indicated for more detailed analysis of the outcome, including group-specific results by age, region, wealth quintiles and other analyses.

[c] Denominators for "adequately iodized salt" and "adequately iron fortified flour" are all households that provided a sample

[d] Adequately fortified: iron EDTA >15ppm; ferrous sulfate, ferrous fumarate >60ppm

[e] Exclusive breastfeeding <6 months not included since age range (0-5 months) not part of the NIMAS

Discussion

- Household level data shows that food security is a notable problem in the Kyrgyz Republic, particularly in Issyk Kul, Naryn and Chui, where just about half of the households report to be food insecure and about every tenth household is severely food insecure. Food insecurity is mainly driven by poverty, which is reflected in the NIMAS data, as a large proportion of severely food insecure households are in the lowest wealth quintile.
- Salt was sampled from almost all households and analyzed qualitatively using a rapid test kit and quantitatively using the iReader device. Quantitative analyses show that about 98% of households use iodized salt (concentration ⩾ 5mg/kg or ⩾ 5ppm), 76% use adequately iodized salt (⩾ 15 mg/kg or ⩾ 15ppm) and about 23% of the households use inadequately iodized salt. If the higher cut-off set by the Kyrgyz government (40±15mg iodine/kg or 40ppm±15ppm salt) were applied, only about 31% of the households use adequately iodized salt.
- Almost all households had flour at home at the time of the NIMAS. More than half of the households reported using fortified flour (by perception) and about three- quarter of households with flour had flour in its original package, with nearly ½ of the packages stating that the flour was fortified. Nevertheless, only one quarter of all samples collected were fortified, and only 2% of samples were adequately fortified. Moreover, no significant difference in the proportion of fortified flour was observed between flour produced in the Kyrgyz Republic and imported flour.
- The NIMAS identified 7% of children 6-59 months of age as being stunted, so that stunting can be classified as a mild public health problem (2.5%- <10%) at the national level according to WHO classification. However, stunting is considered a problem with medium public health significance for certain sub-groups, such as children with low birth weight, children living in Batken, and children whose households are of the lowest wealth quintile, severely food insecure, had no adequate sanitation or no safe drinking water. Wasting and underweight in children 6-59 months of age living in Kyrgyzstan is rare with a prevalence of less than 1%. On the other hand, the prevalence of overweight and obesity in children 6-59 months of age can be classified as a problem with "medium" public health significance. The prevalence of overweight and obesity steadily increases with increasing age. It affects about 20% of adolescent girls aged 15-18 years, nearly 45% of non-pregnant women 15-49 years of age and more than 75% of women 45-49 years of age.
- Both anemia and iron deficiency are common in women and children 6-59 months of age in the Kyrgyz Republic. Anemia is considered a "moderate" public health problem in non-pregnant women and children 6-59 months of age and a severe public health problem in pregnant women according to the criteria published by the World Health Organization. Anemia is less common in children 5-9 years of age and adolescent girls, posing a "mild" public health problem. Compared to the micronutrient survey conducted in 2009, the prevalence in children 6-59 months of age decreased by five percentage points and increased by three percentage points in non- pregnant women. Iron deficiency has been identified in this survey as a strong putative risk factor for anemia in all population groups and a large proportion of individuals with anemia have concurrent iron deficiency. There is some evidence that vitamin A deficiency also contributes to nutritional anemia in children 5-9 years of age, adolescent girls and non-pregnant women. For children 5-9 years of age anemia was also found to be more prevalent in those with elevated inflammation markers indicating that anemia of inflammation and chronic disease also contribute to the overall anemia burden, but most likely to a lower extent than anemia due to iron deficiency.
- Vitamin A deficiency is present in all population groups and poses a mild public health problem in adolescent girls and non-pregnant women and a moderate public health problem in children. Compared to the micronutrient survey conducted in 2009, the prevalence in children 6-59 months of age and non-pregnant women increased by 11 and 4 percentage points, respectively. It is likely that the termination of the vitamin A supplementation program in 2011 and the discontinuation of the micronutrient powder program in 2018 led to the substantial increase in vitamin A deficiency prevalence from 2009 to 2021. While vitamin A status poses a mild to moderate public health problem nationally, the problem can be classified as severe in certain regions. Specifically, the problem is severe in children 6-59 months of age living in Bishkek and in children 5-9 years of age living in Chui and Osh City. Moreover, vitamin A deficiency is highly associated with elevated inflammation markers in children, adolescent girls and women, highlighting the important role of vitamin A in immune health.
- Folate deficiency is very high (>80%) in Kyrgyz adolescent girls and non-pregnant women. The high prevalence merits attention, particularly since folate deficiency is the main cause of neural tubes defects and increases the risk of preterm delivery, infant low birth weight, and fetal growth retardation.

- The prevalence of vitamin D deficiency in children 6-59 months of age is 5% and is higher among adolescent girls and non-pregnant women; 9% and 15% respectively. Similarly, the proportion of individuals with insufficient vitamin D status is lowest in young children and highest in non-pregnant women. Significant differences in the vitamin D deficiency or insufficiency prevalence were detected in children 6-59 months of age: About half of the children 6-11 months of age and half of the children living in the wealthiest households have suboptimal vitamin D status. Though vitamin D deficiency prevalence in the Kyrgyz Republic can be considered low, the high prevalence of young children with suboptimal status merit attention due to the important role of vitamin D in the processes of cell proliferation, differentiation, and maturation.
- Nationally, the median urinary iodine concentration in adolescent girls, non-pregnant (lactating and non-lactating) and pregnant women indicate adequate iodine status in all population groups. Though significant differences were observed for some sub-groups, only pregnant women residing in households in the highest wealth quintile and non-pregnant lactating women living in severely food insecure households, and those living in households using salt that was not iodized were identified with inadequate iodine status. However, the number of non-pregnant lactating women in the subgroup analyses is small and results will have to be interpreted with caution. Of note, pregnant women 15-19 years of age and non-pregnant adolescent girls living in Talas have a median urinary iodine concentration just below the threshold for being classified with excess iodine intake.

Strengths and limitations

- The NIMAS yields national and region-specific prevalence estimates for a variety of micronutrient biomarkers in children 6-59 months of age, children 5-9 years of age, adolescent girls 10-18 years of age, non-pregnant women 15-49 years of age and pregnant women, which will guide future decisions of national stakeholders and inform national nutrition programs.
- The NIMAS yielded satisfactory response rates for households (89%), children 5-9 years of age (78% for venous blood sample), adolescent girls and non-pregnant women (77% for venous blood sample). However, a relatively high refusal rate for blood sampling among children 6-59 months of age and some technical difficulties to successfully collect venous blood samples in children 6-59 months of age were experienced, which resulted in a slightly smaller number of children with blood sample (72%) than a priori estimated and thus slightly lower precision for stratum- and age-specific prevalence estimates than calculated a priori.
- The NIMAS included children 5-9 years of age and adolescent girls 10-18 years old in addition to children 6-59 months of age and non-pregnant and pregnant women, enabling for the first time to comprehensively assess nutritional status in those age groups. One challenge faced during the interpretation of the results was that for several blood biomarkers, no established thresholds exist for children 5-9 years of age and adolescent girls, thus thresholds from the literature were used, where available or, when lacking, thresholds from different population groups were applied.
- Quantitative analysis of salt iodine content allowed for a more accurate estimation of household coverage with adequately iodized salt than previous estimations. Moreover, it was possible to estimate the proportion of households using inadequately iodized salt.
- Similar to the 2009 micronutrient survey, the NIMAS collected venous blood samples, which removed potential pre-analytical biases, which can occur with capillary sampling, such as the potential of sample dilution from interstitial fluid. Moreover, both surveys measured hemoglobin concentrations on a portable device (HemoCue 301). The anemia prevalence rates between the two surveys are comparable and importantly, are much lower than reported in the Demographic and Health Survey (DHS) 2012. The DHS used capillary blood to measure hemoglobin on a different portable hemoglobinometer (HemoCue 201+). Recent research indicates that hemoglobin measurements from capillary blood samples and the HemoCue 201+ yield reduced hemoglobin concentrations and thus, increased anemia prevalence. On the other hand, there is some evidence that the HemoCue 301 yield slightly increased hemoglobin concentration and thus a lower anemia prevalence. To validate the hemoglobin results obtained from the HemoCue 301, the NIMAS measured hemoglobin on a complete blood counter in a sub-sample of children 6-59 months of age, children 5-9 years of age, adolescent girls and non-pregnant women. The mean hemoglobin concentration measured by the complete blood count (CBC) is 4g/L (~3%) lower than the concentration obtained by the HemoCue 301 across all population groups. Hence, though the actual prevalence of anemia might be slightly higher than estimated, classification of public health significance of anaemia remains the same.

Recommendations

- **Reduce household food insecurity and poverty**
  The proportion of households living under the poverty line is high and is expected to further increase mainly due to the crisis in Ukraine and the ongoing pandemic affecting remittances, food prices, job opportunities, and causing a continued cooling of the economy. Existing programs must be adapted to the current situation in order to counteract a further increase in poverty and, if possible, to reduce the number of people living below the poverty line. In addition, creation of new programs to fight poverty could be considered.
- **Amend the salt iodization law**
  The NIMAS generally found that adolescent girls, non-pregnant women, and pregnant women have adequate iodine status, indicating that the salt iodization programme is functioning well. Sub-group analyses, however, reveal a relatively large variation in urinary iodine, with some population groups at the edge of excess iodine. To reduce that variation, stakeholders in the Kyrgyz Republic should consider aligning the salt iodization standards, currently set at 40ppm ± 15ppm, with the international cut-off of 15ppm. This change in the salt iodization standards should be accompanied by the strengthening of the compliance monitoring system used to enforce salt iodization at the level of salt production, importation, and distribution. Moreover, since the iodine status of the population is at the high end of adequacy, programs designed to reduce salt intake would not have a serious effect on iodine status.
- **Strengthen wheat flour fortification**
  Only one third of households use fortified flour and only 2% of households use flour that is fortified according to national standards[1], with non-significant differences between the locally produced and the imported flour. Therefore, adherence to fortification standards of locally-produced wheat flour should be strengthened at the level of production and distribution, and monitoring activities should be extended to ensure that imported flour meets the Kyrgyz Republic's national standards. These actions can be expected to increase coverage of adequately fortified wheat flour and to provide additional micronutrients. If both are implemented, reductions of anemia, iron and folate deficiency are plausible. Moreover, adding vitamin D to the fortification program might then be a viable strategy to combat vitamin D deficiency.
- **Reduce the prevalence of overweight and obesity**
  Overweight and obesity is a public health problem with medium relevance in young children and a serious public health concern in women, particularly in older women and should be addressed through governmental policies and programs. Programs targeted to pregnant and lactating women are an entry point for reducing overweight and obesity in young children as well as adult women. It is thus recommended that antenatal and postnatal care be expanded to include behaviour change messages and counselling for mothers. Further, it is advisable to ideally instil appropriate eating behaviours early in life, since such changes are often more easily induced in younger people. As such, schools could provide the platform to deliver messages about good nutrition and provide nutrition education to children 5-9 years of age and adolescent girls.
- **Strengthen other strategies to tackle micronutrient deficiencies**
  To increase the vitamin A stores in the overall population, the implementation of a vitamin A fortification program could be considered. Because food fortification of staples may not be the most appropriate approach to reach young children 6-23 months of age, since their food intake is limited compared against their micronutrient need, programs to provide micronutrient powders may be envisioned to tackle iron and vitamin A deficiencies in young children. Moreover, campaigns that raise the awareness of folate, vitamin A and iron deficiencies and promote the consumption of nutrient rich foods should be implemented. This type of intervention could include promoting local food products rich in micronutrients. Lastly, supplementation is a viable, though more costly, alternative to fortification to address micronutrient deficiencies. Overall, vitamin and mineral supplement consumption is low in women and children. It is therefore recommended that the Kyrgyz Republic's health system promote and expand the distribution of these supplements to achieve a high level of coverage and consumer compliance. General awareness campaigns can also be considered but should only be conducted when distribution channels are in place guaranteeing access to supplements. To increase the coverage of iron and folic acid supplement consumption pregnant women can be targeted at their prenatal and postnatal care visits. Vitamin A supplementation could be linked with vaccination programs in order to achieve a high vitamin A supplementation coverage in children.

[1] The national wheat flour fortification standards of the Kyrgyz Republic state that premium and first grade flours should be fortified at the following levels:

- Iron: Locally produced flour: iron EDTA ≥15ppm; Imported flour: ferrous sulfate or ferrous fumarate ≥60ppm)
- B-Vitamins: B1 (≥2.0 ppm); B2 (≥3.0 ppm), B3 (≥10.0 ppm), B9/folic acid (≥1.0 ppm), B12 (≥0.008 ppm)
- Zinc: ≥30.0 ppm

1. INTRODUCTION

1.1. Country overview

The Kyrgyz Republic is a landlocked country bordering Kazakhstan, Uzbekistan, Tajikistan and China, with a population of approximately 6.9 million[1]. After independence from the former Soviet Union in 1991, the economic situation in the Kyrgyz Republic deteriorated – with the gross domestic product (GDP) decreasing by 45 percent from 1991 to 1995 [2]. In the first decade of the 21st century, the country experienced repeated crises: the revolution of 2005; extreme winters in 2008 and 2009 followed by drought and surges in food and fuel prices; the revolution of 2010; the ethnic conflict in 2010 and the revolution in 2020 [3]. Since 2010 the economy has rebounded and the GDP was estimated around 8.5 billion USD in 2019 compared to about 4.8 billion in 2010 [4]. Due to the COVID pandemic the GDP fell by almost 9% in 2020 but recovered in 2021, reaching almost the same level as before the crises [5].

As of 2021, the Kyrgyz Republic ranked 118 out of 189 countries evaluated in the Human Development Index (HDI). While in 2018 20% of the population was considered 'poor' according to national standards and just about 0.6 % lived under the global absolute poverty line of 2 standardized USD a day[6], the situation has worsened mainly due to the global food crises and the COVID 19 pandemic with poverty increasing to 33% in 2021 [7].

1.2. Nutritional situation of the Kyrgyz population

Due to the Kyrgyz Republic's geomorphological diversity, with high mountain ranges and deep gorges, it is not surprising that economic development varies across the country and between urban and rural areas. Along with economic disparities, food security assessments have shown that rural areas are both poorer and less food secure than urban areas. The limited household purchasing power also affects the quality and diversity of the diet in certain regions.

Reducing undernutrition, including micronutrient deficiencies, contributes to achieving progress in human and economic development. Women of reproductive age, particularly during pregnancy and lactation, exhibit increased nutrient needs and are therefore a vulnerable population group. Additionally, because of the critical link between maternal and child nutrition, public health efforts have turned to ensuring adequate child nutrition during the first "1,000 days" — from conception to a child's second birthday. More recently, the importance of a continuum of adequate nutrition has been re-expanded to the 8000 days window, thus including school-children and adolescents [8].

In the Kyrgyz Republic, the overall nutrition situation among children 6-59 months of age (children under five) has improved over the past two decades. Data on stunting, wasting and underweight prevalence demonstrates (Table 2) that 2006-2018, the prevalence of these three forms of malnutrition decreased by 30%-50% [9–11].

Data on micronutrient status and anemia is either outdated or entirely missing for children 6-59 months of age, children 5-9 years of age, adolescent girls, and women of reproductive age.

The available data depict a situation of high prevalence of anemia and iron deficiency (ID). In children 6-59 months of age, the data shows that anemia prevalence increased from 26% in 2009 [12] to 43% in 2012 [13]; among women of reproductive age the prevalence increased from 23% to 35% in the same time period [12,13]. However, such a large difference over a short period of time can unlikely be explained by a drastically deteriorating situation. More likely, other factors, such as seasonality or methodological differences contributed to this difference, such as the use of different hemoglobinometers (HemoCue 201 vs. HemoCue 301). Depending on the prevalence used, anemia would be classified as a moderate or severe public health problem according to WHO [14]. A survey in 2013 among children 6-29 months of age found that 33% of children were anemic. This is comparable to 2009, when anemia prevalence among children aged 6- 35 months ranged from 30% to 42%. The 2009 national survey on the nutritional status of children and their mothers [12] found that almost 50% of women of reproductive age had folate deficiency and about 50% of the children 6-59 months of age and women of reproductive age had ID. On the other hand, the vitamin A deficiency prevalence was relatively low in both children and women.

Data on the prevalence of other micronutrient deficiencies, such as vitamin D, zinc or vitamin B12 are lacking in the Kyrgyz Republic.

Data on anemia and micronutrient status in children 5-9 years of age and adolescent girls in the Kyrgyz Republic is scarce and therefore these two population groups are not shown in Table 2 below. However, the DHS 2012 reported that 34.5% of women aged 15-18 years were anemic [13], while for 8-10 year old school-age children, only data on urinary iodine concentration (UIC) were generated in 2007, indicating a median UIC of 114 μg/L [15].

In recent years, the double burden of malnutrition – where undernutrition (micronutrient deficiencies, stunting, wasting and underweight) and overweight and obesity or nutrition related non-communicable diseases (e.g. diabetes mellitus type 2) occur concurrently - has become more common, particularly among women living in urban areas [16]. As per 2012 data, more than one-third of women of reproductive age in the Kyrgyz Republic were overweight or obese [13], with an upward trend, while child overweight was about 7% in 2014 [10] and 2018 [11]. Meanwhile, stunting prevalence was estimated to be about 12% and wasting and underweight each about 2% in children 6-59 months of age in 2018 [11].

Table 2. Prevalence estimates for nutrition-relevant data in the recent past in the Kyrgyz Republic.

Nutrition indicator	MICS 2006[6]	IHS 2008	NNS 2009[9]	DHS 2012[10]	MICS 2014[7]	MICS 2018[8]	Other surveys or studies
Household							
Iodized salt (%)	76[a]	-		97[a]	93[a]	92[a]	40 [12]
Children 6-59 months							
Anemia (%)	-	-	26	43	-	-	33 [14][b]
Iron deficiency (%)	-	-	50	-	-	-	35 [14][b]
Iron deficiency anemia (%)	-	-	18	-	-	-	24 [14][b]
Vit A deficiency (%)	-	-	4.2	-	-	-	16 [14][b]
Stunting[c] (<-2SD) (%)	17	30	23	18	13	12	-
Wasting[c] (<-2SD) (%)	3.9	-	1.3	2.7	2.8	2.0	-
Underweight[c] (<-2SD) (%)	3.7	4.1	4.7	3.4	2.8	1.8	-
Overweight[c] (> +2SD WHZ) (%)	5.8	-	4.5	8.5	7.0	6.9	-
Women 15-49 years							
Anemia (%)	-	-	23	35	-	-	-
Iron deficiency (%)	-	-	51	-	-	-	59 [15][d]
Iron deficiency anemia (%)	-	-	20	-	-	-	-
Vit A deficiency (%)	-	-	0.6	-	-	-	-
Folate deficiency (%)	-	-	49	-	-	-	-
Underweight (BMI <18.5, %)	-	-	6.5	7.3	-	-	-
Overweight/obese (BMI>25, %)	-	-	32	36	-	-	-
Median urinary iodine conc. (μg/L)	-	-	-	-	-	-	111 [12][e]

[a] Results determined by rapid iodine test kits;
[b] Children 6-<30 months;
[c] Children 0-59 months;
[d] Women living in Talas Oblast with a child 6-24 months old only;
[e] Survey included pregnant women only, cut-off used to define iodine deficiency: 150 μg/L

1.3. Programs to combat micronutrient deficiencies in the Kyrgyz Republic

The Kyrgyz Republic currently has two main micronutrient deficiency control programs in place: salt iodization and wheat flour fortification with iron, zinc, niacin, riboflavin, thiamine, and folic acid[2]. The first national salt iodization program began in 1994 [19]. It culminated in the law enacted by the Kyrgyz Government in 2001 that mandated all imported and locally-produced edible salt be fortified using potassium iodate (40±15mg iodine/kg salt) [13,15,20]. Salt iodization has made notable progress since 2000, and the household coverage of iodized salt increased from 76% in 2006 to 97% in 2012 and has remained above 90% ever since as reported by DHS and MICS [9–11,13]; of note though, most testing was conducted using rapid test kits that have been shown to inaccurately identify the level of iodine concentration in salt [21]. In addition to consumption of iodized table salt, it has been reported that iodized salt is used by food companies, including bakeries; thus, the population is likely consuming both iodized table salt and iodized salt through processed foods, such as bread [19]. The only national estimate of iodine status, which was done in 2007, indicated iodine sufficiency among children 8-10 years of age, but insufficiency among pregnant women. Contradicting the results from DHS and MICS, this 2007 survey found that less than 40% of the households consumed adequately iodized salt, as measured by iodometric titration [15].

Regarding wheat flour fortification, UNICEF began supporting millers with equipment and premix in 1998, and this effort was followed by a Central Asian regional fortification program in 2002-2007, supported by the Asian Development Bank (ADB). Specifically, the ADB project helped establish a regional premix standard, the KAP Komplex #1, which has been used by multiple countries in Central Asia. The Kyrgyz Republic followed the KAP Komplex #1 standard until 2009, when it changed the iron compound from electrolytic iron to NaFeEDTA. KAP-complex #1 ensures that the quality of flour fortified with iron, zinc, niacin, riboflavin, thiamine, and folic acid, is maintained [22]. In 2017 UNICEF and partners conducted a monitoring survey on the availability of fortified flour. They found that according to the flour package label about half of the surveyed households consumed fortified flour.

Children were also provided with vitamin supplements. National and regional nutrition surveys conducted between 2008 and 2010 have shown that approximately two-thirds of Kyrgyz children 6-59 months of age are given vitamin D supplements by their care-givers [12,17,23]. Approximately 57% and 30% of children nationally receive multi-vitamin and fish oil supplements, respectively [12].

Micronutrient supplementation of children 6-59 months of age and post-partum women began in 2004 [24]. Coverage of vitamin A supplementation of children increased rapidly; the Kyrgyz Republic's 2009 national nutrition survey found that nearly 95% of children ever received a vitamin A supplement, with 80% receiving the supplement in the past six months (36% of mothers received a vitamin A supplement within 2 months after their last pregnancy). Due to low vitamin A deficiency prevalence in children in 2009 and the scale-up of multi-nutrient supplements in 2011, the Kyrgyz Ministry of Health replaced vitamin A supplementation with micronutrient powders [13]. The Gulazyk programme was fully maintained by the Government and development partners at national level until April 2014. After this time disruptions began to emerge in the provision of Gulazyk. Although integration of Gulazyk into infant and young child feeding practices in communities was considered effective, the procurement platforms required to sustain the practice were challenging. Procurement difficulties were further exacerbated by competing priorities related to high disease burden and limited capacity and resources at the national and local levels. Despite the positive impact, 2018, the MoH ceased to procure Gulazyk, asserting that Gulazyk was registered as a biologically active supplement and thus not considered part of the essential medicines list.

The Gulazyk programme offers valuable lessons on outcomes. There is a clear need to place food security and nutrition firmly within a health system strengthening approach, supported by community- and home-based information and communication approaches. Nevertheless, compromise should be reached in the best interests of children in the Kyrgyz Republic. Safe spaces for these dialogues and critical thinking could be fostered to address malnutrition and dietary deficiencies among mothers and children.

[2] The national wheat flour fortification standards of the Kyrgyz Republic state that premium and first grade flours should be fortified at the following levels:

- Iron: Locally produced flour: iron EDTA ≥15ppm; Imported flour: ferrous sulfate or ferrous fumarate ≥60ppm)
- B-Vitamins: B1 (≥2.0 ppm); B2 (≥3.0 ppm), B3 (≥10.0 ppm), B9/folic acid (≥1.0 ppm), B12 (≥0.008 ppm)
- Zinc: ≥30.0 ppm

1.4. Rationale for the survey

While the Kyrgyz Republic has some data available on the nutritional and micronutrient status of young children and women, there is no recent comprehensive assessment of nutritional status measuring both micro- and macro-nutritional indicators in any of the target groups.

As an integral element of the national Food Security and Nutrition Programme 2019-2023 and the 2030 Government Health Programme, the NIMAS 2021 was conducted to both increase the understanding of the severity of micronutrient deficiencies and help design evidence-based nutritional intervention programs for nationwide implementation. The NIMAS also establishes a baseline against which to measure the future progress of various national nutrition programs. Furthermore, by including multiple target groups, the data produced by NIMAS can be used by multiple governmental agencies to design nutrition programs. Lastly, the survey simultaneously collected data on under-nutrition and over-nutrition to provide information about the extent of the double burden of malnutrition.

1.5. Objectives

The NIMAS 2021 was nationwide in scope and collected data from 6 target groups: 1) households, 2) children aged 6-59 months (PSC), 3) children aged 5-9 years (SAC), 4) adolescent girls 10-18 years old (AG), 5) non-pregnant women of child-bearing age, 15-49 years of age (NPW), and 6) pregnant women of any age (PW). For more details on the survey population see chapter 2.3. Indicators collected varied by population groups and are detailed below.

Primary and secondary objectives were proposed initially by the Ministry of Health, UNICEF and other national stakeholders. They were subsequently revised based on the input of GroundWork and the technical committee consisting of national (e.g. Ministry of Health the Kyrgyz Republic, National Statistical Committee, Republican Health Promotion Center) and international (e.g. UNICEF, WFP, USAID, Mercy Corps) stakeholders.

1.5.1. Primary objectives

1. To measure the prevalence and severity of anemia in PSC, SAC, AG, NPW, and PW by measuring the hemoglobin concentration.
2. To measure the prevalence of ID in PSC, SAC, AG, and NPW using plasma ferritin concentration. Plasma ferritin was adjusted for the presence of inflammation as indicated by elevated levels of C-reactive protein (CRP) and alpha-1-acid glycoprotein (AGP).
3. To measure the prevalence of vitamin A deficiency in PSC, SAC, AG and NPW using retinol binding protein (RBP). For PSC, RBP was adjusted for the presence of inflammation as indicated by elevated levels of C-reactive protein (CRP) and alpha-1-acid glycoprotein (AGP).
4. To assess the prevalence of vitamin D deficiency in a sub-sample of PSC, AG and NPW by measuring plasma 25[OH]D.
5. To measure the prevalence of folate deficiency among AG and NPW using plasma folate.
6. To assess iodine status among AG, NPW and PW by measuring urinary iodine concentration.
7. To measure the prevalence of acute malnutrition (wasting) using weight-for-height z-scores, chronic malnutrition (stunting) using height-for-age z-scores, underweight using weight-for-age z-scores, overweight and obesity using weight-for-height z-scores and brain growth using head circumference-for-age z-scores in PSC.
8. To measure the prevalence of chronic malnutrition (stunting) in SAC by calculating height-for-age z-scores; in the same age group, measure the prevalence of underweight calculated using BMI-for-age z-scores, overweight and obesity by calculating the BMI-for-age z-score.
9. To measure the prevalence of chronic malnutrition (stunting) in AG by calculating height-for-age z-scores; in the same age group, measure the prevalence of underweight, overweight and obesity calculated using BMI-for-age z-scores.

10. To measure the prevalence of chronic energy deficiency and overweight and obesity in NPW by calculating BMI or BMI-for-age z-score.
11. To measure the prevalence of acute undernutrition in pregnant women by measuring mid-upper arm circumference (MUAC).
12. To measure the household coverage of (adequately) iodized salt.
13. To measure the household coverage of (adequately) fortified wheat flour in a sub-sample of households.

1.5.2. Secondary objectives

Other variables which may influence various types of malnutrition or play a potentially causative role were also assessed. Such additional variables included socio-economic status, household food security, individual food consumption patterns, infant and young child feeding and breastfeeding practices, intake of micronutrient supplements, and others. Additionally, a short module on household purchases of potentially fortified salt and wheat flour was included to estimate consumption of these.

Further, vitamin A deficiency results were also obtained for NPW and AG from the laboratory at no additional costs as the vitamin A biomarker is measured as part of a set of 5 biomarkers including iron, vitamin A and inflammation markers.

Given the current pandemic situation, the survey also served as a vehicle to collect updated information about the context of COVID-19 in the Kyrgyz Republic.

2. METHODOLOGY

2.1. Geographic scope and basic sampling frame

The sampling universe consisted of all households residing in the Kyrgyz Republic at the time of survey data collection, regardless of nationality and/or ethnicity. To make separate estimates of each outcome for the Kyrgyz Republic's administrative zones, nine explicit strata were created representing the 7 regions and the two cities of Bishkek and Osh City. Due to differences in household size and composition between the oblasts and the cities of Bishkek and Osh, stratum specific sample sizes have been calculated based on household size and composition reported in the MICS 2018. Thus, different numbers of PSUs were randomly selected for each stratum to achieve the desired sample size. The NIMAS included the following numbers of PSU in the different strata: Bishkek: 37; Batken: 22; Chui: 25; Jalal-Abad: 25; Naryn: 23; Osh: 24; Talas: 20; Issyk Kul: 27; Osh City: 28 (see Figure 1).

In each PSU, 15 households were selected. Separate samples were selected for each stratum and produced stratum-specific and, when combined and appropriately statistically weighted, nationally representative estimates. Within each stratum, PSUs were allocated to urban and rural sub-strata proportional to the population of that stratum. Such proportional sub-stratification increased the precision of stratum-specific estimates. The approach for the NIMAS 2021 enabled the calculation of sufficiently precise estimates for each stratum to make stratum-specific conclusions and recommendations, except for pregnant women, where only national estimates were obtained with reasonable precision.

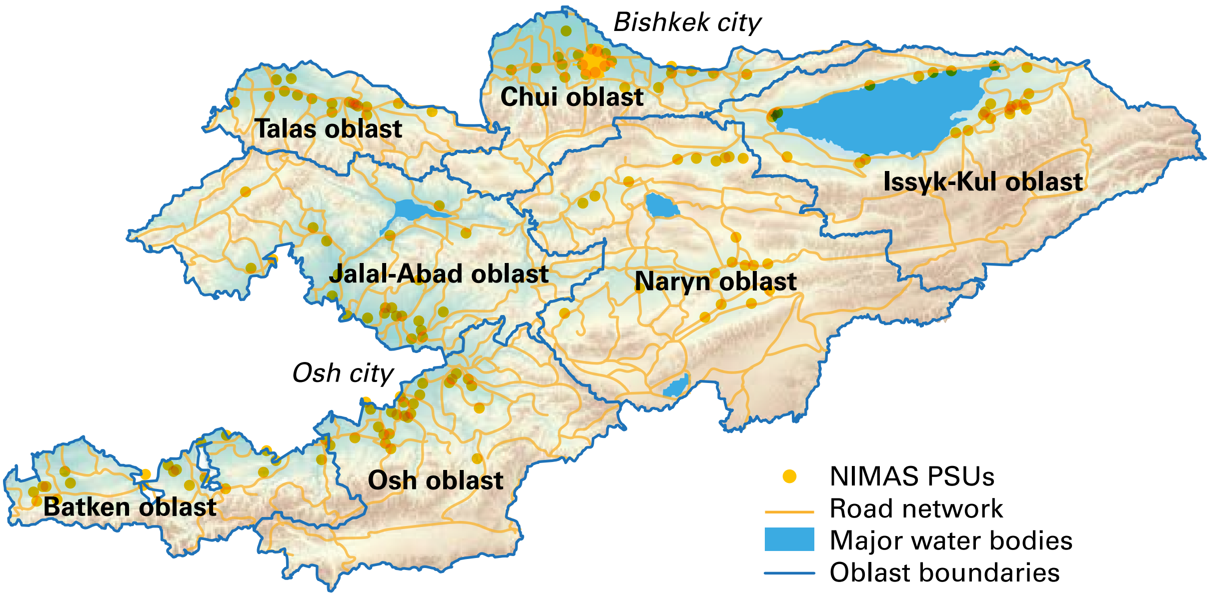


Figure 1. Kyrgyz Republic's administrative zones and PSUs selected for NIMAS

2.2. Sampling approach and sample size determination

The NIMAS 2021 was a cross-sectional stratified survey based on a probability sample large enough to produce stratum-specific estimates for priority nutrition indicators. These estimates were expected to yield acceptable precision for decision makers to draw conclusions and make programme decisions.

For the calculation of the sample size, the key indicator used was anemia prevalence among non-pregnant women and children 6-59 months of age as anemia in these groups was one of the key indicators of the NIMAS.

The Fisher's formula for estimating the minimum sample size for prevalence descriptive studies was used as follows:

$$n = \frac{Z^2{}_{\alpha/2}P(1-P)}{d^2} * DEFF * \frac{100}{RR}$$

Where:

n = minimum sample size, expressed as number of units of analysis,

$Z\alpha/2$ = Z value corresponding to 95% confidence intervals

P = the assumed prevalence

d = the allowable sampling error, or ½ the desired confidence interval

DEFF = design effect

RR = response rate expressed as a decimal

The calculated number of children and women needed for the survey sample had to be converted to the number of households to select, which was done by accounting for the average household size and the proportion of the general population made up of the specific target group in each of the different strata using the MICS 2018 data. In total, 3465 households were calculated to be selected to ensure sufficient sample size of households, children, and non-pregnant women. For PSC, the selection of 3465 households should have resulted in the enrolment of approximately 1615 PSC for the entire survey sample, about 1453 of whom with biologic specimens. The selection of 3465 households should have resulted in the enrolment of approximately 1291 SAC for the entire survey sample, about 1097 of whom with biologic specimens collected. Further, about 1313 NPW should have been eligible, 1116 of whom with biologic specimens collected. Young women aged 15-18 years belong to two target groups: NPW and AG. Thus, for the target group of AG only girls aged 10-14 years were to be additionally recruited. The selection of 3465 households should have resulted in the recruitment of about 927 AG (10-18 years), about 788 with a blood sample.

2.3. Study populations

The study participants were selected from the randomly selected households located in the selected PSUs. Table 3 lists the inclusion criteria for enrolment into the survey, disaggregated by target population group. There were no specific exclusion criteria other than the negation of the inclusion criteria. Importantly, Table 3 defines AG 10-14 years of age and NPW 19-49 years of age as target groups since females 15-18 year of age were included as part of the AG and NPW groups and are therefore listed separately (AG/NPW group in Table 2 below). However, during data analysis, the 15-18 years old females were attributed to both AG and NPW, such that the AG group includes females from 10-18 years, while the NPW group is composed of females 15-49 years of age.

Table 3. Inclusion criteria by targeted population group

Target population	Inclusion criteria
Household	• Household head or spouse or other adult household member gives oral consent for survey data collection • Members currently reside in the Kyrgyz Republic regardless of nationality and/or ethnicity.
PSC	• Age between 6-59 months of age at the time of survey data collection • Considered a household member by adults living in the household • Mother or caretaker gives written consent for interview and collection of biologic specimens

SAC	• Age 5-9 yearsat the time of survey data collection • Considered a household member by adults living in the household • Mother or caretaker gives written consent for interview and collection of biologic specimens
AG	• Age 10-14 yearsat the time of survey data collection • Considered a household member by adults living in the household • Oral assent obtained from participating adolescent girl • Mother or caretaker gives written consent for interview and collection of biologic specimens
AG/ NPW	• Age 15-18 years at the time of survey data collection • Currently non-pregnant by self-report • Gives written consent for survey data collection; if <18 years, mother or caretaker gives written consent for interview and collection of biologic specimens if AG/ NPW aged <18 years. • Considered a household member by other adults living in the household
NPW	• Age 19-49 years at the time of survey data collection • Currently non-pregnant by self-report • Gives written consent for survey data collection • Considered a household member by other adults living in the household
PW	• Currently pregnant by self-report • Gives written consent for survey data collection • Considered a household member by other adults living in the household

2.4. Ethical considerations

In order to ensure that the survey follows principles to protect respondents and prevent unnecessary risks to survey them, ethical approval for the study was obtained from the Scientific and Production Association for Preventive Medicine of Ministry of Health, Kyrgyz Republic (see appendix 8.9 for approval letter) and also endorsed by Bioethics Committee of the Ministry of Health (see appendix 8.11 for endorsement letter), Kyrgyz Republic. In addition, the protocol was also reviewed by a UNICEF-appointed external Institutional Review Board for quality assurance. The survey protocol was registered with the Open Science Framework study registry (https://osf.io/8upnd/).

The survey was conducted in line with the UNICEF procedures for ethical standards in research, evaluation, data collection and analysis [25] and follows the UNICEF ethical reporting guidelines [26]. Further, the survey respected the UNICEF Child Protection Code, and utmost care was taken that no human rights were violated and the survey complied with all principles of the international human rights framework [27].

For household interviews, oral consent was sought from the household head or in his/her absence from another adult household member. The selected women and child caregivers were asked to provide written informed consent (see appendix 8.10 for information sheet and consent form) for themselves and their participating children.

2.5. Field work and data collection

2.5.1. Mapping and listing

Prior to data collection, all households located in the selected PSU were listed in order to create a complete and updated list of households for all selected PSUs. This list served as a sampling frame for the final selection of households included in the NIMAS 2021 sample.

A local research agency was hired to provide teams of specialists for listing and mapping. The research agency, in consultation with an international expert, created 9 teams to work in the 9 different strata. The teams were trained by the international expert. The listing was conducted in August/ September 2021. During the household listing operation, each selected PSU was visited to:

a. Update the existing map of the MICS 2018. Both a location map of the PSU as well as a sketch map of the dwellings in the PSU were drawn.

b. Record an electronic description of location of every dwelling together with the names of the heads of the households found in the dwelling.

2.5.2. Training of survey teams and field testing

Prior to data collection, team members were thoroughly trained, and all survey instruments were pre-tested during the training. The training consisted of classroom instruction and practice, and of field testing of all survey procedures.

Deputy heads of regional health departments were nominated by MoH as regional coordinators to help with administrative issues and all of them were invited to a one-day orientation workshop. During this workshop, regional coordinators were informed on survey goals and objectives, on survey protocol and tasks to ensure support of field work data collection.

Survey staff also received extensive classroom training on each questionnaire, whereby interviewers and team leaders discussed each question, practiced reading the questions, and role-played interviews in local languages. In addition, instructions were provided on how to record, save, and upload data on the tablet computers (Galaxy, Samsung™) and the data entry software (KoboToolbox) used in the survey.

As part of classroom training, anthropometrists and phlebotomists were trained on anthropometric and blood collection techniques. A standardization exercise was conducted for the survey anthropometrists, whereby an anthropometrist, assisted by a phlebotomist, measured and recorded the length or height of 10 children, and their results were checked for precision as well as for accuracy when compared with instructor's "gold standard" measurements. Blood collection procedures were practiced, including training on labelling of samples, processing of samples, labelling of aliquots, pipetting procedures, and maintenance of the cold chain when transporting blood and urine specimens.

Following classroom training, two days of field testing was undertaken in four PSUs in the vicinity of Bishkek that were not included in the survey sample. The teams conducted the community sensitization, interviewing anthropometry, and phlebotomy. Specimens were transported to the laboratory in Bishkek for training (processing, labelling, storage) of all laboratory technicians from the different regions.

Approximately 20% more field workers than required were enlisted for the training to ensure that all survey staff ultimately hired could successfully implement the survey procedures. To assess their understanding of field procedures, a written exam containing questions about various survey procedures was given to all survey staff towards the end of the training. The results of this exam, the results of the anthropometry standardization exercise, and observations from the survey trainers were used to a) identify the best-performing team members and appoint a team leader for each team, and b) identify survey workers that could not adequately understand and implement the survey procedures. These individuals were released and were not included for the field work.

2.5.3. Community mobilization and sensitization

During the planning phase of the survey the Ministry of Health issued a comprehensive Order/ Prikaz on the survey implementation, including organization and coordination of activities, collaboration of regional coordinators, national institutions, health organizations and other national stakeholders. Upon selection of PSUs, the Ministry of Health contacted the respective regional health authorities about the selected clusters in writing to request their support with the NIMAS 2021. At the start of the fieldwork, each survey team was provided with a copy of an order (see appendix 8.11) from the Ministry of Health. Upon arrival of a team in a PSU, the team met with the relevant authorities to inform them about the work and also to seek their support. In most cases, teams met with the head of the local health facility to notify them that the NIMAS 2021 would be conducted in their area and to request their support. A press-conference was held, and a number of TV and radio segments broadcast for sensitization purposes.

2.5.4. Field work: Interviews

Data collection in the 231 PSUs was conducted between 21st September and 16th November 2021.

Each of the 9 teams comprised one team leader, three interviewers, one phlebotomist, one anthropometrist and one driver. The members of each team are listed in appendix 8.12. Each team was assigned to one of the 7 regions, Bishkek and Osh City and was responsible for data collection in all randomly selected households in the selected PSUs. All reasonable attempts were made to recruit selected households. At least two repeat visits were made before dismissing a household as non-responding.

For data collection at the household level, tablet computers were used for direct data entry using Kobo toolbox. Skip patterns were built into the electronic questionnaires, which sped up interviewing as well as minimized erroneous entries. Interviewers administered the household questionnaire first, followed by the child and adolescent girl/woman questionnaires if the household had eligible children and/or adolescent girls/women. During the household interview, a household roster was completed. Household and individual questionnaires were available in English, Kyrgyz and Russian. Interviews were conducted in the interviewee's preferred language. All questionnaires are provided in appendix 8.13. For the translated versions, the English questionnaires were translated into Kyrgyz and Russian, and back-translated by a separate translator. Discrepancies were discussed and harmonized; lastly, during training and field testing, any remaining issues were corrected in all versions of the questionnaires.

Where available, standard questionnaire modules were used, e.g. for infant and young child feeding questions, including the 24-hour recall module [28]. To help the respondents recalling food products, interviewers used a picture catalogue of commonly used food products, e.g. infant cereals, fortified foods, vitamin A supplements, etc. Similarly, for the women's questionnaire, the 24-hour recall module was adapted from existing tools [29].

Salt specimens (approx. 100g) were collected in each recruited households and flour samples (approx. 50g) in every 4th household by the interviewers after completion of the household interview. For selected adolescent girls, women and children, interviewers prepared and labelled a biological form (see appendix 8.13) and directed those participants (or their mothers) to a central location in the PSU where the anthropometrist and phlebotomist were stationed.

2.5.5. Field work: Anthropometry and phlebotomy

First, weight measurements from selected children, adolescent girls and non-pregnant women were taken using standard methods [30] on a SECA scale (UNICEF, # S0141021). For children who could not stand by themselves, the mother or caregiver was first measured alone, then together with the child, so that the child's weight was obtained by automatic subtraction using the scale's tare function. The scales were calibrated every morning using a 5kg calibration weight and results were entered into a scale calibration monitoring spreadsheet. Scales were replaced if deviation from target was >0.1kg. Children's height or length was measured by using a standard wooden height board (UNICEF, #S0114540). For adolescent girls and non-pregnant women, height was measured using the same standard wooden height board. For pregnant women, only their MUAC was measured to assess their nutritional status, since weight measurements are not providing useful anthropometric information during pregnancy. Head circumference was measured in children 6-59 months of age. Each anthropometric measurement was carried out twice in order to ensure a high quality. A third measurement was conducted in case the first two measurements were too far apart (>0.1g or >0.5cm).

For adolescent girls and non-pregnant women, blood was collected via venipuncture into 6 ml plasma EDTA tubes. For children (6-59 months and 5-9 years) blood was collected via venipuncture into 4 ml plasma EDTA tubes. Using a Haemodiff device, a small amount of blood was extracted from the tubes onto a weighing boat to assess hemoglobin concentration using a portable hemoglobinometer (HemoCue® 301). Remaining whole blood was placed in a cool box containing cold packs to ensure they were stored cold but not frozen at ~4°C and in the dark until further processing later the same day. Temperature in the cold boxes was monitored using thermometers. For pregnant women, blood was collected from a fingerstick for hemoglobin measurement only. The second drop of blood was used for the hemoglobin measurement.

A spot urine sample was collected from each selected adolescent girl and woman. A labelled urine beaker was given to the woman, and she was instructed to bring the urine specimen with her to the phlebotomy site. Urine samples were aliquoted in the field and placed into cold boxes.

Participants found to have severe acute malnutrition or severe anemia were referred for treatment at the nearest health hospital or clinic (see appendix 8.14 for referral form). No efforts were made to collect blood in a fasting state as this was not required since no biomarkers sensitive to fasting state were measured.

At the end of each day, the team leader reviewed and collated the biological forms and consent forms, and reviewed data collected in KoboCollect. Interviewers were notified of any errors and/or omissions, whereupon they were instructed to make the necessary corrections, when possible.

2.5.6. Cold chain and processing of blood samples

Following collection, all blood samples were placed on cold packs (at +4°C to +8°C) until processing. Phlebotomists recorded the temperature inside ice chests containing the cold packs every two hours.

Every evening, when the field teams stopped their daily work, the blood and urine samples were transported to the regional processing laboratories. Upon arrival at the regional processing laboratories, the blood collection tubes were centrifuged at 3,000 rpm for 7 min to separate the plasma from the erythrocytes, platelets, and leukocytes. Subsequently, plasma was pipetted from the blood collection tubes and aliquoted into cryovials appropriately labelled with the respondents' ID numbers. Aliquots destined for different laboratories were sorted into their corresponding storage boxes/ bags and stored frozen at around -20°C. Urine samples were sorted and frozen at around -20°C. Upon completion of field work in all regions the plasma and urine samples were collected and transported frozen to the central processing laboratory in Bishkek. There, blood and urine samples were consolidated and sent to international laboratories for analyses using dry ice. All blood samples were analyzed within 6 months of collection.

Flour and salt samples were periodically sent to the laboratory of the Department on Diseases Prevention and State Sanitary Epidemiological Surveillance.

2.5.7. Supervision of fieldwork

Supervision was provided consistently. During the first week of field work, intense supervision was conducted to identify and address any flaws, as well as to provide initial quality assurance. In addition to team leaders, roaming supervisor from the Ministry of Health and various organizations ensured that the correct survey procedures were followed, i.e. a follow-up quality assurance measure was performed.

2.6. Definitions of indicators and specimen analysis

2.6.1. Infant and young child feeding indicators

IYCF indicator definitions follow the UNICEF-WHO IYCF guidelines published in 2021 [28].

2.6.2. Anthropometric indicators

Children under five

In children 6-59 months of age, undernutrition (including wasting, stunting, and underweight) and overnutrition were calculated using WHO Child Growth Standards [31]. Children with z-scores below -2.0 for weight-for-height, height-for-age, or weight-for-age are defined as wasted, stunted, or underweight, respectively. Moderate wasting, stunting, and underweight are defined as a z-score less than -2.0 but greater than or equal to -3.0. Z-scores less than -3.0 define severe wasting, severe stunting, or severe underweight. Overnutrition is defined as a weight-for-height z-score greater than +2.0. Overweight is a weight-for-height z-score of greater than +2.0 but less than or equal to +3.0. Obesity is defined as a weight-for-height z-score greater than +3.0.

Children with z-scores below -2.0 for head circumference-for-age are defined as having microcephaly. For children 6-59 months of age, a data quality assessment was conducting using the "ENA for SMART 2020" data analysis program (see Appendix 8.15).

Children 5 years to 9 years of age

In children aged 5-9 years, undernutrition (including acute malnutrition, short stature, and underweight) and overnutrition was calculated using WHO growth reference for children 5-9 years of age and adolescents [32]. Children with z-scores below -2.0 for height-for-age or weight-for-age are defined as being of short stature or underweight, respectively; acute malnutrition (or thinness) is defined as children having BMI-for-age z-score -2.0 or less.

Overweight is defined as a BMI-for-age z-score of >+1, while obesity will be defined as a BMI-for-age z-score of >+2 [33].

Adolescent girls 10-18 years of age

In adolescent girls aged 10-18 years, undernutrition (including short stature, and underweight) and overnutrition was calculated using WHO growth reference for children 5-9 years of age and adolescents [32]. Girls with z-scores below -2.0 for height-for-age are defined as being of short stature; acute malnutrition (or thinness) will be defined as children having BMI-for-age z-score -2.0 or less.

Overweight will be defined as a BMI-for-age z-score of >+1, while obesity will be defined as a BMI-for-age z-score of >+2 [33].

Non-pregnant women

Chronic energy deficiency and overnutrition in non-pregnant women were assessed by using BMI. The most commonly used cut-off points for BMI to define levels of malnutrition in non-pregnant women have been applied (19): <16.0 severe undernutrition, 16.0-16.9 moderate undernutrition, 17.0-18.4 at risk of undernutrition, 18.5-24.9 normal, 25.0-29.9 overweight and >30 obese.

Pregnant women

Because body weight in pregnancy is increased by the products of conception and extra body fluid, BMI is not a valid indicator of nutritional status. Thus, MUAC was used instead to measure the nutritional status of pregnant women. A MUAC of less than 23.0 cm was used to define a pregnant woman as undernourished [34].

2.6.3. Blood and urine specimens

The cut-off values for each biomarker indicator used to determine nutritional status for each participant are presented in Table 4. For hemoglobin and urinary iodine concentrations, multiple cut-offs were used to classify the severity of anemia and iodine status. For other indicators, a single cut-off was used to identify deficiency or abnormality.

Table 4. Clinical cut-off points and classifications for biomarker indicators

Indicator*	Excess	Adequate	Mild	Moderate	Severe
Urinary Iodine Concentration [35]					
Non-pregnant non-lactating women, AG	≥ 300 µg/L	100-299 µg/L	50-99 µg/L	20-49 µg/L	<20 µg/L
Non-pregnant lactating women	≥ 250 µg/L	≥ 100 µg/L	< 100 µg/L		
PW		150-249 µg/L	< 150 µg/L		

Hemoglobin [36] [1]					
PSC	--	≥ 110 g/L	100-109 g/L	70-99 g/L	<70 g/L
SAC	--	≥ 115g/L	110-114 g/L	80-109 g/L	<80 g/L
AG 10-11 years	--	≥ 115g/L	110-114 g/L	80-109 g/L	<80 g/L
AG >11 years and NPW	--	≥ 120 g/L	110-119 g/L	80-109 g/L	<80 g/L
Pregnant women	--	≥ 110 g/L	100-109 g/L	70-99 g/L	<70 g/L
	Deficiency cut-offs				
Retinol [37] PSC, SAC, AG, NPW	<0.7 μM/L[2,3]				
Retinol-binding protein PSC, SAC, AG, NPW	<0.569 μM/L[2,3]				
Plasma ferritin [38] PSC, SAC, AG, NPW	< 12 μg/L[2] < 15 μg/L[2]				
α1-acid-glycoprotein [39] PSC, SAC, AG, NPW	>1 g/L				
C-reactive protein [39] PSC, SAC, AG, NPW	>5 mg/L				
Folate [40] AG and NPW	<10 nmol/L (<4.4 ng/mL)				
25[OH]D [4] PSC, AG and NPW	<12ng/ml (30nmol/L); deficiency); <20 ng/mL (50nmol/L; insufficiency)				

* AG, Adolescent girls 10-18 years; NPW, non-pregnant women 19-49 years; PSC, children 6-59 months of age; PW, pregnant women; SAC, children 5-9 years.

[1] Because the normal hemoglobin differs by altitude and smoking, the cut-off for defining normal hemoglobin concentrations was adjusted for these factors, see because hemoglobin concentration is affected by altitude, the WHO recommends an altitude adjustment as shown in Table 5 and Table 6.

[2] These indicators were adjusted for sub-clinical inflammation using appropriate algorithms [41,42].

[3] No established deficiency cut-offs have been developed for RBP, and as such the linear correlation between RBP and plasma retinol was used to estimate a vitamin A deficiency cut-off of 0.569 μm/L (see page 19 and appendix 8.6). Further, for adult women, no thresholds exist but in literature, the same cut-off as for children is being used.

[4] There is no consensus cut-off point for 25[OH]D to define vitamin D deficiency. The cut-off <20ng/mL is used by NHANES and many other surveys.

Because hemoglobin concentration is affected by altitude, the World Health Organization recommends an altitude adjustment, as shown in Table 5

Table 5. Adjustments in cut-off defining anemia, by altitude of residence [43]

Altitude (meters)	Increase in cut-off point defining anemia (g/L)
< 1000	No adjustment
1000 – 1249	+ 2
1250 – 1749	+ 5
1750 – 2249	+ 8

The NIMAS adjusted the cut-off defining normal hemoglobin concentrations in adolescent girls and women based on the number of cigarettes smoked per day as per the WHO recommendations [44] (see Table 6).

Table 6. Adjustments in cut-off defining anemia, by smoking status (Adapted from [44])

Cigarettes smoked per day	Increase in cut-off point defining anemia (g/L)
< 10 per day	No adjustment
10 – 19 per day	+ 3
20 – 39 per day	+ 5
40 + per day	+ 7
Smoker, amount unknown	+ 3

Anemia

Blood hemoglobin concentration was measured using a HemoCue™ portable hemoglobinometer (Hb301, HemoCue, Ångelholm, Sweden, new devices calibrated by manufacturer). Quality control of the Hemocue devices was done daily using low and medium concentration liquid control blood commercially available (Eurotrol, Ede, The Netherlands). Control blood was kept in cold boxes (2-8°C) for the duration of the field work to prevent degradation. Because anemia prevalence estimates obtained by using portable hemoglobinometers are being debated currently [45–48], a complete blood count (CBC) was conducted in all samples collected in the Bishkek stratum using Mindray BC-600 (China) analyzer in order to validate the HemoCue results. The CBC was conducted by Aqualab Bishkek by highly trained personnel and using daily quality control measures.

Iron (plasma ferritin), retinol binding protein, retinol & acute phase proteins (CRP, AGP)

Plasma ferritin, retinol binding protein, CRP and AGP were analyzed by the VitMin Laboratory in Germany, which regularly participates in Center for Disease Control and Prevention (CDC)s VITAL-EQA quality program. The laboratory used a combined and optimized sandwich ELISA technique using a single small-volume plasma sample [49], which has recently been validated against the methods used by United States NHANES [50].

Ferritin is recommended by the World Health Organization for population-based assessment of iron status because it is responsive to iron interventions overtime [51]. Retinol binding protein (RBP) was used to assess the vitamin A status of all individuals in the survey. RBP can be analyzed with small quantities of plasma. It is highly correlated with plasma retinol [52], the biomarker of vitamin A status recommended by the World Health Organization [53]. Because RBP is not a WHO-recommended biomarker for assessment of vitamin A status, the correlation between the RBP results and plasma retinol measured by high-performance liquid chromatography (HPLC) was checked by testing a subset of plasma specimens from children, adolescent girls and non-pregnant women at the Swiss Vitamin Institute in Lausanne, Switzerland and the VitMin Laboratory, Germany. The laboratories have repeatedly participated and performed well in this analysis in the CDC external quality assurance program Vital-EQA. Comparisons of retinol and RBP values and more details are presented in Appendix 8.6. There was strong correlation between retinol and RBP values when compared as continuous values, yet the RBP values were consistently lower than their respective retinol counterparts. As such, the regression equation was used to estimate the RBP cut-off for defining vitamin A deficiency, resulting in a cut-off of 0.569 μmol/L; this cut-off value was subsequently used to define vitamin A deficiency throughout this report.

However, both ferritin and RBP concentrations are affected by inflammation; ferritin concentrations are elevated and RBP concentrations are suppressed in the presence of the acute phase proteins alpha-1-acid-glycoprotein (AGP) and C-reactive protein (CRP). Due to this inflammatory response, ferritin and RBP concentrations were adjusted for inflammation using the correction algorithm developed by the Biomarkers Reflecting Inflammation and Nutritional Determinants of Anemia (BRINDA) [42,54].

Specifically, the BRINDA equation and correction factors were used to adjust ferritin concentrations in children 6-59 months of age and non-pregnant women 15-49 years of age, and RBP concentrations in children 6-59 months of age. The BRINDA project does not recommend adjusting RBP in non-pregnant women 15-49 years of age.

The BRINDA project does not, however, have correction factors for children 5-9 years of age and adolescent girls, and has recommended that internal correction factors — or correction factors calculated from a specific dataset — be used for other population groups [55] if an association between ferritin and inflammation biomarkers is observed.

For ferritin, pairwise correlations showed a significant continuous association between ferritin and CRP, and between ferritin and AGP in both children 5-9 years of age and adolescent girls. As such, internal correction factors were calculated and used in tandem with the BRINDA equation to adjust ferritin concentrations for inflammation.

For RBP, pairwise correlations showed a significant association between RBP and CRP, and between RBP and AGP in children 5-9 years of age. As with ferritin, internal correction factors were calculated and used with the BRINDA equation to adjust RBP concentrations. RBP was not adjusted for adolescent girls, as the age range of this population group — 10 to 18 years of age — overlaps with age range of non-pregnant women.

Prior to conducting the inflammation adjustments, CRP concentrations below the level of detection (i.e., <0.2 mg/L) were replaced with randomly generated values between 0 and 0.2 mg/L, as this has been shown to improve the reliability of the inflammation adjustment [56].

Plasma folate

Plasma folate is used to assess short-term folate status and is highly responsive to increased intakes of folate naturally present in foods and folic acid added during fortification [57]. Plasma folate concentrations were measured using electro-chemoluminescence on a Roche e600 SER/E170 analyzer at Biolab in Amman, Jordan. Since no folate cut-offs using macrocytic anaemia as the threshold have been defined for protein-binding assays, we defined folate deficiency as the folate concentration (<10 nmol/L) at which homocysteine levels begin to increase, as recommended by WHO [40]. To assure quality of the folate analyses, the laboratory participates in quality assurance programs and has a long-standing track-record of successful external quality control (Randox laboratories and College of American Pathologists) and has recently enrolled with CDC's VITAL-EQA program.

Plasma vitamin D

Plasma 25(OH)D concentrations were analyzed by Biolab Amman using the Diasorin Liaison analyzer (chemiluminescence). For plasma 25(OH)D the laboratory successfully participates in the external quality control program of the College of American Pathologists.

Urinary iodine

The WHO recommends measuring iodine in urine for population-based surveys [58]. Urinary iodine results serve as an approximate reflection of recent iodine intake, but substantial intra-individual diurnal variation is a major limitation of this biomarker for clinical diagnosis.

Urinary iodine was analyzed by the Tanzania Food and Nutrition Center, which regularly participates CDCs Ensuring the Quality of Urinary Iodine Procedures (EQUIP) quality program. Further, the Tanzania Food and Nutrition Center is recognized as an Iodine Global Network laboratory. The iodine in the urine was then measured by a modification of the traditional colorimetric method of Sandell-Kolthoff as proposed by Pino et al [59].

2.6.4. Food samples

Analysis of salt and flour samples

Salt and flour samples were analyzed by the laboratory of the Department on Diseases Prevention and State Sanitary Epidemiological Surveillance in Bishkek. Iodine in salt was first measured qualitatively using a rapid test kit (RTK) for iodate. Subsequently, a quantitative analysis was conducted using the iReader device (Mahidol University, Bangkok, Thailand) [60] on samples testing positive when using RTK. After every ninth sample, a quality control sample was measured. This external quality control sample was prepared by Südwestdeutsche Salzwerke AG, Heilbronn, Germany. Laboratory technicians were trained on the analytical procedures specific to the NIMAS.

To determine iron concentration in the wheat flour samples the iCheck Iron device was used (BioAnalyt, Potsdam, Germany; [61]). iCheck Iron is a portable all-inclusive test kit that measures iron in a wide range of premixes and foods using a single-wavelength photometer, pre-calibrated for quantitative measurement of iron. As different sample dilution methods were needed with iCheck depending on the iron compound added to the wheat flour during fortification, a rapid spot test was performed prior to the iCheck analysis, which allowed to distinguish between Sodium Iron ETDA (NaFeEDTA), ferrous sulfate or ferrous fumarate. After every ninth sample, a quality control sample was measured. Laboratory technicians were trained on the analytical procedures specific to the NIMAS.

2.7. Data management and analysis

2.7.1. Data entry

Direct electronic data entry was done using KoboCollect during the household, child, and women interviews. For the parts of the individual questionnaires (biological form) that were completed by the anthropometrist/phlebotomist using a paper form, the interviewers entered the data into KoboCollect on the same or the following day. Completed questionnaires were cross-checked on a daily basis by the team leaders prior to data uploading to a cloud-based secure server.

2.7.2. Data monitoring

Interview data uploaded from the tablets to the cloud were monitored continuously and a weekly monitoring report was prepared. In case of systematic and sporadic errors made by one or several teams, all team leaders were immediately informed about the problem, so the problem was not repeated. For errors that the teams could address, they were requested to do so immediately, while still in a given PSU. For some variables, such data quality checks could not be done immediately (e.g., composite anthropometric indicators) and thus, during data analysis, quality checks were conducted to assess the quality of the data collected.

2.7.3. Data analysis

Data analysis was done using Stata/IC version 17. All analyses of questionnaire data, biomarkers and salt samples were conducted using a weighted analysis to account for the unequal probability of selection in the 9 strata. However, tables presenting the summary of the survey sample accounted for unequal probability of selection of primary sampling units, but each household, child, or woman were equally weighted to produce summary figures.

For continuous variables, means with standard deviations and medians with interquartile ranges were calculated for normally distributed and skewed data, respectively. Regarding urinary iodine concentrations (UIC), median UICs were calculated for each target group overall and for subgroups in order to judge population iodine status against WHO criteria [58]. However, in order to judge the statistical precision of apparent differences among subgroups, a square root transformation of the UIC values created a variable which was normally distributed [62]. Linear regression was then used to calculate p-values for apparent association between the geometric UIC means and each characteristic.

For categorical variables, proportions were calculated to derive the prevalence of various outcomes. The statistical precisions of all prevalence estimates were assessed by using 95% confidence limits which were calculated accounting for the complex sampling used in this survey, including the cluster and stratified sampling. All measures of precision, including confidence limits and chi square p-values for differences, were calculated accounting for the complex cluster and stratified sampling used by the NIMAS 2021.

Descriptive statistics were calculated for children 6-59 months of age, children 5-9 years of age, adolescent girls and non-pregnant women (i.e., across all strata), for each stratum separately and by sex (for children). Results are also presented by specific age sub-groups for non-pregnant women and children. For example, results are presented for children 6-11 months, 12-23 months, 24-35 months, 36-47 months, and 48-59 months of age; for SAC, yearly intervals served as the sub-group age ranges. Age subgroups for non-pregnant women are 15-19 years, 20-29 years, 30-39 years, and 40-49 years. For adolescent girls, sub-groups include pre-menarche and menarche. For pregnant women, only national estimates for all ages have been generated and little subgroup analysis was possible due to the small sample size.

Females aged 15-18 years belonged to 2 different groups: a) adolescent girls and b) non-pregnant women. All females aged 15-18 years were included in the adolescent girl data analyses. For the non-pregnant women analyses, females aged 15-18 years were only included from every second household following the same selection procedure as for non-pregnant women 19-49 years of age.

Calculation of composite variables

Wealth index: Using data on each household's dwelling, water and sanitation conditions and facilities, and ownership of durable goods, a wealth index was calculated using the World Bank method [63]. Calculation of wealth index quintiles was used to categorize the continuous wealth index and permit the cross-tabulation and the subsequent presentation of key indicators by wealth.

Household sanitation: Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field.

Safe drinking water: Composite variable of main source of drinking water and treating water to make safe for drinking. Improved source of drinking water was defined as water from piped system, tube well or borehole, protected well, protected spring, rainwater collection, bottled water or sachet water. Unimproved source was defined as water from unprotected well, unprotected spring, tanker truck or cart, surface water or other.

Minimum dietary diversity: For women, adolescent girls, and children 5-9 years of age, minimum dietary diversity was calculated using the FANTA W-MDD method [29]. For the calculation of the IYCF complementary feeding indicator for children 6-23 months of age, the 2021 updated WHO/UNICEF guideline on indicators for assessing infant and young child feeding practices was used, which defines minimum diversity as consuming foods and beverages from at least five out of eight defined food groups (including breast milk) during the previous day [28]. For children 6-59 months of age, minimum dietary diversity was defined using the same defined food groups as for children 6-23 months, but excluding breast milk; thus minimum dietary diversity was achieved if these children ate at least four out of seven food groups. For all other population groups minimum dietary diversity was defined as the consumption of at least 5 food groups.

Food security: To determine each household's access for food in the past 30 days, household questionnaires included the Household Food Insecurity Access Scale (HFIAS) module. Specifically, nine separate yes/no questions were asked to gauge if different aspects of food insecurity existed in the past 30 days, and if so, a follow up question was asked to determine the frequency of the occurrence. Question responses were summed to produces a food insecurity score for each household, which in turn was classified into a food insecurity category according to guidelines developed by the Food and Nutrition Technical Assistance (FANTA) project [64].

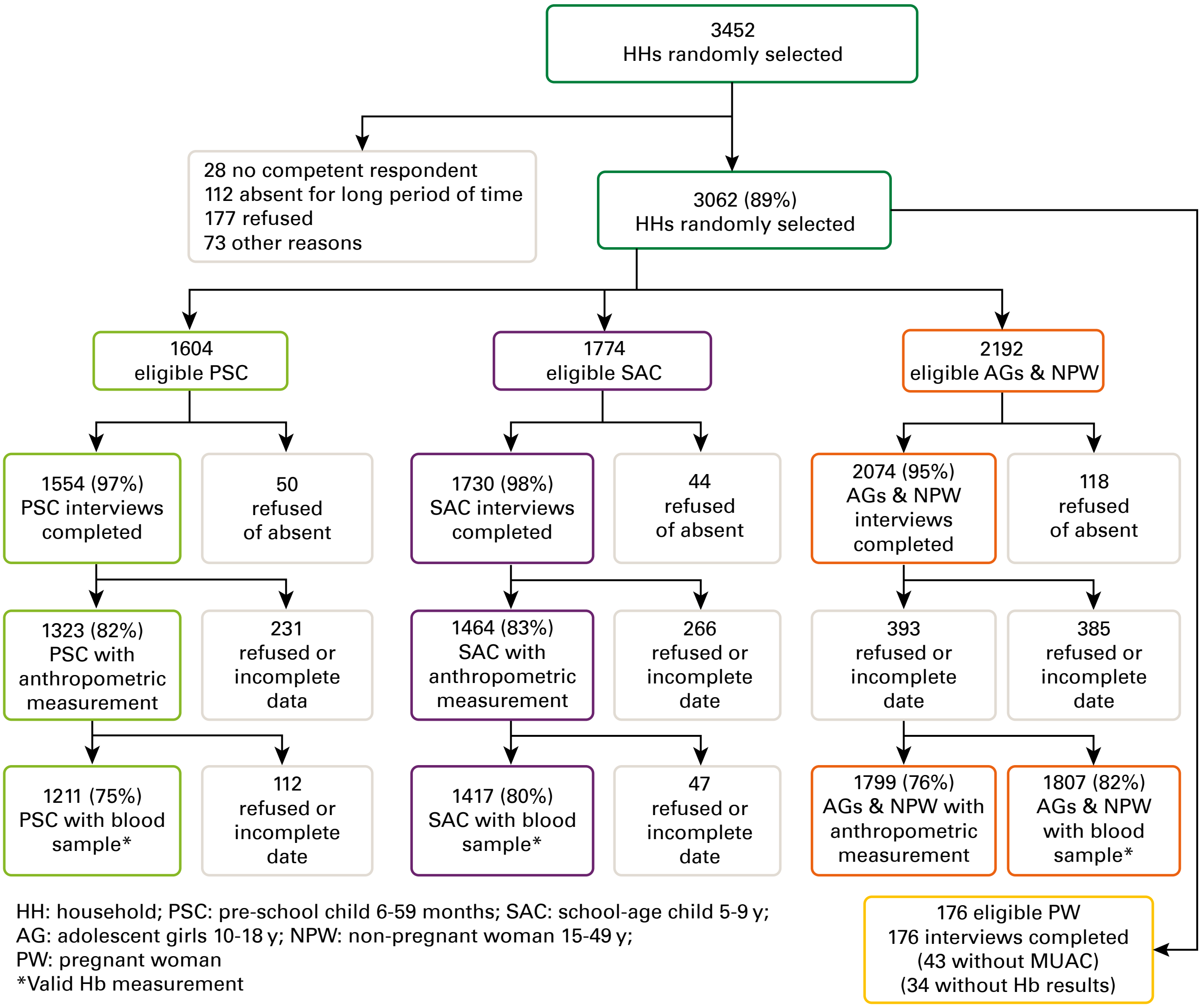
Clean/solid fuel: Solid fuels include coal/lignite, charcoal, wood, straw/shrub/grass, agricultural crops, and animal dung. Clean fuels include electricity, liquefied petroleum gas (LPG), natural gas, and biogas [65].

3. RESULTS

3.1. Study participation of households, children, and women

Figure 2 below provides an overview of the number of respondents at the different survey stages. Only about 11% of households were absent or refused to participate in the survey. Among women and adolescent girls residing in the participating households, 2250 women and adolescent girls agreed to participate and completed the individual interview. Anthropometric measurements and blood (hemoglobin) were collected from 1799 and 1802 non- pregnant women and adolescent girls, respectively. Overall, 1557 children 6-59 months old participated in the survey, of which 1323 completed anthropometry measurements. Hemoglobin measurements were obtained from 1211 children 6-59 months old. Among children aged 5-9 years residing in the participating households, 1730 completed the individual interview. Anthropometric measurements and blood (hemoglobin) were collected from 1464 and 1417 children 5-9 years of age, respectively.

Figure 2. Participation flow diagram for households, women, adolescent girls and children, the Kyrgyz Republic 2021



HH: household; PSC: pre-school child 6-59 months; SAC: school-age child 5-9 y;
AG: adolescent girls 10-18 y; NPW: non-pregnant woman 15-49 y;
PW: pregnant woman
*Valid Hb measurement

3.2. Household characteristics

3.2.1. Demographic characteristics

The characteristics of participating households in the NIMAS 2021 are summarized in Table 7, Table 8, and Table 9 below. In total, 3062 households were included, with about 60% recruited from rural areas. On average, households contained about 4.3 members. A large majority of households in the Kyrgyz Republic have household heads who are of Kyrgyz ethnicity, followed by Uzbek and Russian. Almost 60% of the household heads are male and about 90% of the household heads completed secondary school or higher.

Table 7. Characteristics of participating households, the Kyrgyz Republic 2021

Characteristic	N	%[a]	% in most recent census [63]
Urban/rural			
Urban	1370	40.1	34
Rural	1692	59.9	66
Region			
Batken oblast	298	7.0	8
Jalal-Abad oblast	321	16.0	19
Issyk-Kul oblast	352	8.8	8
Naryn oblast	312	4.6	4
Osh oblast	332	17.0	21
Talas oblast	283	4.1	4
Chui oblast	308	16.9	15
Bishkek city	476	20.4	16
Osh city	380	5.2	5
Wealth quintile			
Lowest	686	20.0	
Second	593	20.0	
Middle	575	20.0	
Fourth	602	20.1	
Highest	606	19.9	
Ethnicity of household			
Kyrgyz	2369	76.4	
Russian	203	8.0	
Узбек	398	11.7	
Other	92	4.0	
First language of			
Kyrgyz	2327	74.3	
Uzbek	395	11.6	
Russian	316	12.9	
Other	24	1.1	
Sex of household head			
Male	1879	58.5	
Female	1183	41.5	
TOTAL	3062		

Note: The N's are the denominators for a specific sub-group.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection.

Table 8. Household composition of participating households, the Kyrgyz Republic 2021

Characteristic	N	%[a] or mean	(95% CI) [b]
Average household size			
Mean	3062	4.3	(4.2, 4.5)
Number of household (HH) members			
1	251	8.5	(7.2, 10.0)
2	434	14.8	(13.5, 16.3)
3	483	16.1	(14.4, 17.8)
4	486	15.8	(14.3, 17.4)
5	465	15.3	(13.9, 16.8)
6	392	12.3	(11.2, 13.6)
7	288	9.1	(8.0, 10.4)
8+	263	8.1	(7.0, 9.4)
Proportion of HHs with given number of women 15-49 years of age			
0	2159	16.5	(15.1, 18.0)
1	8194	59.9	(57.7, 62.1)
2	2473	19.1	(17.0, 21.3)
3	635	4.3	(3.3, 5.6)
4	58	0.2	(0.1, 0.6)
Proportion of HH with given number of adolescent girls 10-18 years of age			
0	2246	73.7	(71.9, 75.4)
1	624	20.5	(19.0, 22.1)
2	162	4.9	(4.0, 5.9)
3	27	0.8	(0.5, 1.2)
4	3	0.1	(0.0, 0.4)
Proportion of HH with given number of children 6-59 months of age			
0	1891	62.5	(60.2, 64.7)
1	759	24.3	(22.4, 26.3)
2	364	11.6	(10.4, 13.0)
3	43	1.3	(1.0, 1.8)
4	5	0.2	(0.1, 0.5)
Proportion of HH with given number of children 5-9 years of age			
0	1801	60.1	(58.1, 62.1)
1	799	25.3	(23.6, 27.0)
2	386	11.9	(10.6, 13.3)
3	67	2.4	(1.9, 3.1)
4	6	0.2	(0.1, 0.5)
5	3	0.1	(0.0, 0.2)
TOTAL	**3062**	**--**	**--**

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

Table 9. Educational level of household head for participating households, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Head of household ever attended school or preschool			
Yes	2953	96.7	(95.8, 97.4)
No	102	3.1	(2.4, 3.9)
Don't know	7	0.3	(0.1, 0.6)
Highest level of school attended by household head			
Primary	33	1.4	(1.0, 2.0)
Basic secondary	278	8.8	(7.5, 10.3)
Complete secondary	1161	39.6	(36.9, 42.3)
Professional Primary/ middle	834	28.8	(26.7, 31.1)
Higher	631	20.9	(18.9, 23.0)
Don`t know	16	0.5	(0.2, 0.9)

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.2.2. Cooking fuel and household lighting

As shown in Table 10, nearly 80% of participating households used clean fuel for cooking, and nearly all households used electricity from the electricity grid to light their house. Regarding home heating, more than half of the participating households used a solid fuel source exclusively, and nearly one-quarter of households used clean heating fuel. Both clean and solid fuels were used in tandem by about 20% of households.

3.2.3. Household food insecurity

Table 11 presents the household food insecurity status for residence, region, and wealth quintile, showing food insecurity status is significantly associated with all of them. Regarding residence, urban households are significantly more food secure than rural households, but the difference in the prevalence (~6%) of Household food securitys is relatively small. Issyk-Kul, Naryn, Talas, and Chui have the highest proportions (40-48%) of food insecure households. The proportion of Household food securitys is also correlated with wealth quintile, with higher proportions of Household food securitys as wealth quintile increases.

Food insecurity status is presented by category (i.e., food secure, mildly food insecure, moderately food insecure, severely food insecure) in Table 88 in appendix 8.1. The proportion of households with severe food insecurity is higher in rural areas compared to urban centers. Moreover, the largest proportion of severely food insecure households was found in Chui (11%) and Naryn (8.6%), while few households are severely food insecure in Jalal Abad and Bishkek. Further, households of the lowest wealth quintile are more likely to be severely food insecure than households of the other wealth quintiles.

Table 10. Type of energy used for cooking, lighting and heating in participating households, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI))[b]
Type of fuel used for cooking			
Clean fuel[c]	2461	78.0	(75.8, 80.1)
Solid fuel[c]	576	21.5	(19.4, 23.7)
No food cooked in household / Don't know / Other	25	0.5	(0.3, 0.8)
How household is lit at night			
Mains electricity	3055	99.7	(99.4, 99.9)
Solar energy	2	0.1	(0.0, 0.3)

Kerosene/ paraffin	1	0.0	(0.0, 0.3)
Firewood	2	0.1	(0.0, 0.3)
Biogas lamp	1	0.0	(0.0, 0.3)
Gasoline lamp	1	0.0	(0.0, 0.3)
Type of fuel or energy used to heat the house [c]			
Clean fuel only	707	23.2	(19.9, 26.9)
Solid fuel only	1700	55.1	(51.8, 58.2)
Clean and solid fuel	636	21.1	(18.6, 23.9)
Household does not have heating	2	0.0	(0.0, 0.2)
Other heating source	12	0.3	(0.2, 0.8)
Don`t know	5	0.2	(0.1, 0.6)
TOTAL	**3062**		

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

a Percentages weighted for unequal probability of selection.

b CI=confidence interval, calculated taking into account the complex sampling design.

c Clean fuels include electricity, liquefied petroleum gas (LPG), natural gas, and biogas. Solid fuels include coal/lignite, charcoal, wood, straw/shrub/grass, and animal dung.

Table 11. Household food insecurity score (HFIAS) categories, by residence, region, and wealth quintile, the Kyrgyz Republic 2021

Characteristic	N	Food secure, %[a]	(95% CI)[b]	Food insecure, %[a]	(95% CI)[b]	P-value[c]
Residence						
Urban	1370	73.9	(70.0, 77.4)	26.1	(23.1, 29.3)	<0.01
Rural	1692	68.1	(65.1, 71.0)	31.9	(29.3, 34.6)	
Region						
Batken oblast	298	77.4	(70.8, 82.9)	22.6	(17.1, 29.2)	<0.001
Jalal-Abad oblast	321	85.4	(79.4, 89.8)	14.6	(10.1, 20.8)	
Issyk-Kul oblast	352	56.4	(49.7, 62.9)	43.6	(37.7, 49.7)	
Naryn oblast	312	53.2	(49.0, 57.3)	46.8	(42.7, 51.0)	
Osh oblast	332	75.2	(69.4, 80.3)	24.8	(19.6, 30.7)	
Talas oblast	283	60.4	(53.9, 66.4)	39.6	(33.5, 46.1)	
Chui oblast	308	52.2	(46.8, 57.7)	47.8	(42.5, 53.1)	
Bishkek city	476	78.5	(73.2, 83.0)	21.4	(17.0, 26.7)	
Osh city	380	73.7	(69.4, 77.6)	26.3	(22.4, 30.6)	
Wealth quintile						
Lowest	686	53.4	(48.6, 58.2)	46.5	(41.8, 51.3)	<0.001
Second	593	65.7	(61.1, 69.8)	34.3	(30.1, 38.8)	
Middle	575	76.2	(72.6, 79.5)	23.9	(20.7, 27.4)	
Fourth	602	77.1	(72.7, 80.7)	23	(19.2, 27.1)	
Highest	606	79.9	(74.6, 84.3)	20.1	(15.9, 25.0)	
TOTAL	**3062**	**70.4**	**(68.4, 72.5)**	**29.6**	**(27.5, 31.6)**	

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

3.2.4. Water and sanitation

As shown in Table 12, almost 95% of the households have an improved source of water for drinking. About half of the households reported treating their water to make it safe to drink. Thus, almost all participating households in fact drank safe water. Most households (n=26) that do not consume safe drinking water are located in Jalal-Abad (data not shown). Regarding sanitation, almost nine out of ten households nationally have improved sanitation facilities, however, significantly ($p<0.001$) lower prevalences are found in Batken and Jalal-Abad (see Figure 3).

Table 12. Indicators of household water and sanitation, the Kyrgyz Republic 2021

Characteristic	N	% [a]	(95% CI)) [b]
Main source of water for drinking [c]			
Unimproved source	189	5.3	(3.4, 8.1)
Improved source	2871	94.6	(91.9, 96.5)
Don't know	2	0.1	(0.0, 0.3)
Treat water to make safe to drink			
Yes	1661	47.9	(45.5, 50.4)
No	1392	51.9	(49.5, 54.3)
Don't know	9	0.2	(0.1, 0.4)
Treatment method (N=1661) [d]			
Boil	1331	79.3	(76.1, 82.3)
Add bleach	33	1.5	(1.0, 2.3)
Strain through cloth	22	1.3	(0.8, 2.0)
Water filter	275	17.5	(14.6, 20.9)
Solar disinfection	20	1.2	(0.7, 1.9)
Let it stand	214	9.4	(7.8, 11.2)
Drink safe water			
Yes	3012	98.1	(96.3, 99.0)
No	48	1.9	(0.9, 3.7)
Don't know	2	0.1	(0.0, 0.3)
Household sanitation [f]			
Adequate	2658	87.2	(85.3, 88.9)
Unadequate	400	12.7	(11.0, 14.6)
Don't know	4	0.1	(0.0, 0.2)
TOTAL	**3062**		

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Improved source = water from piped system, tube well or borehole, protected well, protected spring, rainwater collection, bottled water or sachet water. Unimproved source = water from unprotected well, unprotected spring, tanker truck or cart, surface water or other.

[d] Water treatment methods asked to households reporting that some type of water treatment was done (N=1661, and multiple responses to water treatment method were permitted

[e] Composite variable of main source of drinking water and treating water to make safe for drinking.

[f] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab or ventilated improved pit latrine not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field.

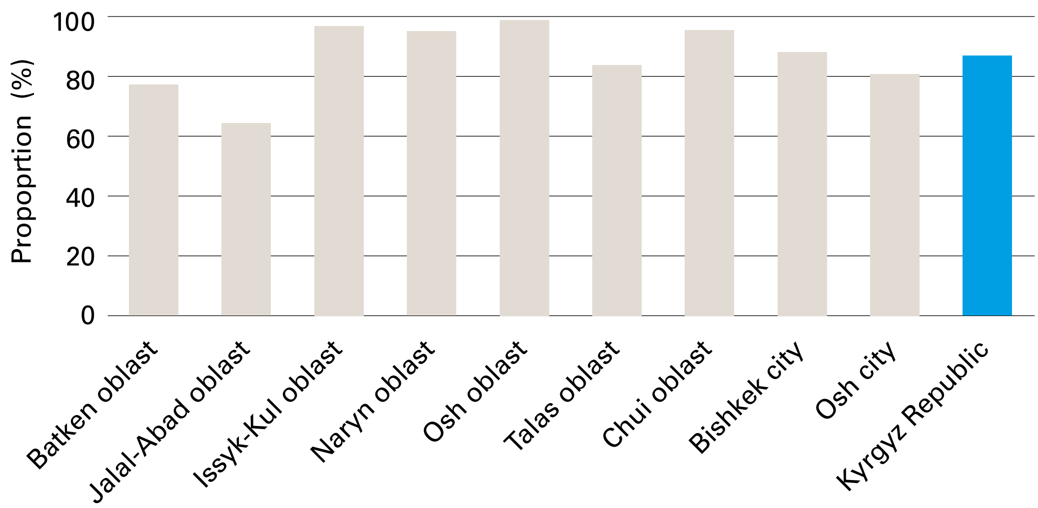


Figure 3. Proportion of households with adequate sanitation facilities, by region

About 70% of the households have a fixed sink or basin for handwashing, and the remaining households wash hands elsewhere in or around the dwelling. Almost all households had water available at the handwashing site and had some kind of soap at the handwashing site at the time of the survey (Table 13).

Table 13. Indicators of handwashing, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Location of handwashing site			
Fixed place (observed)	2155	71.0	(68.7, 73.1)
Mobile (observed)	847	27.7	(25.6, 29.9)
Not observed, not in dwelling	43	0.9	(0.6, 1.4)
Not observed, permission to see not given	11	0.2	(0.1, 0.5)
Not observed, other reason	6	0.2	(0.1, 0.5)
Water is available at observed handwashing place[c]			
No	149	4.5	(3.6, 5.6)
Yes	2853	95.5	(94.4, 96.4)
Soap seen at handwashing site[c]			
Bar soap, liquid soap, detergent	2873	95.0	(94.0, 95.9)
Ash / mud / sand	46	1.3	(0.9, 1.9)
No soap	122	4.8	(3.9, 5.8)

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Results based on households where handwashing site was observed (N=3002), but N's do not sum to total as multiple responses permitted.

3.2.5. Salt iodization

About 99% of households had salt in their house at the time of the survey, and almost all participating households provided a sample to the interviewer. A very high proportion (93.3%) of households believed that the salt they used was iodized. Note, this result reflects the respondents' perception of their salt's iodization status. More than 70% of surveyed households had salt in its original package, with the package label stating that it was iodized, whereas about one quarter of the available salt was not in the original package (see Table 14).

Salt was collected from participating households for subsequent quantitative testing for iodine content at the central laboratory. Nationally, the median iodine salt concentration in the Kyrgyz Republic is relatively high (19.7 ppm). As shown in Figure 4, about three quarter of the salt samples are adequately iodized, about one quarter are inadequately iodized, and a small proportion is not iodized.

Figure 5 presents the distribution of household salt iodine concentration, corroborating that a small proportion contains less than 5 ppm iodine and none of the salt is over-iodized. While most of the samples are above the international cut-off of 15 ppm, the majority of the salt is below the cut-off mandated by the government (25 ppm).

Table 14. Household salt availability, and packaging, the Kyrgyz Republic 2021

Characteristic	N	% [a]	(95% CI) [b]
Household uses salt			
Yes	3056	99.8	(99.6, 99.9)
No	6	0.2	(0.1, 0.4)
Have salt in house			
Yes	3014	98.6	(98.1, 99.0)
No	42	1.4	(1.0, 1.9)
Interviewer able to observe salt storage			
Yes	2947	97.7	(96.9, 98.3)
No	67	2.3	(1.7, 3.1)
Salt exposure to light[c]			
Exposed to sunlight	121	5.0	(4.0, 6.1)
Sheltered from sunlight	2826	95.0	(93.9, 96.0)
Respondent believes salt is iodized[c, d]			
Yes	2794	93.3	(92.0, 94.4)
No	20	0.6	(0.4, 1.1)
Don't know	200	6.1	(5.0, 7.4)
Salt iodization labelling[c]			
Original packaging stating salt is iodized	2111	71.9	(69.6, 74.0)
Original packaging without mention of iodization	64	2.7	(1.9, 3.9)
Undetermined, not in original package	684	23.2	(21.4, 25.2)
Undetermined for other reasons	88	2.2	(1.8, 2.8)
Most commonly used salt brands[e]			
Bereke	764	35.4	(31.9, 39.1)
Kartuz	624	30.4	(27.6, 33.5)
Extra	373	19.0	(16.6, 21.6)
Araltuz	299	9.6	(8.0, 11.4)
Osh Tuzu	39	1.9	(0.9, 4.0)
Salamat	19	1.2	(0.5, 2.5)
Extra Povarenok	10	0.5	(0.2, 1.1)
Nur	10	0.5	(0.3, 1.0)
Other	42	1.6	(1.1, 2.2)

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Results based on households that had salt in the house at the time of the survey.

[d] This variable was calculated based on respondents' perceptions about whether or not salt was iodized.

[e] Results (n=2180) exclude salt not in original package.

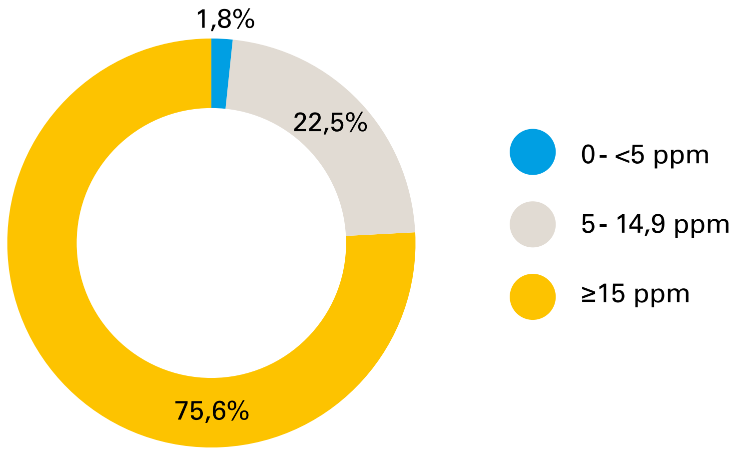


Figure 4. Salt iodine concentration by categories not iodized (0-<5ppm), inadequately iodized (5-14.9ppm) and adequately iodized (≥ 15 ppm), the Kyrgyz Republic 2021

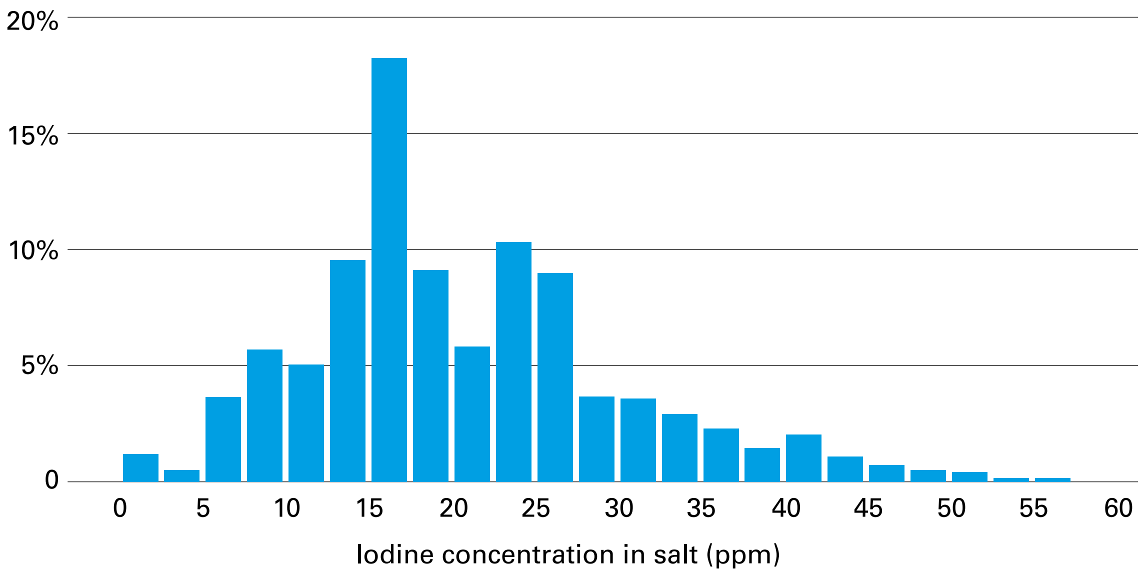


Figure 5. Distribution of household salt iodine concentrations, the Kyrgyz Republic 2021

As shown in Table 15, a significantly larger proportion of households in urban than rural areas have adequately iodized salt. Significant differences were also found by region: More than 95% of households in Bishkek have adequately iodized salt, whereas just over 60% of surveyed households have adequately iodized salt in Batken, Issyk Kul, and Osh City (see also Figure 6). Moreover, significant differences were found by household wealth, with a larger proportion of households in the highest quintile using adequately iodized salt. While no association was detected between food insecurity and adequate salt iodization, significantly fewer households with severe food insecurity have iodized salt (i.e., any amount of iodine) at home compared to other households. Similarly, significant differences in the proportion of households with iodized salt (any level) were found for residence, region and wealth quintile. Surprisingly, neither the label, nor the salt brand is significantly associated with iodization (any level). Surprisingly, the proportion of adequately iodized salt is higher in samples that were not labelled as iodized compared to salt in the original packaging stating that it is iodized.

Table 15. Доля домохозяйств, в которых соль была йодирована a и адекватно йодирована, Kyrgyzская Республика a, 2021 год

Characteristic	N	Median iodine concentration (ppm)	Iodized[a]			Adequately iodized (≥15ppm)[a]			Adequately iodized (≥25ppm)[a]		
			%[b]	(95% CI)[c]	P-value[d]	%[b]	(95% CI)[c]	P-value[d]	%[b]	(95% CI)[c]	P-value[d]
Residence											
Urban	1256	20.67	99.0	(98.1, 99.5)	<0.05	80.8	(78.0, 83.3)	<0.001	37.2	(33.2, 41.4)	<0.01
Rural	1606	19.01	97.6	(96.3, 98.5)		72.3	(69.4, 75.0)		30.0	(27.0, 33.2)	
Region											
Batken oblast	295	17.25	97.4	(93.6, 98.9)	<0.05	62.3	(53.5, 70.3)	<0.001	17.0	(13.3, 21.6)	<0.001
Jalal-Abad oblast	304	24.62	99.0	(97.1, 99.7)		71.4	(64.6, 77.3)		44.7	(38.4, 51.3)	
Issyk-Kul oblast	336	16.07	98.5	(96.1, 99.5)		65.6	(60.4, 70.5)		7.4	(4.6, 11.8)	
Naryn oblast	287	17.14	99.3	(97.3, 99.8)		68.0	(61.8, 73.5)		23.0	(17.7, 29.2)	
Osh oblast	304	16.83	96.6	(92.0, 98.6)		70.6	(63.7, 76.7)		27.3	(20.3, 35.5)	
Talas oblast	278	21.74	95.6	(91.2, 97.8)		78.1	(72.1, 83.2)		35.4	(28.4, 43.1)	
Chui oblast	281	20.35	97.5	(94.8, 98.8)		78.3	(74.1, 82.0)		36.3	(30.8, 42.2)	
Bishkek city	417	23.45	100	-		95.4	(92.9, 97.1)		46.5	(39.5, 53.7)	
Osh city	360	16.79	97.5	(93.7, 99.0)		64.9	(58.3, 70.9)		25.0	(20.1, 30.6)	
Wealth quintile											
Lowest	652	18.36	97.3	(94.9, 98.6)	<0.005	72.8	(68.9, 76.3)	<0.001	25.4	(21.2, 30.0)	<0.001
Second	564	19.82	98.2	(96.5, 99.1)		72.7	(67.9, 76.9)		31.9	(27.2, 37.0)	
Middle	538	17.40	96.8	(94.8, 98.1)		66.8	(61.6, 71.6)		29.8	(25.2, 34.9)	
Fourth	571	20.09	98.9	(97.6, 99.5)		77.9	(73.6, 81.7)		32.1	(27.5, 37.1)	
Highest	535	22.60	99.7	(98.5, 99.9)		88.9	(85.7, 91.5)		46.0	(39.3, 52.7)	
Household food security											
Secure	1954	20.13	98.5	(97.7, 99.0)	<0.05	76	(73.6, 78.3)	0.621	34.1	(31.2, 37.2)	0.299
Mildly insecure	320	18.90	97.7	(94.9, 98.9)		72.5	(66.5, 77.8)		29.8	(23.8, 36.5)	
Moderately insecure	425	19.65	98.0	(96.0, 99.0)		76.6	(72.1, 80.5)		29.4	(24.7, 34.7)	
Severely insecure	163	18.69	94.8	(86.4, 98.1)		73.8	(64.9, 81.1)		31.2	(23.5, 40.2)	
Packaging of salt											
Original packaging stating salt is iodized	2013	18.73	98.0	(96.9, 98.7)	0.708	73.2	(70.6, 75.7)	<0.005	30.1	(27.4, 33.0)	<0.01

Original packaging without mention of iodization	54	21.39	98.9	(92.1, 99.8)		87.7	(74.5, 94.5)		37.9	(23.8, 54.4)	
Undetermined, not in original package	649	22.0	98.2	(96.7, 99.0)		79.6	(75.8, 82.9)		39.1	(34.1, 44.3)	
Undetermined for other reasons	82	23.89	100	-		86.6	(76.9, 92.7)		40.2	(28.3, 53.3)	
Salt brand (n=2072)											
Bereke	724	18.45	98.8	(97.5, 99.4)	<0.05	75.1	(70.9, 78.9)	<0.001	22.3	(18.5, 26.6)	<0.001
Kartuz	592	16.39	96.9	(93.9, 98.4)		65.2	(59.0, 70.9)		21.5	(18.0, 25.6)	
Osh Tuzu	37	16.75	100.0	-		72.1	(62.9, 79.7)		17.8	(6.9, 38.9)	
Extra	352	30.78	100.0	-		86.5	(81.8, 90.2)		70.1	(64.1, 75.5)	
Extra Povarenok	8	39.85	100.0	-		91.6	(56.4, 98.9)		55.3	(21.4, 84.9)	
Araltuz	293	17.06	98.6	(96.7, 99.4)		73.2	(68.2, 77.8)		15.7	(11.2, 21.7)	
Nur	9	19.22	74.7	(33.7, 94.5)		61.9	(26.5, 88.0)		4.8	(0.6, 29.0)	
Salamat	18	15.82	87.7	(57.4, 97.4)		70.1	(49.2, 85.0)		17.6	(8.3, 33.6)	
Other	39	19.07	90.0	(72.0, 96.9)		72.2	(54.2, 85.1)		36.7	(21.4, 55.1)	
TOTAL	**2862**	**19.74**	**98.2**	**(97.3, 98.7)**		**75.6**	**(73.7, 77.5)**		**32.8**	**(30.4, 65.4)**	

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

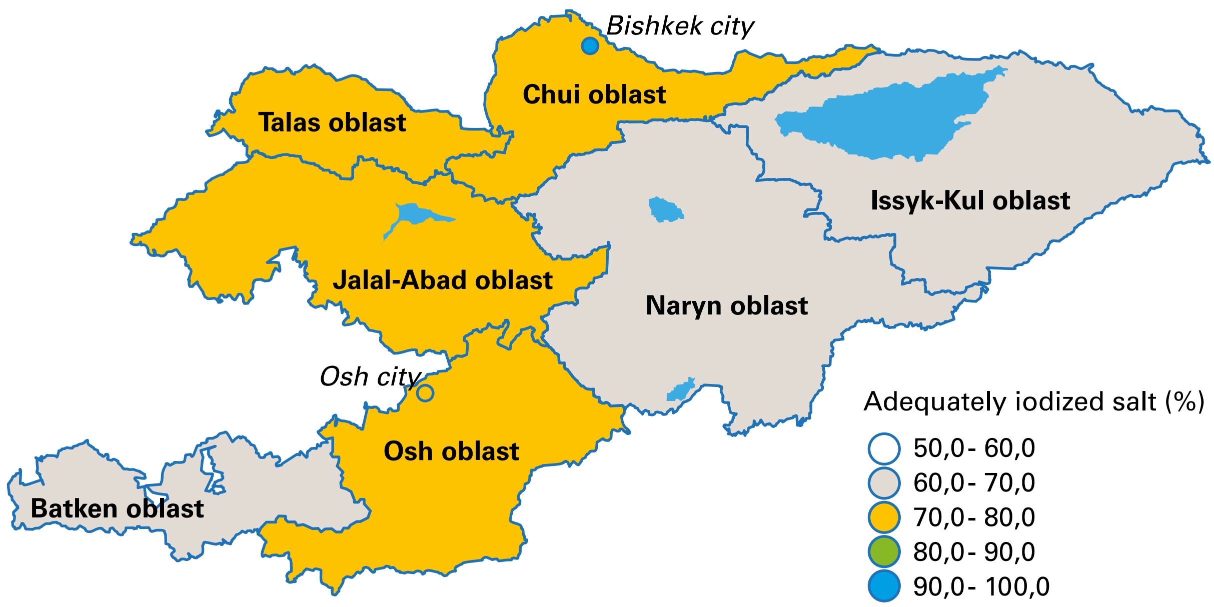
[a] Iodized salt: ⩾ 5ppm; adequately iodized salt: ⩾ 15ppm (international cut-off); adequately iodized salt: ⩾ 25ppm (national cut-off)

[b] All percentages except region-specific estimates are weighted for unequal probability of selection.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups

Figure 6. Proportion of households with adequate salt iodization (≥15 ppm), by region, the Kyrgyz Republic 2021



3.2.6. Bread and flour types and iron fortification

As shown in Table 16, almost all surveyed households consume bread and more than 60% consume home-made bread. The most commonly purchased breads were white bread and flat bread.

Almost 96% of participating households had flour at home at the time of the survey. About half of the respondents believed that the flour they used was fortified and about one-third of households were unsure about whether it was fortified or not. More than 70% of surveyed households had flour in its original package, and the majority of packages stated that the flour was fortified (see Table 17).

Table 16. Household bread consumption, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Household consumes bread			
Yes	3032	99.2	(98.8, 99.5)
No	29	0.8	(0.5, 1.2)
Вид обычно употребляемого хлеба			
Mainly purchased	1016	36.6	(33.8, 39.4)
Mainly homemade	2016	63.4	(60.6, 66.2)
Type of bread most commonly purchased[c]			
White loaf/ white bread	426	46.3	(42.9, 49.8)
Rye bread	129	13.5	(11.3, 16.0)
Flat bread (Lepeshka)	433	37.4	(33.8, 41.2)
Wholegrain bread (Celnozernovoi)	13	1.4	(0.6, 3.0)
Other	11	1.2	(0.6, 2.5)
Don`t know	4	0.2	(0.1, 0.4)

Note: The N’s are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.
[c] Only includes households mainly purchasing bread

Table 17. Household wheat flour consumption, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Household had flour in household			
Yes	2576	95.7	(94.6, 96.6)
No	104	4.3	(3.4, 5.4)
Household reports flour is fortified[c,d]			
Yes	1388	55.5	(53.0, 58.1)
No	276	9.7	(8.5, 11.0)
Don't know	912	34.8	(32.5, 37.2)
Packaging of flour[e]			
Original packaging stating flour is fortified	1168	48.2	(45.4, 51.1)
Original packaging without mention of fortification	595	25.0	(22.6, 27.6)
Undetermined, not in original package	601	23.6	(21.5, 25.9)
Undetermined for other reasons	97	3.2	(2.5, 4.1)
Most commonly used flour brands[f]			
Akun	253	15.6	(13.7, 17.7)
Aliya	78	4.6	(3.6, 5.8)
Yashar	99	6.1	(4.5, 8.1)
Zhaksy	119	6.3	(5.1, 7.9)
Eldan	194	8.7	(7.5, 9.9)
Cesna	232	8.6	(7.4, 10.0)
Elnur	16	1.3	(0.7, 2.3)
Grain Ho	29	2.3	(1.3, 3.8)
Barakat	30	1.3	(0.8, 2.1)
Dani-Nan	38	1.5	(0.9, 2.5)
Dastarkh	46	2.9	(2.0, 4.3)
Dilnaz	43	3.4	(2.3, 5.0)
Makfa	16	1.0	(0.5, 1.9)
Mariyam	22	1.8	(1.1, 3.0)
Narodnay	20	1.3	(0.7, 2.4)
Nooruz	16	1.0	(0.5, 2.1)
Orion	19	1.4	(0.7, 3.0)
Pioneer	31	1.4	(0.9, 2.1)
Saryarqa	73	4.2	(2.9, 6.0)
Don't know	389	25.4	(22.7, 28.4)

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages and means are weighted for unequal probability of selection between regions; for some sub-groups the percentages do not add up to 100% because of a small proportion of the respondents that reported 'don't know', which is not shown.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] Results based on households that had flour in the house at the time of the survey.

[d] This variable was calculated based on respondents' perceptions about whether or not flour was fortified.

[e] Results based on households that had flour in the house at the time of the survey and where interviewer was able to observe the flour (N=2461).

[f] Results exclude flour not in original package.

As shown in Table 18 and Figure 7, nearly one-quarter of the Kyrgyz Republic's wheat flour is fortified, but <2% was adequately fortified (i.e., iron EDTA ≥15ppm; ferrous sulfate or ferrous fumarate ≥60ppm). Regarding fortified flour, significant differences were observed by residence, region, and wealth quintile, with higher prevalences found in urban areas, Bishkek (see Figure 8), and higher wealth households, respectively. A statistically significant association was also found between wheat flour fortification and household food security status, with fortified flour consumed more by "mildly" food insecure households. Flour packaging, brand, and country of origin were not significantly associated with the coverage of fortified flour, and no associations were observed between the coverage of adequately fortified flour and the various subgroups.

Table 18. Proportion of households with fortified a and adequately a fortified flour, the Kyrgyz Republic 2021

Characteristic	N	Fortified[a]			Adequately fortified[a]		
		%[b]	(95% CI)[c]	P-value[d]	%[b]	(95% CI)[c]	P-value[d]
Residence							
Urban	299	32.1	(25.9, 38.9)	<0.01	2.4	(1.1, 5.2)	0.404
Rural	405	19.5	(14.8, 25.2)		1.4	(0.5, 4.0)	
Region							
Batken oblast	69	21.5	(12.5, 34.5)	<0.001	0.0	-	0.207
Jalal-Abad oblast	77	13.0	(5.1, 29.5)		2.6	(0.4, 16.2)	
Issyk-Kul oblast	81	22.2	(14.9, 31.6)		3.7	(1.2, 10.5)	
Naryn oblast	76	35.6	(22.0, 51.9)		4.0	(1.3, 11.2)	
Osh oblast	86	29.1	(19.0, 41.9)		0.0	-	
Talas oblast	69	6.1	(2.4, 14.8)		1.8	(0.2, 12.0)	
Chui oblast	67	6.0	(1.8, 17.7)		0.0	-	
Bishkek city	89	47.2	(35.1, 59.6)		3.4	(1.1, 10.0)	
Osh city	90	34.4	(23.9, 46.8)		2.2	(0.6, 8.3)	
Wealth quintile							
Lowest	148	13.5	(8.0, 22.0)	<0.01	0.9	(0.2, 3.6)	0.054
Second	140	23.2	(16.4, 31.7)		0.3	(0.0, 2.2)	
Middle	148	20.3	(13.2, 30.0)		2.9	(0.8, 10.2)	
Fourth	144	27.5	(20.2, 36.2)		0.5	(0.1, 2.1)	
Highest	124	38.7	(27.3, 51.4)		4.1	(1.6, 10.2)	
Household food security							
Secure	487	26.6	(21.8, 32.0)	<0.01	2.1	(1.0, 4.5)	0.531
Mildly insecure	70	30.6	(20.0, 43.6)		0.0	-	
Moderately insecure	113	13.0	(7.7, 21.1)		1.1	(0.3, 4.5)	
Severely insecure	34	12.2	(4.2, 30.7)		1.4	(0.2, 9.3)	
Packaging of flour							
Original packaging stating flour is fortified	300	23.1	(17.6, 29.6)	0.684	2.6	(1.0, 6.3)	0.370
Original packaging without mention of fortification	163	28.4	(20.7, 37.6)		2.0	(0.8, 5.4)	
Undetermined, not in original package	175	22.8	(16.2, 31.1)		0.5	(0.1, 2.0)	
Undetermined for other reasons	27	24.3	(10.8, 45.8)		0.0	-	
Flour brand							
Akun	61	34.0	(22.6, 47.7)	0.149	0.0	-	0.816
Aliya	20	28.1	(12.6, 51.3)		0.0	-	
Yashar	23	41.4	(23.2, 62.4)		4.9	(0.7, 28.2)	
Zhaksy	38	38.6	(23.1, 56.9)		6.6	(1.5, 24.4)	

Eldan	42	15.2	(7.7, 28.0)		2.3	(0.3, 15.3)	
Cesna	58	21.0	(10.5, 37.4)		7.4	(2.1, 22.6)	
Elnur	2	0.0	-		0.0	-	
Grain Ho	11	26.9	(9.8, 55.7)		0.0	-	
Barakat	9	20.2	(5.4, 53.1)		0.0	-	
Dani-Nan	15	8.6	(2.1, 29.4)		0.0	-	
Dastarkh	14	39.9	(15.0, 71.4)		0.0	-	
Dilnaz	7	29.2	(7.1, 69.0)		0.0	-	
Makfa	4	62.0	(14.1, 94.2)		16.5		
Mariyam	9	20.6	(4.2, 60.5)		0.0	-	
Narodnay	4	11.0	(1.2, 56.3)		0.0	-	
Nooruz	4	10.7	(1.4, 49.5)		0.0	-	
Orion	7	0.0	-		0.0	-	
Pioneer	8	0.0	-		0.0	-	
Saryarqa	23	13.0	(4.8, 30.6)		3.5	(0.8, 13.9)	
Don't know	104	21.1	(12.6, 33.1)		2.0	(0.5, 7.3)	
Country of origin							
The Kyrgyz Republic	148	29.6	(22.3, 38.1)	0.1992	1.3	(0.3, 5.6)	0.1385
Kazakhstan	207	22.7	(16.5, 30.4)		3.1	(1.4, 7.0)	
Russia	4	62.0	(14.1, 94.2)		16.4	(1.9, 66.5)	
Unknown	104	21.1	(12.6, 33.1)		2.0	(0.5, 7.3)	
TOTAL	**704**	**24.1**	**(20.2, 28.4)**		**1.7**	**(0.9, 3.4)**	

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data. Flour was collected in a sub-sample (25%) of participating households

[a] Iron fortification: ≥ 5ppm NaFeEDTA or ≥ 10ppm iron fumarate/ sulfate; adequate: ≥ 15ppm NaFeEDTA or ≥ 60ppm iron fumarate/ sulfate

[b] All percentages except region-specific estimates are weighted for unequal probability of selection between regions; for some sub-groups the percentages do not add up to 100% because of a small proportion of the respondents that reported 'don't know', which is not shown.

[c] CI=confidence interval calculated taking into account the complex sampling design

[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

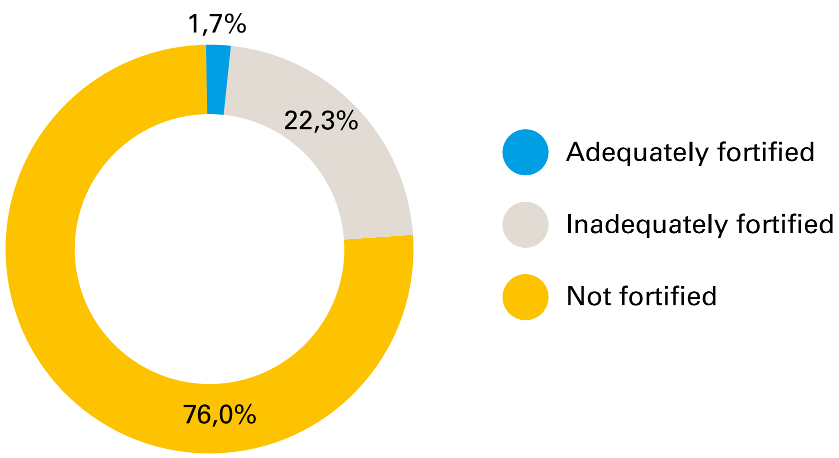


Figure 7. Flour fortification with iron by categories not fortified, inadequately fortified and adequately fortified, the Kyrgyz Republic 2021

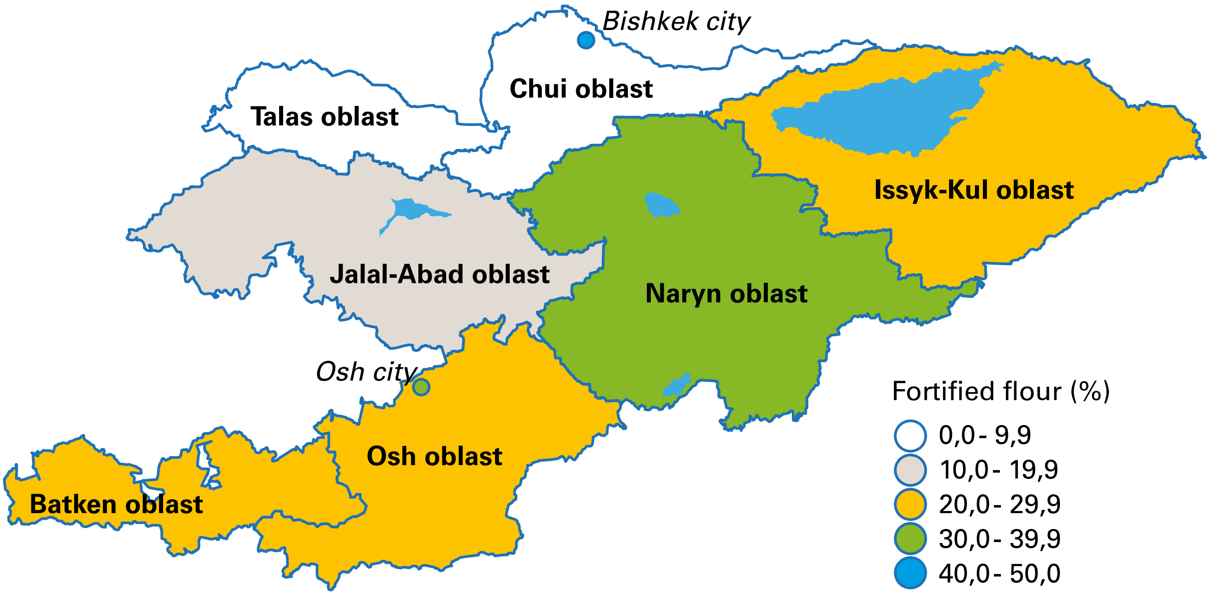


Figure 8. Proportion of households with fortified wheat flour, by region, the Kyrgyz Republic 2021

3.2.7. Covid-19 pandemic impact on participating households

As shown in Table 19, about one-third of households reported that household members have been infected with COVID since the outbreak of the virus, with only about one-quarter of those who reported a COVID infection also reporting that it was confirmed by a positive test result. For almost half of the households, COVID had a negative impact on the income. About 15% of the households received assistance during the COVID outbreak, most of them food.

Table 20 shows the effect of COVID 19 on food access and consumption. Though the majority of surveyed households reported that costs of food have increased since the COVID outbreak, only about 25% of households reported changing their eating behaviour during the pandemic. Moreover, less than one-third of households reported any effects of COVID on food access, half of those stating that it is more difficult to buy foods from local markets, mainly due to price increases.

Table19. Effect of the COVID-19 outbreak on participating households, the Kyrgyz Republic 2021

Characteristic	N	%[a] or mean	(95% CI)[b]
Household member reported infected with COVID since start of the pandemic			
Yes	947	31.5	(29.4, 33.8)
No	2057	66.1	(63.8, 68.3)
Don't know	57	2.4	(1.8, 3.0)
Number of household members sick with COVID-19[c]			
Mean	947	2.0	(1.9, 2.1)
Number of household members with positive COVID-19 test[c]			
Mean	947	0.5	(0.5, 0.6)
Proportion of individuals that reported being sick with COVID-19 infection that had received positive COVID-19 test[d]			
Mean proportion	900	27.6	(24.1, 31.1)
COVID-19 effects on household income			
Income increased	241	7.3	(6.1, 8.7)
Income decreased	1303	44.3	(42.1, 46.5)

No change of income	1484	47.0	(44.8, 49.3)
Don`t know	33	1.4	(0.9, 2.0)
Household received assistance during the pandemic			
Yes	517	15.7	(13.7, 17.9)
No	2529	83.8	(81.6, 85.8)
Don't know	15	0.5	(0.3, 0.9)
Type of assistance[c]			
Money	16	3.2	(1.9, 5.2)
Food	484	94.9	(92.3, 96.6)
Hygiene/ protection kits	48	6.6	(5.0, 8.8)
Other	25	4.5	(3.0, 6.9)
Number of times food was received[d]			
Mean	485	2.3	(1.3, 3.4)
Amount of food received was sufficient[d]			
Yes	250	51.3	(46.1, 56.6)
No	225	46.1	(40.7, 51.7)
Don't know	9	2.6	(1.4, 4.7)
Quality of food provided[d]			
Good	237	47.9	(41.9, 53.9)
Average	189	41.0	(35.5, 46.6)
Poor	50	9.6	(6.9, 13.1)
Don't know	8	1.6	(0.8, 3.5)
В домохозяйстве есть санитайзер для рук (наблюдение)			
Yes	2414	78.7	(76.8, 80.6)
No	647	21.3	(19.4, 23.2)
TOTAL	**3061**		

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Question only asked to households responding to previous question.

[d] Households were excluded from this analysis if the number of individuals testing positive was greater than the number reporting a COVID-19 infection.

[e] Question only asked to households responding "Yes" to receiving assistance during the pandemic (n=517)

Table 20. Effect of COVID-19 on food access and consumption of participating households, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Costs of food have increased since COVID-19 outbreak			
Yes	2782	89.2	(87.8, 90.4)
No	235	9.3	(8.1, 10.6)
Don't know	44	1.5	(1.1, 2.2)
Household's eating behavior has changed because of COVID-19			
Yes	818	24.4	(22.6, 26.4)
No	2179	73.4	(71.4, 75.3)
Don't know	62	2.2	(1.6, 2.9)
Changes in household's eating behaviour[c]			
Eaten less variety of food	359	45.9	(41.4, 50.5)

Eaten smaller quantity of food	289	34.9	(31.1, 38.8)
Eaten larger quantity of food	347	40.6	(36.4, 44.9)
Eaten foods of lower quality	140	19.5	(16.1, 23.3)
Other	135	12.8	(10.7, 15.3)
COVID-19 affects household food access			
Yes	974	33.0	(30.7, 35.2)
No	2035	65.4	(63.1, 67.7)
Don't know	52	1.7	(1.2, 2.4)
Effect of COVID-19 on food access[c]			
Severely reduced	299	34.9	(30.5, 39.3)
Reduced	415	39.6	(35.6, 44.0)
Slightly reduced	253	25.0	(21.7, 28.7)
Increased	7	0.5	(0.2, 1.0)
More difficult to buy foods from local markets or shops since the onset of COVID			
Yes	1684	51.7	(49.2, 54.2)
No	1353	47.5	(45.0, 50.0)
Don't know	24	0.8	(0.5, 1.2)
Reasons for increased difficulty to buy foods from local markets or shops[c]			
Markets/ shops closed	406	21.2	(18.7, 23.9)
Lack of stock in the markets	365	18.9	(16.5, 21.5)
Prices have gone up	1527	89.9	(87.9, 91.5)
Lack of transport/ cannot get to market	366	19.6	(17.0, 22.4)
Lack of cash for purchase	217	12.3	(10.5, 14.5)
Other	31	1.5	(0.9, 2.3)
Main foods less accessible[d]			
Grains, cereals, tubers, roots	743	45.2	(42, 48.4)
Pulses	467	30.8	(27.8, 34)
Fruits	645	40.4	(37, 43.8)
Vegetables	619	38.8	(35.6, 42.0)
Eggs	485	31.9	(28.9, 35.2)
Milk, milk products	496	32.0	(28.9, 35.4)
Meat, poultry, meat products	983	61.2	(58.1, 64.2)
Fish, seafood	631	42.3	(39.1, 45.6)
Nuts	395	27.6	(24.7, 30.7)

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total b/c of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.
[c] Question only asked to households responding "Yes" to household's eating behavior changing during pandemic
[d] Question only asked to households responding to previous question

3.3. Children 6-59 month of age

3.3.1. Characteristics

Table 21 presents the demographic characteristics of children 6-59 months of age participating in the NIMAS. These results show that the NIMAS survey population is similar to the actual Kyrgyz population based on the 2009 Census data. The sole exception is an underrepresentation in the survey of children 6-11 months of age and children living in Bishkek.

Table 21. Description of children 6-59 months of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]	Children in Kyrgyz population [67]
Age Group (in months)				
6-11	161	10.5	(9.0, 12.2)	19
12-23	331	21.5	(19.4, 23.8)	21
24-35	381	23.7	(21.4, 26.2)	21
36-47	350	22.3	(20.1, 24.6)	19
48-59	331	22.0	(20.0, 24.3)	19
Sex				
Male	777	50.1	(47.3, 53.0)	51
Female	774	49.9	(47.0, 52.7)	49
Residence				
Urban	572	28.9	(26.0, 32.0)	35
Rural	982	71.1	(68.0, 74.0)	65
Region				
Batken oblast	191	8.9	(7.7, 10.2)	9
Jalal-Abad oblast	195	19.1	(16.5, 22.0)	19
Issyk-Kul oblast	134	6.8	(5.7, 8.1)	7
Naryn oblast	163	4.8	(4.1, 5.6)	4
Osh oblast	229	23.3	(20.5, 26.4)	22
Talas oblast	148	4.4	(3.7, 5.2)	4
Chui oblast	150	16.4	(13.7, 19.4)	14
Bishkek city	108	9.5	(7.6, 11.7)	16
Osh city	236	6.9	(5.8, 8.2)	6
Wealth quintile				
Highest	338	20.2	(17.6, 22.9)	
Second	370	26.0	(23.4, 28.8)	
Middle	343	24.2	(21.3, 27.4)	
Fourth	315	20.3	(17.3, 23.7)	
Highest	180	9.4	(7.2, 12.1)	
TOTAL	**1554**			

Note: The N's are un-weighted numbers in each subgroup. Subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.3.2. Recent illness and health indicators

Table 22 presents key birthweight and illness indicators. Regarding birthweight, nearly all children participating in the survey had been weighed at birth, and low birthweight was rare among children 6-59 months of age. About two-thirds of respondents provided their child's birthweight from memory, with most of the remaining birthweight measures coming directly from the child's medical card. Regarding illness, the NIMAS found that the proportion of children with acute lower respiratory infection is very low, but found that fever and diarrhea are more common, each affecting approximately 14% and 8% of children, respectively. Despite relatively low proportion of illness (self-reported), approximately one-third of surveyed children have elevated inflammation markers.

Table 22. Health indicators in children 6-59 months of age, the Kyrgyz Republic 2021

Characteristic	N	% or mean[a]	(95% CI)[b]
Child weighed at birth			
Yes	1477	95.2	(93.3, 96.5)
No	7	0.5	(0.2, 1.3)
Don't know	52	3.5	(2.4, 5.2)
Birthweight in kilograms (mean kg)[c]	**1477**	**3.45**	**(3.39, 3.51)**
Low birthweight[c]			
<2500 grams	56	4.1	(3.0, 5.6)
2500+ grams	1386	95.9	(94.4, 97)
Birthweight source			
Medical card	515	31.8	(28.9, 34.8)
Recall	920	67.8	(64.8, 70.6)
Other	7	0.4	(0.2, 1.2)
Had lower acute respiratory infection in past 2 weeks[d]			
Yes	18	1.5	(0.8, 2.6)
No	1528	98.5	(97.4, 99.2)
Had diarrhea in past 2 weeks			
Yes	124	8.1	(6.5, 10.2)
No	1411	91.1	(89.0, 92.8)
When child had diarrhea, ORS/zinc given[e]			
Yes	17	18.3	(10.7, 29.5)
No	98	81.7	(70.5, 89.3)
Had fever in past 2 weeks			
Yes	196	13.9	(11.7, 16.4)
No	1348	86.0	(83.5, 88.2)
Inflammation[f]			
None	835	69.9	(66.8, 72.9)
Early (High CRP, Normal AGP)	38	3.0	(2.1, 4.3)
Acute (High CRP, High AGP)	105	9.2	(7.4, 11.5)
Convalescent (Normal CRP, High AGP)	183	17.8	(15.4, 20.5)

Note: The N's are the numerators for a specific sub-group.

[a] Percentages and means weighted for unequal probability of selection among regions. The percentages do not add up to 100% because the small proportion of the respondents that reported 'don't know' or 'not applicable' is not shown.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] Only includes those children weighed at birth

[d] Questions on recent illness were phrased according to the MICS manual [68].

[e] Only including respondents whose children had diarrhea in preceding 2 weeks.

[f] For thresholds of inflammatory markers, refer to [69].

3.3.3. Infant and young child feeding indicators

Table 23 presents several of the standard infant and young child feeding indicators recommended by WHO and UNICEF [28]. More than 95% of the surveyed children 6-23 months of age had ever been breastfed and more than 90% of children were breastfed immediately after birth. The proportion of children exclusively breastfed for the first two days after birth is high, and was practiced by 77% of women. While almost two-thirds of children are fed with appropriate frequency, less than one-third of children had consumed 5 or more food groups in the past 24 hours prior to the survey and only about 15% received a minimum acceptable diet.

Table 23. IYCF indicators in children 6-23 months of age (unless stated otherwise), the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Ever breastfed (Indicator #1)			
Yes	476	96.9	(94.5, 98.2)
No	14	2.8	(1.5, 5.0)
Early initiation of breastfeeding (Indicator #2)			
Yes	440	91.8	(88.6, 94.1)
No	33	7.7	(5.5, 10.6)
Exclusively breastfed for the first two days after birth (Indicator #3)			
Yes	94	21.8	(17.9, 26.2)
No	378	77.1	(72.5, 81.2)
Continued breastfeeding at 1 year (12-23 months of age; Indicator #6)			
Yes	162	50.0	(43.7, 56.2)
No	151	45.3	(39.2, 51.5)
Introduction of solid foods (6-8 months; Indicator #7)			
Yes	88	74.5	(60.9, 84.6)
No	26	25.5	(15.4, 39.1)
Minimum dietary diversity (Indicator #8)			
Yes	139	26.2	(21.8, 31.2)
No	350	73.8	(68.8, 78.2)
Minimum meal frequency (Indicator #9)			
Yes	320	64.3	(59.2, 69.1)
No	171	35.7	(30.9, 40.8)
Minimum milk feeding frequency for non-breastfed children (Indicator #10)			
Yes	93	53.7	(44.7, 62.6)
No	78	46.3	(37.4, 55.3)
Minimum acceptable diet (Indicator #11)			
Yes	82	15.3	(11.8, 19.6)
No	407	84.7	(80.4, 88.2)
Egg and/or flesh food consumption (Indicator #12)			
Yes	361	73.1	(68.6, 77.2)
No	129	26.9	(22.8, 31.4)
Sweet beverage consumption (Indicator #13)			
Yes	336	70.0	(66.0, 73.8)
No	155	30.0	(26.2, 34.0)
Zero vegetable or fruit consumption (Indicator #15)			
Zero vegetable or fruits	86	18.3	(15.0, 22.1)
Any vegetable or fruits	404	81.7	(77.9, 85.0)
Bottle fed in past 24 hours (WHO/UNICEF IYCF indicator #16)			
Yes	245	50.0	(44.9, 55.1)
No	236	50.0	(44.9, 55.1)

Note: The N's are the numerators for a specific sub-group. The percentages do not add up to 100% because the small proportion of the respondents that reported 'don't know' or 'not applicable' is not shown.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.3.4. Dietary diversity in children 6-23 months of age

Table 24 presents the results of dietary diversity in children 6-23 months of age and shows that nationally one-quarter of children have a minimum dietary diversity according to WHO's guidelines. Statistically significant differences were found by age group, residence, region, and household food security. Specifically, the proportion of children with minimal dietary diversity increases with age and is highest in children 18-23 months of age. Minimum dietary diversity is also significantly higher in rural children, and the lowest levels of minimum dietary diversity were found in Bishkek and Chui, and the highest prevalences in Issyk-kul and Batken. Regarding food security status, a dose-response relationship is observed, with the proportion of children achieving minimum dietary diversity increasing as household food security status improves.

Table 24. Dietary diversity in children 6-23 months of age, the Kyrgyz Republic 2021

Characteristic	Consumed 5+ food groups				Mean dietary score
	N	%[a]	(95% CI)[b]	p-value[c]	
Age Group (in months)					
6-11	160	11.1	(6.9, 17.3)	<0.001	3.6
12-17	179	29.6	(22.0, 38.5)		4.7
18-23	150	38.3	(29.8, 47.5)		5.2
Sex					
Male	252	22.7	(17.3, 29.1)	0.077	4.5
Female	237	30.0	(24.0, 36.9)		4.5
Residence					
Urban	178	18.2	(13.9, 23.4)	<0.01	4.1
Rural	311	29.3	(23.4, 35.9)		4.6
Region					
Batken oblast	46	36.8	(23.1, 53.0)	<0.05	4.9
Jalal-Abad oblast	63	27.0	(17.3, 39.5)		4.7
Issyk-Kul oblast	43	39.1	(25.7, 54.5)		4.9
Naryn oblast	48	31.6	(20.4, 45.5)		4.8
Osh oblast	81	30.0	(19.0, 43.8)		4.3
Talas oblast	48	32.4	(18.6, 50.2)		4.8
Chui oblast	46	12.8	(5.9, 25.6)		4.3
Bishkek city	29	9.7	(3.0, 27.5)		3.7
Osh city	85	29.0	(21.9, 37.3)		4.4
Wealth quintile					
Lowest	104	17.9	(11.0, 27.9)	0.060	4.3
Second	109	25.4	(17.9, 34.8)		4.5
Middle	114	35.8	(27.2, 45.3)		4.6
Fourth	100	25.3	(17.2, 35.6)		4.5
Highest	60	23.0	(13.7, 36.1)		4.2
Household food security					
Secure	321	30.4	(24.3, 37.2)	<0.05	4.6
Mildly insecure	48	23.5	(12.8, 3.09)		4.5
Moderately insecure	90	17.2	(10.4, 27.1)		4.2
Severely insecure	28	12.3	(5.0, 27.1)		3.9
TOTAL	**489**	**26.2**	**(21.8, 31.2)**		**4.5**

Note: The N's are un-weighted numbers in each subgroup. Subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] P-value <0.05 indicates that the variation in the values of the subgroup are significantly different from all other subgroups

3.3.5. Consumption of vitamins, minerals, supplements, and fortified foods

The consumption of vitamins, minerals, and supplements is presented in Table 25. A relatively small proportion (<10%) of children 6-59 months of age consumed fortified infant formula or fortified baby cereal in the 24 hours prior to the survey. About 10% of the surveyed children took iron tablets, and less than 20% took multivitamin or vitamin D tablets in the past 6 months prior to the survey.

Table 25. Consumption of iron-fortified food, vitamin A and vitamin D supplements in children 6-59 months of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Consumed commercially fortified baby cereal			
Yes	134	8.2	(6.6, 10.3)
No	1370	88.5	(86.2, 90.5)
Consumed micronutrient powder			
Yes	28	2.2	(1.4, 3.3)
No	1481	94.9	(92.9, 96.4)
Consumed infant formula with added iron			
Yes	75	4.8	(3.5, 6.4)
No	1424	91.4	(89.1, 93.3)
Took iron tablets or syrup in past 6 months			
Yes	145	9.6	(7.6, 11.9)
No	1385	89.2	(86.8, 91.3)
Took multivitamin supplements in past 6 months			
Yes	260	17.5	(15.1, 20.2)
No	1269	81.4	(78.6, 83.9)
Took vitamin D tablets or syrup in past 6 months			
Yes	273	17.1	(14.8, 19.7)
No	1264	82.5	(79.8, 84.8)
Is still taking vitamin D tablets or syrup[c]			
Yes	108	39.9	(32.7, 47.6)
No	165	60.1	(52.4, 67.3)
Took fish oil supplements in past 6 months			
Yes	102	7.0	(5.5, 8.8)
No	1428	91.9	(89.9, 93.5)
Is still taking fish oil supplements[c]			
Yes	49	50.5	(39.4, 61.5)
No	48	49.5	(38.5, 60.6)
Took drug for intestinal worms			
Yes	79	5.4	(4.1, 7.1)
No	1454	93.8	(92.0, 95.2)

Note: The N's are the numerators for a specific sub-group. The percentages do not add up to 100% because the small proportion of the respondents that reported 'don't know' or 'not applicable' is not shown.

[a] Percentages weighted for unequal probability of selection among regions.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Percentages weighted for unequal probability of selection among regions.

3.3.6. COVID 19 and child feeding practices

Approximately 14% of caregivers received messages on IYCF in the context of COVID-19 (see Table 26). Very few women stopped or did not start breastfeeding because of the pandemic, and less than 1% received donated infant formula since the beginning of the pandemic. When asked to describe how their child's feeding changed during the pandemic, the majority of caregivers reported no change in the quantity or frequency of consumption of the various food groups. However, of the caregivers that reported a change, most reported feeding their child the different food groups at increased quantities or frequencies during the pandemic(see Table 26).

Table 26. Effect of COVID-19 pandemic on child feeding practices among children 6-59 months of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Did caregiver receive message on IYCF in the context of COVID-19			
Yes	273	13.7	(11.7, 16.0)
No	1191	79.2	(76.6, 81.6)
Stopped breastfeeding or did not start because of COVID pandemic			
Yes	31	2.3	(1.5, 3.3)
No	1259	77.2	(74.4, 79.8)
Received donated infant formula since COVID pandemic started			
Yes	9	0.6	(0.2, 1.5)
No	1520	98.5	(97.6, 99.1)
Increase or decrease of quantity or frequency of following foods			
Infant formula, growing up milks			
Change in quantity and/ or frequency	347	22.4	(19.7, 25.4)
No change	1199	77.6	(74.6, 80.3)
How did consumption change			
Increase	318	92.7	(89.4, 95.1)
Decrease	25	7.3	(4.9, 10.6)
Sweetened drinks			
Change in quantity and/ or frequency	499	31.5	(28.5, 34.7)
No change	1047	68.5	(65.3, 71.5)
How did consumption change			
Increase	440	89.1	(85.3, 92.1)
Decrease	58	10.9	(7.9, 14.7)
Porridge or cereals-based food			
Change in quantity and/ or frequency	545	35.6	(32.7, 38.7)
No change	1001	64.4	(61.3, 67.3)
How did consumption change			
Increase	513	93.5	(90.8, 95.5)
Decrease	32	6.5	(4.5, 9.2)
Meat/fish/chicken or other meats			
Change in quantity and/ or frequency	573	37.6	(34.5, 40.8)
No change	973	62.4	(59.2, 65.5)
How did consumption change			
Increase	484	84.9	(80.2, 88.7)
Decrease	89	15.1	(11.3, 19.8)
Eggs			

Change in quantity and/ or frequency	505	32.2	(29.2, 35.4)
No change	1041	67.8	(64.6, 70.8)
How did consumption change			
Increase	425	85.5	(81.0, 89.2)
Decrease	80	14.5	(10.8, 19.0)
Plant-based proteins such as lentils, beans, chickpeas			
Change in quantity and/ or frequency	247	16.6	(14.0, 19.6)
No change	1299	83.4	(80.4, 86.0)
How did consumption change			
Increase	195	86.2	(80.9, 90.2)
Decrease	42	13.8	(9.8, 19.1)
Fruits and vegetables			
Change in quantity and/ or frequency	683	44.2	(40.8, 47.6)
No change	863	55.8	(52.4, 59.2)
How did consumption change			
Increase	644	93.9	(91.3, 95.8)
Decrease	39	6.1	(4.2, 8.7)
Packaged sweet and salty foods			
Change in quantity and/ or frequency	446	31.4	(28.2, 34.8)
No change	1100	68.6	(65.2, 71.8)
How did consumption change			
Increase	360	81.5	(76.1, 85.9)
Decrease	85	18.5	(14.1, 23.9)

Note: The N's are the numerators for a specific sub-group. The percentages do not add up to 100% because the small proportion of the respondents that reported 'don't know' or 'not applicable' is not shown.

[a] Percentages weighted for unequal probability of selection among regions.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.3.7. Stunting

The national prevalence of stunting in the Kyrgyz Republic is 7% (Table 27) and is classified as "low" according to WHO guidelines [70]. However, the prevalence is classified as "medium" (i.e., 10-19%) in several sub-groups, including among children a) born with a low birthweight, b) living in Batken, c) residing in households in the lowest wealth quintile, d) residing in severely food insecure households, e) residing in households with inadequate sanitation, and f) residing in households with unsafe drinking water.

The prevalence of stunting significantly differs by wealth quintile and age. Children living in poor households are more likely to be stunted than those living in wealthier households, and children aged 6-11 months are less likely to be stunted than older children. Though not significant, children with low birth weight are twice as likely to be stunted as children with normal birth weight. None of the other sub-group analyses yielded any significant differences.

Figure 9 shows the distribution of the height-for-age z-score in the surveyed population of children 6-59 months of age, and shows that the z-score is shifted slightly towards the left of the standard growth curve. Figure 10 shows the geographic distribution of child stunting prevalence by region. Of note, among the regions only the stunting prevalence in Batken can classified as "medium" prevalence by WHO guidelines [70].

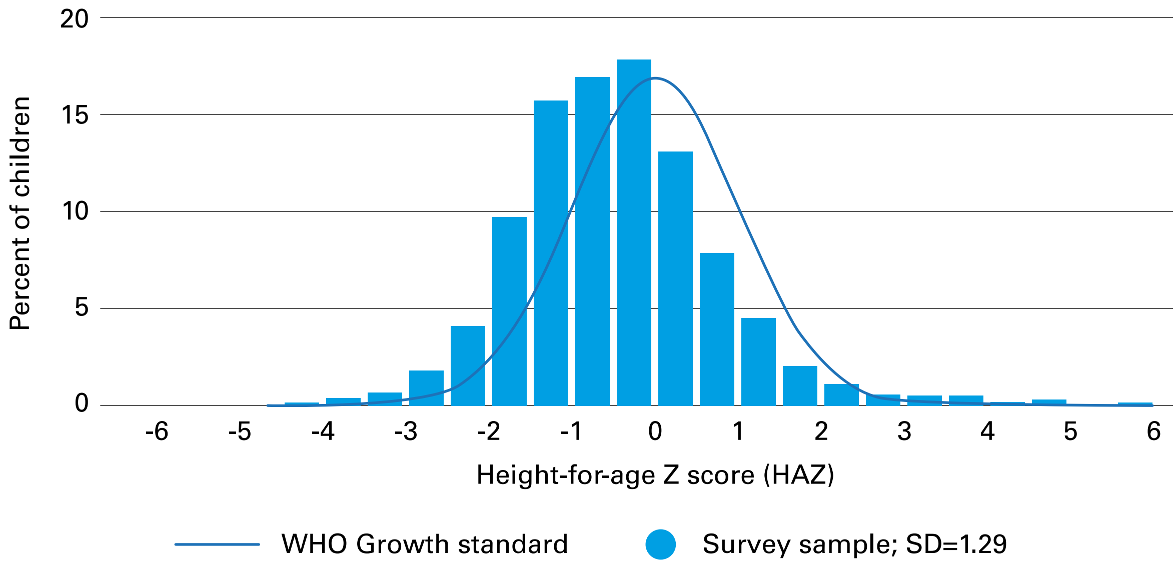


Figure 9. Distribution of height-for-age z-scores in children 6-59 months of age, the Kyrgyz Republic 2021

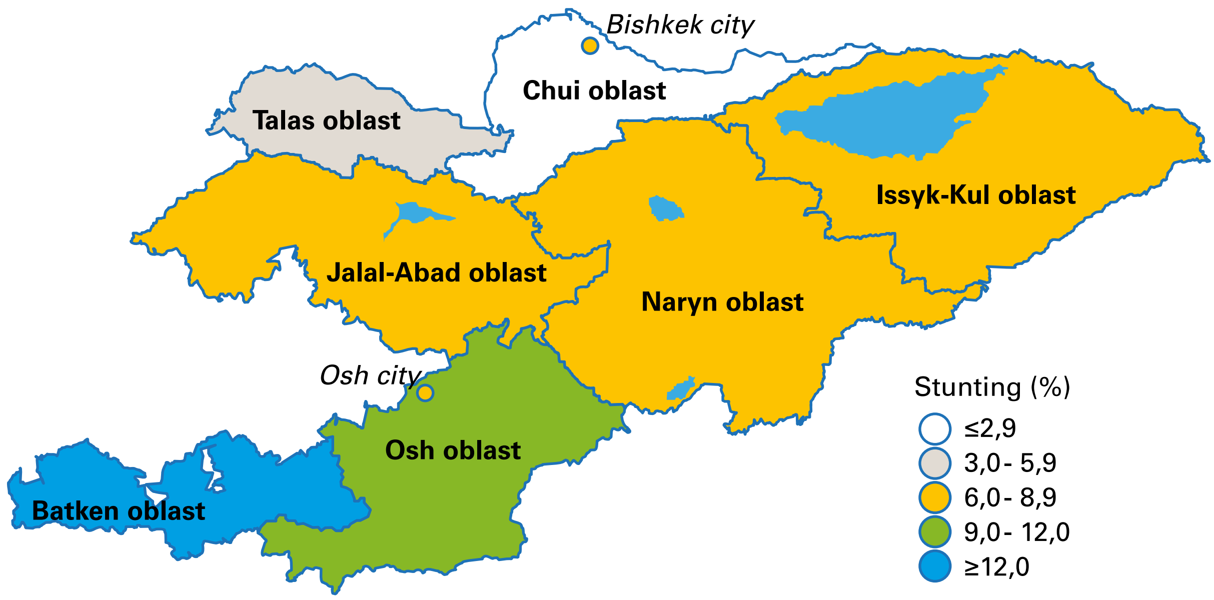


Figure 10. Prevalence of stunting by region, children 6-59 months, the Kyrgyz Republic 2021

Table 27. Percentage of children (6-59 months) with stunting, the Kyrgyz Republic 2021

Characteristic	N	Severe stunting[c]		Moderate stunting[d]		Any stunting[e]		
		%[a]	(95% CI)[b]	%[a]	(95% CI)[b]	%[a]	(95% CI)[b]	p-value[f]
Age Group (in months)								
6-11	143	0	(0, 0)	0	(0, 0)	0	(0, 0)	<0.05
12-23	272	1.1	(0.5, 2.5)	7.9	(4.2, 14.6)	9.1	(5.1, 15.5)	
24-35	325	1.2	(0.4, 3.7)	7.0	(4.5, 10.8)	8.2	(5.3, 12.3)	
36-47	296	2.2	(1.0, 4.9)	5.8	(3.3, 10.0)	8.0	(5.1, 12.3)	
48-59	279	1.1	(0.4, 3.4)	5.3	(3.3, 8.6)	6.5	(4.1, 9.9)	

Low birth weight								
Yes	45	0	(0, 0)	14.3	(6.1, 30.1)	14.3	(6.1, 30.1)	0.062
No	1180	1.3	(0.7, 2.5)	5.1	(3.9, 6.7)	6.4	(5.0, 8.3)	
Sex								
Male	649	1.5	(0.8, 2.7)	5.7	(3.5, 9.0)	7.2	(4.8, 10.6)	0.864
Female	666	1	(0.4, 2.9)	5.9	(4.1, 8.4)	6.9	(5.0, 9.5)	
Residence								
Urban	482	0.8	(0.4, 1.8)	7.2	(3.7, 13.4)	8.0	(4.4, 14.1)	0.584
Rural	833	1.4	(0.7, 2.8)	5.2	(3.8, 7.2)	6.7	(5.0, 8.8)	
Region								
Batken oblast	172	1.1	(0.3, 4.5)	11.1	(7.0, 17.3)	12.3	(7.9, 18.7)	0.471
Jalal-Abad oblast	174	2.3	(0.9, 5.5)	3.9	(2.0, 7.3)	6.1	(3.3, 11.1)	
Issyk-Kul oblast	120	3.1	(0.8, 12.0)	3.1	(0.9, 10.1)	6.2	(2.6, 14.2)	
Naryn oblast	152	2.1	(0.7, 5.8)	5.2	(2.3, 11.3)	7.3	(4.2, 12.5)	
Osh oblast	191	1.2	(0.2, 5.8)	7.9	(4.6, 13.2)	9.1	(5.6, 14.4)	
Talas oblast	120	0	(0, 0)	4.0	(1.7, 9.3)	4.0	(1.7, 9.3)	
Chui oblast	86	0	(0, 0)	2.9	(0.4, 19.0)	2.9	(0.4, 19.0)	
Bishkek city	93	0	(0, 0)	6.4	(1.5, 23.1)	6.4	(1.5, 23.1)	
Osh city	207	1.6	(0.7, 3.9)	6.6	(3.7, 11.5)	8.2	(4.6, 14.3)	
Wealth quintile								
Lowest	317	3.6	(1.7, 7.3)	8.1	(4.7, 13.4)	11.6	(7.7, 17.2)	<0.05
Second	301	1.0	(0.3, 3.0)	6.7	(4.3, 10.3)	7.7	(5.1, 11.4)	
Middle	286	0.4	(0.1, 1.9)	3.0	(1.5, 5.9)	3.5	(1.9, 6.3)	
Fourth	258	1.0	(0.2, 4.1)	5.8	(3.4, 9.7)	6.8	(4.1, 11.0)	
Highest	146	0.4	(0.1, 2.8)	3.1	(0.8, 11.6)	3.5	(1.0, 12.0)	
Household food security								
Secure	870	1.3	(0.6, 2.6)	6.3	(4.7, 8.4)	7.6	(5.7, 10.0)	0.469
Mildly insecure	141	0.4	(0.1, 2.7)	2.1	(0.8, 5.2)	2.5	(1.1, 5.6)	
Moderately insecure	230	1.1	(0.3, 3.9)	5.9	(2.3, 14.3)	7.0	(3.1, 15.1)	
Severely insecure	67	2.6	(0.4, 16.8)	7.4	(1.1, 37.6)	10.1	(2.2, 35.7)	
Household sanitation[g]								
Unadequate	199	2.0	(0.7, 6.0)	8.2	(5.0, 13.3)	10.2	(6.5, 15.8)	0.303
Adequate	1106	1.3	(0.6, 2.6)	5.2	(3.8, 7.1)	6.5	(4.9, 8.5)	
Safe drinking water[h]								
Yes	1265	1.1	(0.6, 2.1)	5.8	(4.4, 7.5)	6.9	(5.4, 8.8)	0.558
No	30	5.4	(1.2, 20.6)	4.8	(0.9, 22.5)	10.2	(4.0, 23.4)	
TOTAL	**1315**	**1.2**	**(0.7, 2.2)**	**5.8**	**(4.3, 7.8)**	**7.0**	**(5.4, 9.2)**	

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Severe stunting represents children who are below -3 standard deviations (SD; z-scores) from the WHO Child Growth Standards population median.

[d] Moderate stunting includes children who are equal to or above -3 standard deviations (SD) and below-2 SD from the WHO Child Growth Standards population median.

[e] Any stunting includes both severely and moderately stunted children.

[f] P-value <0.05 indicates that the variation in the values of the subgroup are significantly different from all other subgroups. Results are based on any stunting.

[g] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/ latrine, no facility, bush, field.

[h] Composite variable of main source of drinking water and treating water to make safe for drinking

3.3.8. Wasting, overweight and obesity

Less than 1% of children 6-59 months of age in the Kyrgyz Republic are wasted. This prevalence can be classified as "very low" according to WHO classification [70]. Most of the wasted children suffer from moderate acute malnutrition; severe acute malnutrition is rare (Table 28).

The survey found significant differences in wasting by residence, region, and household food security status. Children living in urban areas are more likely to be wasted compared to children in rural areas. Among the regions, wasting was significantly higher in Naryn, and accounted for the majority of wasting cases. In addition, the highest prevalence of wasting was found in children living in mildly food insecure households. No significant differences were detected by age, low birth weight, sex, household wealth quintile, household sanitation and household access to safe drinking water.

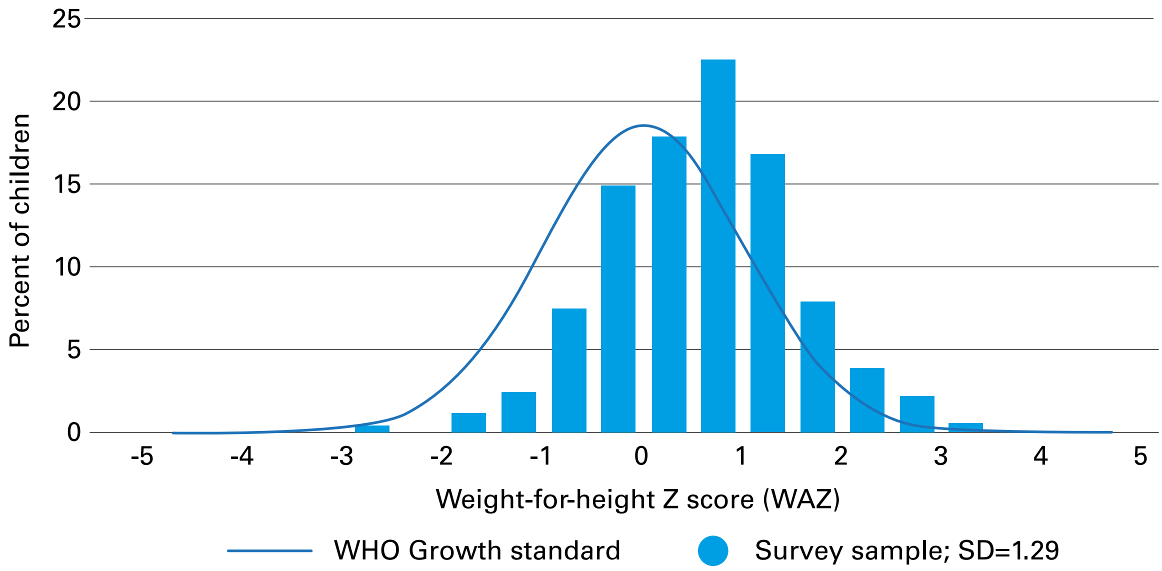


Figure 11. Distribution of weight-for-height z-scores in children 6-59 months of age, the Kyrgyz Republic 2021

Figure 11 shows the distribution of the height-for-age z-score in the surveyed population of children 6-59 months of age. It shows that the distribution is slightly shifted towards the right of the standard growth curve, indicating that weight-for-height z-scores were on average higher than those in the WHO Growth Standard population.

Table 28. Percentage of children (6-59 months) with wasting, the Kyrgyz Republic 2021

Characteristic	N	Severe stunting[c]		Moderate stunting [d]		Any stunting[e]		
		%[a]	(95% CI)[b]	%[a]	(95% CI)[b]	%[a]	(95% CI)[b]	p-value[f]
Age Group (in months)								
6-11	143	0.3	(0, 2.2)	0.3	(0, 1.9)	0.6	(0.2, 1.8)	0.366
12-23	274	0.1	(0, 0.9)	1.5	(0.3, 8.0)	1.6	(0.3, 7.7)	
24-35	321	0	(0, 0)	0.8	(0.2, 3.2)	0.8	(0.2, 3.2)	
36-47	294	0.6	(0.3, 1.4)	0.2	(0, 1.1)	0.8	(0.3, 1.8)	
48-59	275	0	(0, 0)	0	(0, 0)	0	(0, 0)	
Low birth weight								
Yes	45	0	(0, 0)	1.5	(0.2, 10.1)	1.5	(0.2, 10.1)	0.377
No	1172	0.2	(0.1, 0.5)	0.4	(0.1, 1.1)	0.6	(0.3, 1.3)	

Sex								
Male	646	0.2	(0.1, 0.6)	0.3	(0.1, 0.6)	0.5	(0.2, 1.0)	0.212
Female	661	0.2	(0.1, 0.7)	0.9	(0.2, 3.4)	1.1	(0.4, 3.3)	
Residence								
Urban	480	0.7	(0.3, 1.5)	1.3	(0.3, 5.7)	2.0	(0.7, 5.5)	<0.01
Rural	827	0	(0, 0)	0.3	(0.1, 1.0)	0.3	(0.1, 1.0)	
Region								
Batken oblast	170	0	(0, 0)	0.5	(0.1, 3.7)	0.5	(0.1, 3.7)	<0.05
Jalal-Abad oblast	173	0	(0, 0)	0.6	(0.1, 4.4)	0.6	(0.1, 4.4)	
Issyk-Kul oblast	119	0.7	(0.1, 5.1)	0	(0, 0)	0.7	(0.1, 5.1)	
Naryn oblast	153	3.3	(1.5, 7.2)	2.5	(1.2, 5.2)	5.8	(3.1, 10.6)	
Osh oblast	190	0	(0, 0)	0	(0, 0)	0	(0, 0)	
Talas oblast	118	0	(0, 0)	0	(0, 0)	0	(0, 0)	
Chui oblast	87	0	(0, 0)	1.8	(0.2, 12.1)	1.8	(0.2, 12.1)	
Bishkek city	91	0	(0, 0)	0	(0, 0)	0	(0, 0)	
Osh city	206	0	(0, 0)	0	(0, 0)	0	(0, 0)	
Wealth quintile								
Lowest	313	0	(0, 0)	0.5	(0.1, 3.8)	0.5	(0.1, 3.8)	0.871
Second	300	0.3	(0, 1.9)	0.1	(0, 1.0)	0.4	(0.1, 1.4)	
Middle	285	0.4	(0.1, 1.7)	0.4	(0.1, 1.6)	0.8	(0.3, 2.2)	
Fourth	258	0.2	(0, 1.5)	0.8	(0.2, 4.2)	1.1	(0.3, 4.0)	
Highest	144	0.5	(0.1, 3.2)	0.5	(0.1, 3.2)	0.9	(0.1, 6.4)	
Household food security								
Secure	864	0.2	(0.1, 0.6)	0.3	(0.1, 1.1)	0.6	(0.2, 1.3)	<0.05
Mildly insecure	141	0.6	(0.1, 4.4)	2.9	(0.5, 14.7)	3.6	(0.8, 14.4)	
Moderately insecure	229	0	(0, 0)	0	(0, 0)	0	(0, 0)	
Severely insecure	66	0	(0, 0)	0.5	(0.1, 3.5)	0.5	(0.1, 3.5)	
Household sanitation[g]								
Unadequate	197	0.3	(0, 1.8)	0.7	(0.1, 5.1)	1.0	(0.2, 4.6)	0.932
Adequate	1100	0.2	(0.1, 0.5)	0.4	(0.2, 1.0)	0.6	(0.3, 1.2)	
Safe drinking water[h]								
Yes	1257	0.3	(0.1, 0.5)	0.5	(0.2, 1.1)	0.7	(0.4, 1.4)	0.926
No	30	0	(0, 0)	0	(0, 0)	0	(0, 0)	
TOTAL	**1307**	**0.2**	**(0.1, 0.4)**	**0.6**	**(0.2, 1.7)**	**0.8**	**(0.3, 1.8)**	

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Severe wasting represents children who are below -3 standard deviations (SD; z-scores) from the WHO Child Growth Standards population median

[d] Moderate wasting includes children who are equal to or above -3 standard deviations (SD) and below-2 SD from the WHO Child Growth Standards population median

[e] Any wasting includes both severely and moderately wasted children

[f] P-value <0.05 indicates that the variation in the values of the subgroup are significantly different from all other subgroups. Results are based on any wasting.

[g] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[h] Composite variable of main source of drinking water and treating water to make safe for drinking

Overweight and obesity affects approximately 7% of Kyrgyz children aged 6-59 months, and the overweight prevalence is classified as "medium" by WHO thresholds [70]. Significant differences were found by the age group, birthweight status, and region. Regarding age group, children 6-11 months of age have the highest overnutrition prevalence, and the prevalence declines, albeit not consistently, as age increases. Children with low birthweight are less likely to be overweight or obese compared to those with normal birth weight. Further, significant differences were detected by region, with highest prevalences in Naryn and Osh oblast and lowest in Chui and Bishkek. No significant differences were detected by sex, wealth quintile, household food security, household sanitation, access to safe drinking water, and inflammation.

Table 29. Prevalence of overweight and obesity in children 6-59 months of age, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	N	Overweight[d]		Obese[d]		Overweight or obesity[d]		
		%[a]	(95% CI)[b]	%	(95% CI)[b]	%	(95% CI)[b]	p-value[c]
Age Group (in months)								
6-11	143	14.5	(9.3, 21.9)	2.1	(0.5, 7.7)	16.5	(10.9, 24.4)	<0.005
12-23	274	6.1	(3.6, 10.1)	0.6	(0.2, 1.9)	6.7	(4.1, 10.7)	
24-35	321	7.6	(4.9, 11.6)	0.9	(0.2, 3.2)	8.5	(5.5, 12.8)	
36-47	294	5.0	(2.4, 10.1)	0	(0, 0)	5.0	(2.4, 10.1)	
48-59	275	3.6	(1.8, 7.2)	0.9	(0.2, 3.3)	4.5	(2.4, 8.2)	
Low birth weight								
Yes	45	0.8	(0.1, 5.6)	0	(0, 0)	0.8	(0.1, 5.6)	<0.01
No	1172	6.7	(5.2, 8.5)	0.7	(0.4, 1.4)	7.4	(5.8, 9.4)	
Sex								
Male	646	6.6	(4.7, 9.3)	1.0	(0.5, 2.1)	7.6	(5.5, 10.4)	0.719
Female	661	6.5	(4.7, 8.8)	0.5	(0.2, 1.8)	7.0	(5.0, 9.6)	
Residence								
Urban	480	5.0	(3.3, 7.7)	0.6	(0.2, 1.7)	5.6	(3.9, 8.2)	0.143
Rural	827	7.1	(5.4, 9.3)	0.8	(0.4, 1.7)	8.0	(6.0, 10.4)	
Region								
Batken oblast	170	5.0	(2.6, 9.4)	1.2	(0.3, 4.5)	6.2	(3.4, 10.9)	<0.05
Jalal-Abad oblast	173	7.0	(4.2, 11.5)	0	(0, 0)	7.0	(4.2, 11.5)	
Issyk-Kul oblast	119	4.1	(1.9, 8.7)	0.9	(0.1, 5.9)	5.0	(2.6, 9.4)	
Naryn oblast	153	9.0	(4.2, 18.0)	2.1	(0.7, 5.8)	11.0	(5.9, 19.7)	
Osh oblast	190	10.7	(7.5, 15.1)	1.8	(0.7, 4.7)	12.6	(8.5, 18.2)	
Talas oblast	118	6.6	(2.5, 16.2)	0.7	(0.1, 5.1)	7.3	(3.1, 16.4)	
Chui oblast	87	3.5	(0.8, 13.3)	0	(0, 0)	3.5	(0.8, 13.3)	
Bishkek city	91	3.8	(1.6, 8.6)	0	(0, 0)	3.8	(1.6, 8.6)	
Osh city	206	4.2	(2.2, 7.8)	0.4	(0.1, 2.6)	4.6	(2.6, 8.1)	
Wealth quintile								
Lowest	313	6.9	(4.4, 10.7)	1.7	(0.7, 4.2)	8.6	(5.5, 13.1)	0.383
Second	300	5.6	(3.5, 9.0)	0.5	(0.2, 1.6)	6.1	(3.9, 9.5)	
Middle	285	8.6	(5.4, 13.5)	1.1	(0.3, 3.6)	9.7	(6.0, 15.5)	
Fourth	258	4.9	(2.1, 11.0)	0	(0, 0)	4.9	(2.1, 11.0)	
Highest	144	6.8	(3.7, 12.0)	0	(0, 0)	6.8	(3.7, 12.0)	
Household food security								
Secure	864	6.4	(4.8, 8.5)	0.7	(0.3, 1.6)	7.1	(5.3, 9.4)	0.764
Mildly insecure	141	9.8	(4.4, 20.5)	0.4	(0.1, 2.7)	10.2	(4.7, 20.7)	

Moderately insecure	229	5.3	(3.0, 9.1)	1.5	(0.4, 4.7)	6.7	(3.7, 11.8)	
Severely insecure	66	6.5	(2.2, 17.3)	0.5	(0.1, 3.8)	7.0	(2.6, 17.6)	
Household sanitationHousehold sanitation[e]								
Unadequate	197	3.9	(1.9, 8.0)	0.3	(0, 2.2)	4.2	(2.0, 8.6)	0.305
Adequate	1100	7.1	(5.5, 9.1)	0.8	(0.4, 1.6)	8.0	(6.2, 10.1)	
Safe drinking water[f]								
Yes	1257	6.7	(5.3, 8.5)	0.8	(0.4, 1.5)	7.5	(5.9, 9.5)	0.723
No	30	4.5	(0.5, 28.5)	0	(0, 0)	4.5	(0.5, 28.5)	
Inflammation[g]								
Yes	323	8.2	(5.6, 12.0)	0.3	(0.1, 1.2)	8.5	(5.9, 12.3)	0.276
No	815	5.5	(3.9, 7.8)	1.0	(0.5, 2.1)	6.5	(4.6, 9.0)	
TOTAL	**1307**	**6.5**	**(5.2, 8.2)**	**0.8**	**(0.4, 1.4)**	**7.3**	**(5.8, 9.2)**	

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.
[c] P-value <0.05 indicates that at least one subgroup is significantly different from the others.
[d] Overweight is defined as having a weight-for-height z-score greater than +2 but less than or equal to +3 standard deviations from the WHO Child Growth Standards population median; obesity is defined as having a weight-for-height z-score greater than +3 standard deviations from the WHO Child Growth Standards population median.
[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field
[f] Composite variable of main source of drinking water and treating water to make safe for drinking

3.3.9. Underweight

Only 0.7% (95% CI: 0.4, 1.2; N= 1319) of children 6-59 months of age are underweight and no significant differences were detected in any of the sub-group analyses. Due to the small number of children found with underweight, results by sub-group are not displayed.

3.3.10. Microcephaly

Nationally, 1.3% of children 6-59 months of age have microcephaly. Microcephaly is significantly associated with stunting, wasting, and underweight. Moreover, significant differences were found by region, with highest prevalence in Naryn and lowest in Jalal-Abad and Chui. No significant differences were found for age, low birth weight, sex, residence, household wealth quintile, food security, sanitation and access to safe drinking water. Due to the small number of children found with microcephaly results by sub-group are not displayed.

3.3.11. Anemia, iron deficiency, and iron deficiency anemia

About 21% of children 6-59 months of age are anemic (Table 30). A small proportion (0.2%) of child anemia is classified as severe, and ~7% and ~14% of children have moderate and mild anemia, respectively (see appendix 2, Table 89). According to WHO, anemia in children can be considered a moderate public health problem [36]. The distribution of hemoglobin values for children is shown in Figure 12. It is roughly symmetric with the majority of values above the cut-off point of 110 g/L. Median hemoglobin concentration among all children 6-59 months old is 119 g/L.

The highest anemia prevalence occurs in children 6-11 months of age and the prevalence decreases with age. The prevalence of anemia is significantly higher in rural areas than in urban centers. Further, significant differences were detected by region, with the highest anemia prevalences found in Issyk Kul and Naryn, and the lowest prevalences found in Bishkek and Osh City. Moreover, significant differences were found by wealth quintile and household sanitation. Children living in poorest households have the highest anemia prevalence, and those residing in the wealthiest households have the lowest anemia prevalence. Other variables, such as sex, low birth weight, household food security and access to safe drinking water are not significantly associated with anemia with statistical significance.

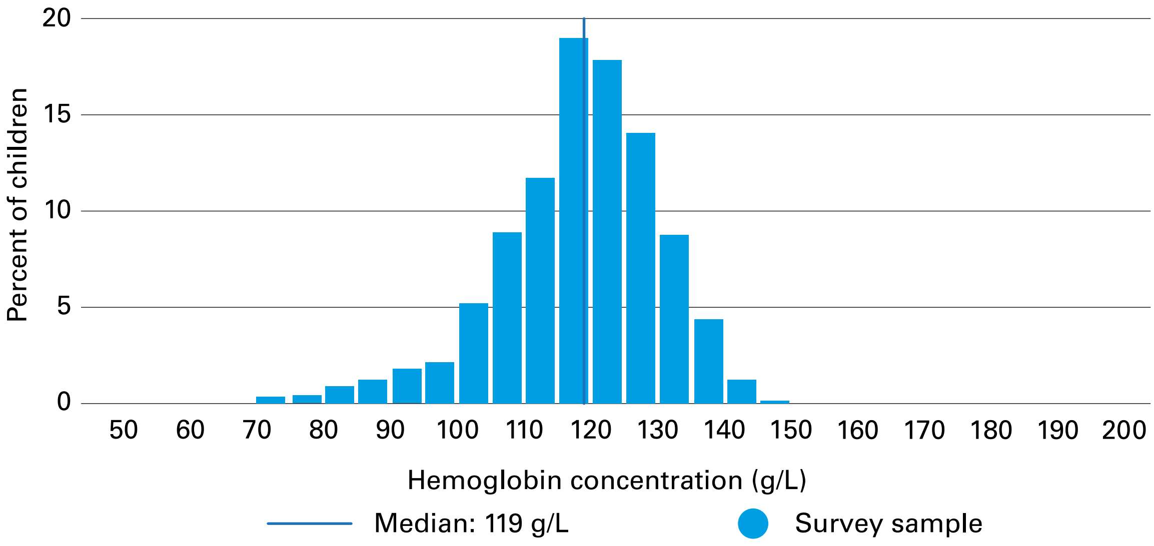


Figure 12. Distribution of adjusted hemoglobin (g/L) in children 6-59 months of age, the Kyrgyz Republic 2021

In children 6-59 months of age, the ID prevalence is more than double the anemia prevalence (Table 30). Only age group is significantly associated with ID prevalence, with the highest prevalence found in children 12-23 months of age. Figure 13 illustrates the overlap between anemia and ID in children 6-59 months of age, and shows that about three-quarters of the children who have anemia also have ID.

Similar to ID, the highest prevalence of iron deficiency anemia (IDA) was found in children 12-23 months of age. IDA is significantly associated with urban/rural residence, region, wealth quintile, household food security and household sanitation. Children living in rural areas are more likely to have IDA compared to those in urban centers. The largest proportion of children with IDA was found in Chui and the smallest in Jalal Abad. Moreover, children residing in the poorest and severely food insecure households are the most affected by IDA. Surprisingly, the prevalence of IDA is higher in children living in households with adequate sanitation compared to those with inadequate sanitation. Other demographic variables investigated here are not significantly associated with IDA.

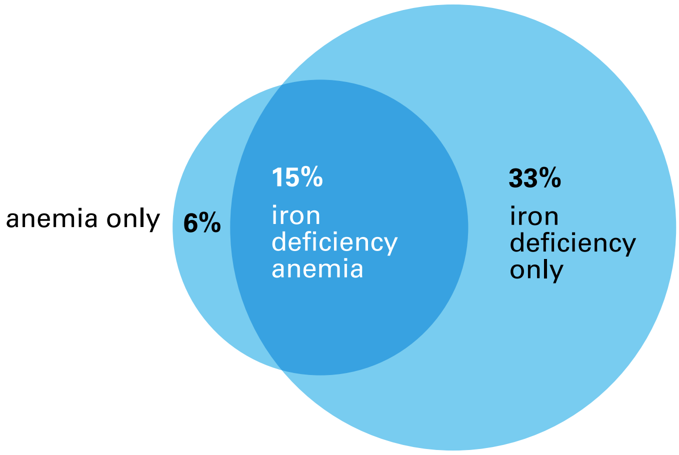


Figure 13. Диаграмма Венна, показывающая одновременное наличие анемии и Deficienta железа у детей в возрасте 6-59 месяцев, Kyrgyzская Республика, 2021 год

Table 30. Prevalence of anemia, iron deficiency, and iron deficiency anemia in children 6-59 months of age, by various demographic characteristics, the Kyrgyz Republic 2021.

Characteristic	Anemia				Iron deficiency[e]				Iron deficiency anemia			
	N	% a, b	95% CI[c]	p-value[d]	N	% [a]	95% CI[c]	p-value[d]	N	% [a, f]	95% CI[c]	p-value[d]
Age Group (in months)												
6-11	120	36.9	(26.9, 48.2)	<0.001	99	39.7	(27.8, 52.9)	<0.001	99	14.5	(7.2, 27.2)	<0.001
12-23	240	36.4	(28.5, 45.0)		234	59.4	(51.6, 66.7)		226	28.9	(21.1, 38.3)	
24-35	302	22.6	(17.8, 28.3)		287	55.4	(48.8, 61.8)		284	16.7	(12.2, 22.3)	
36-47	283	12.7	(7.9, 19.7)		274	42.3	(34.7, 50.3)		272	10.4	(6.1, 17.1)	
48-59	265	7.4	(4.6, 11.6)		262	36.9	(30.5, 43.7)		259	6.0	(3.5, 10.0)	
Low birth weight												
Yes	40	27.6	(14.4, 46.2)	0.819	40	53.4	(36.9, 69.2)	0.528	38	24.3	(11.8, 43.5)	0.145
No	1084	20.4	(17.3, 23.8)		1032	47.8	(43.8, 51.9)		1019	14.7	(12.0, 18.0)	
Sex												
Male	593	20.7	(16.7, 25.3)	0.895	569	48.8	(44.3, 53.3)	0.331	562	15.8	(12.3, 20.1)	0.551
Female	614	21.1	(16.7, 26.2)		584	46.0	(41.1, 50.9)		575	14.2	(10.5, 19.0)	
Residence												
Urban	452	14.1	(10.4, 18.7)	<0.005	427	42.7	(36.4, 49.3)	0.148	421	10.3	(7.0, 15.0)	<0.05
Rural	759	23.8	(19.7, 28.3)		734	48.6	(44.1, 53.2)		720	16.8	(13.2, 21.1)	
Region												
Batken oblast	172	19.9	(13.2, 28.9)	<0.001	172	47.4	(40.1, 54.8)	0.476	172	17.6	(12.0, 25.1)	<0.001
Jalal-Abad oblast	164	11.0	(7.0, 16.9)		162	46.4	(37.0, 56.1)		160	6.0	(3.2, 11.0)	
Issyk-Kul oblast	118	33.9	(23.8, 45.8)		120	44.9	(33.9, 56.4)		118	21.5	(14.8, 30.2)	
Naryn oblast	141	32.7	(23.9, 43.0)		140	59.8	(47.5, 71.0)		139	20.6	(12.2, 32.8)	
Osh oblast	140	22.2	(14.5, 32.4)		147	45.4	(37.8, 53.2)		137	14.2	(8.2, 23.5)	
Talas oblast	120	33.1	(24.7, 42.8)		86	48.3	(34.8, 62.1)		86	14.9	(8.9, 23.9)	
Chui oblast	76	29.2	(18.5, 42.8)		77	51.0	(39.0, 63.0)		75	27.3	(16.8, 41.2)	
Bishkek city	90	10.8	(5.9, 19.1)		73	48.0	(36.9, 59.3)		72	8.5	(3.8, 17.9)	
Osh city	190	11.6	(6.7, 19.6)		184	35.4	(27.1, 44.8)		182	6.9	(3.6, 12.9)	
Wealth quintile												
Lowest	292	27.6	(20.6, 36.0)	<0.05	273	54.2	(46.7, 61.5)	0.144	268	23.4	(16.3, 32.5)	<0.01

Second	275	17.4	(12.7, 23.2)		268	47.0	(40.0, 54.2)		262	10.8	(7.3, 15.7)	
Middle	270	23.2	(17.7, 29.8)		270	45.2	(37.3, 53.4)		264	16.5	(11.3, 23.5)	
Fourth	232	17.9	(12.8, 24.6)		222	45.8	(37.0, 54.7)		220	11.2	(6.9, 17.8)	
Highest	137	14.2	(8.3, 23.3)		124	35.0	(25.1, 46.4)		123	10.4	(5.7, 18.3)	
Food secure												
Secure	799	18.6	(15.2, 22.6)	0.167	775	45.6	(40.6, 50.6)	0.330	765	12.1	(9.3, 15.6)	<0.05
Mildly insecure	134	21.6	(13.3, 33.2)		122	41.6	(30.6, 53.6)		121	15.6	(8.2, 27.7)	
Moderately insecure	212	24.5	(18.2, 32.2)		206	52.6	(43.6, 61.5)		199	21.0	(14.6, 29.2)	
Severely insecure	61	34.2	(16.8, 57.2)		54	55.1	(38.9, 70.3)		52	32.5	(13.8, 59.2)	
Household sanitation[g]												
Unadequate	187	12.0	(7.2, 19.4)	<0.05	178	43.1	(34.3, 52.4)	0.387	176	6.3	(3.3, 11.7)	<0.005
Adequate	1017	22.6	(19.1, 26.6)		978	47.6	(43.7, 51.5)		960	16.7	(13.4, 20.5)	
Safe drinking water[h]												
Yes	1165	21.2	(18.0, 24.8)	0.493	1126	46.9	(43.1, 50.7)	0.783	1106	15.1	(12.2, 18.5)	0.871
No	30	17.2	(8.8, 31.0)		30	47.9	(25.5, 71.2)		30	13.4	(5.5, 29.1)	
TOTAL	**1211**	**20.9**	**(17.8, 24.4)**		**1161**	**47.0**	**(43.3, 50.7)**		**1141**	**15.0**	**(12.1, 18.3)**	

Note: The N's are the denominators for a specific sub-group. For iron deficiency and iron deficiency anemia, the numbers are smaller than for anemia due to unsuccessful blood collection (sufficient blood could be obtained only for the on-site analysis of hemoglobin concentration).

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[f] Iron deficiency defined as plasma ferritin < 12 µg/L, ferritin adjusted for inflammation [41].

[g] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[h] Composite variable of main source of drinking water and treating water to make safe for drinking

3.3.12. Vitamin A deficiency

The prevalence of vitamin A deficiency in Kyrgyz children 6-59 months of age would be classified as moderate by WHO [71], see Table 31. The prevalence is significantly higher in male children than in females and significantly differs by region. In Bishkek, more than 20% of children suffer from vitamin A deficiency and vitamin A deficiency can be considered a severe public health problem there. Moreover, with just over 19% deficiency prevalence in Osh Oblast and Osh City vitamin A deficiency is close to severe in those regions. Meanwhile, the prevalence of vitamin A deficiency in Issyk Kul and Naryn is below 5%.

Vitamin A deficiency does not differ by child age, household wealth, urban/rural residence, or household food security status.

Table 31. Prevalence of vitamin A deficiency in children 6-59 months, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	N	%[a] with VAD[b]	(95% CI))[c]	p-value[d]
Age Group (in months)				
6-11	99	14.3	(7.3, 26.2)	0.735
12-23	234	11.8	(7.8, 17.5)	
24-35	287	14.2	(10.1, 19.5)	
36-47	274	14.6	(9.9, 21.1)	
48-59	262	17.3	(11.8, 24.8)	
Sex				
Male	569	17.2	(13.6, 21.5)	<0.05
Female	584	12.0	(9.1, 15.5)	
Residence				
Urban	427	18.8	(13.6, 25.4)	0.094
Rural	734	13.5	(10.8, 16.8)	
Region				
Batken oblast	172	18.0	(12.2, 25.9)	<0.05
Jalal-Abad oblast	162	12.4	(8.1, 18.7)	
Issyk-Kul oblast	120	3.6	(1.3, 9.5)	
Naryn oblast	140	4.4	(1.9, 9.9)	
Osh oblast	147	19.3	(13.5, 26.8)	
Talas oblast	86	10.1	(4.9, 19.7)	
Chui oblast	77	14.4	(7.9, 24.9)	
Bishkek city	73	21.0	(10.3, 38.2)	
Osh city	184	19.5	(14.1, 26.4)	
Wealth quintile				
Lowest	273	15.4	(10.4, 22.3)	0.806
Second	268	16.6	(11.6, 23.1))	
Middle	270	13.0	(8.7, 18.9)	
Fourth	222	13.1	(8.1, 20.4)	
Highest	124	18.6	(8.8, 35.2)	
TOTAL	**1161**	**15.0**	**(12.5, 17.9)**	

Note: The N's are the denominators for a specific sub-group; for VAD, the numbers are smaller than for anemia due to unsuccessful blood collection (sufficient blood could be obtained only for the on-site analysis of hemoglobin concentration) or insufficient sample volumes for retinol binding protein analysis.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.
[b] VAD = Vitamin A deficiency, defined as RBP adjusted for inflammation [42] <0.569 umol/L.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.3.13. Vitamin D deficiency

Vitamin D was measured in a 25% sub-sample of children aged 6-59 months. About one- quarter of children are vitamin D deficient or insufficient. Deficiency or insufficiency consistently decrease with the child's age. Moreover, a much larger proportion of children in the wealthiest households are affected by deficiency or insufficiency compared to children living in households of the other wealth quintiles. Other demographic variables investigated here are not significantly associated with vitamin D deficiency or insufficiency.

Table 32. Prevalence of vitamin D deficiency in children 6-59 months of age, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	N[b]	Deficient[a]		Insufficient[a]		Deficient or insufficient		
		%[c]	(95% CI)[d]	%[c]	(95% CI)[d]	%[c]	(95% CI)[d]	p-value[e]
Age Group (in months)								
6-11	34	15.8	(6.0, 35.5)	32.9	(16.6, 54.7)	48.7	(30.1, 67.6)	<0.05
12-23	68	3.1	(1.3, 7.1)	29.6	(17.9, 44.7)	32.6	(20.6, 47.5)	
24-35	99	7.3	(2.7, 18.0)	18.3	(10.8, 29.3)	25.6	(16.1, 38.1)	
36-47	99	3.1	(1.3, 7.1)	15.6	(9.1, 25.6)	18.7	(11.7, 28.7)	
48-59	90	3.2	(1.1, 9.0)	12.3	(7.0, 20.7)	15.5	(8.8, 25.9)	
Sex								
Male	189	4.5	(2.3, 8.5)	16.5	(11.1, 23.7)	21.0	(14.8, 28.9)	0.267
Female	201	5.6	(2.9, 10.7)	21.5	(15.3, 29.5)	27.2	(19.8, 36.1)	
Residence								
Urban	158	5.8	(3.2, 10.2)	30.1	(20.6, 41.6)	35.9	(26.2, 47.0)	0.05
Rural	236	4.7	(2.5, 8.6)	16.6	(12.3, 21.9)	21.2	(15.7, 28.1)	
Wealth quintile								
Lowest	83	6.1	(2.5, 14.0)	17.9	(10.4, 29.1)	23.9	(14.5, 36.9)	<0.01
Second	96	2.1	(0.8, 5.2)	26.1	(17.6, 36.8)	28.1	(19.5, 38.8)	
Middle	92	5.2	(1.9, 13.1)	7.8	(3.8, 15.1)	12.9	(7.2, 22.2)	
Fourth	71	4.4	(1.1, 16.7)	22.4	(12.9, 36.0)	26.8	(16.5, 40.5)	
Highest	48	7.9	(2.6, 21.6)	43.7	(22.9, 67.0)	51.6	(30.1, 72.6)	
Household food security								
Secure	241	17.9	(12.7, 24.6)	5.1	(2.7, 9.3)	23.0	(16.7, 30.9)	0.637
Mildly insecure	44	27.1	(15.8, 42.6)	6	(1.6, 19.8)	33.2	(20.5, 48.8)	
Moderately insecure	89	21.2	(12.3, 34.0)	3.5	(1.1, 10.4)	24.7	(14.5, 38.9)	
Severely insecure	17	28.4	(12.1, 53.4)	2.7	(0.3, 18.7)	31.2	(14.2, 55.3)	
TOTAL	**394**	**5.0**	**(3.1, 7.8)**	**20.4**	**(16.1, 25.4)**	**25.4**	**(20.3, 31.2)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] Deficient <12 ng/mL (<30nmol/L); Insufficient 12-19.9 ng/mL (<50nmol/L). Vitamin D concentrations below the limit of detection (<9 ng/mL; n=11) were recoded to 9 ng/mL.

[b] 25% sub-sample

[c] Percentages weighted for unequal probability of selection.

[d] CI=confidence interval, calculated taking into account the complex sampling design.

[e] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.3.14. Associations between micronutrient deficiencies and various factors

Anemia in children 6-59 months is strongly associated with ID (see Table 33), and the prevalence of anemia in iron deficient children is three times higher compared to iron sufficient children. Children who consume fortified cereal were shown to have a significantly higher anemia prevalence than those not consuming fortified cereal. However, ancillary analysis (data not shown) revealed that, in this case, the consumption of fortified baby cereal is essential a proxy for age and is significantly associated with anemia because the anemia prevalence is significantly higher in children <23 months of age; an age group that consumes more fortified baby cereals than older age groups. No significant associations between anemia and any of the other investigated indicators was detected.

Table 33. Correlation between various factors and anemia in children 6-59 months of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Anemic	p-value[b]
Child had diarrhea			
Yes	100	15.7	0.288
No	1097	21.3	
Child had fever			
Yes	145	21.5	0.854
No	1060	20.8	
Child had lower respiratory infection			
Yes	10	14.2	0.480
No	1197	21.0	
Child's household had safe drinking water			
Yes	1176	21.1	0.529
No	30	17.2	
Consumed commercially fortified baby cereal			
Yes	106	30.7	<0.05
No	1065	20.0	
Consumed micronutrient powder			
Yes	22	11.5	0.208
No	1155	21.2	
Consumed infant formula with added iron			
Yes	60	29.9	0.129
No	1111	20.3	
Took iron tablet or syrup in past 6 months			
Yes	112	24.1	0.469
No	1085	20.7	
Took multivitamin supplement in past 6 months			
Yes	207	22.0	0.753
No	987	20.7	
Household flour iron fortification[c]			
None	230	16.0	0.752
Insufficient	78	19.6	
Adequate	8	19.0	
Child had inflammation			
Yes	318	20.8	0.729
No	823	19.6	

Child iron deficient			
Yes	540	31.5	<0.001
No	601	9.5	
Child vitamin A deficient			
Yes	159	18.7	0.691
No	982	20.2	
Child vitamin D status[d]			
Normal	264	20.4	0.277
Insufficient	96	27.8	
Deficient	29	14.2	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other

[c] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm

[d] Vitamin D deficiency measured in a 25% sub-sample of children

Table 34 presents the correlations between ID and potential risk factors. This analysis shows that children who had consumed infant formula with added iron the day before the survey have a lower prevalence of ID than those who did not consume the infant formula. Also, there is indication that children who consumed iron syrup in the 6 months prior to the survey are less likely to be iron deficient than children who did not, albeit this difference is not statistically significant. Moreover, the data also suggests that children with vitamin A deficiency are more likely to be iron deficient, though the difference is not statistically significant. Other variables investigated here are not significantly associated with ID.

Table 34. Correlation between various factors and iron deficiency in children 6-59 months of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Iron deficiency	p-value[b]
Child had diarrhea			
Yes	92	48.3	0.866
No	1051	47.1	
Child had fever			
Yes	142	39.2	0.069
No	1009	48.6	
Child had lower respiratory infection			
Yes	10	27.0	0.269
No	1143	47.6	
Child's household had adequate sanitation			
Yes	978	47.6	0.350
No	178	43.1	
Child's household had safe drinking water			
Yes	1126	46.9	0.934
No	30	47.9	
Minimum dietary diversity			
Yes	97	44.9	0.127
No	234	57.1	

Consumed commercially fortified baby cereal			
Yes	95	39.2	0.231
No	1023	47.9	
Consumed micronutrient powder			
Yes	23	37.5	0.661
No	1101	47.5	
Consumed infant formula with added iron			
Yes	53	28.6	<0.05
No	1066	47.9	
Took iron tablet or syrup in past 6 months			
Yes	106	38.0	0.076
No	1037	48.0	
Took multivitamin supplement in past 6 months			
Yes	199	46.7	0.868
No	943	47.5	
Household flour iron fortification[c]			
None	220	39.1	0.393
Insufficient	76	42.8	
Adequately fortified	8	59.4	
Child had inflammation			
Yes	326	43.2	0.187
No	835	48.7	
Child vitamin A deficient			
Yes	163	54.5	0.078
No	998	45.7	
Child vitamin D status[d]			
Normal	267	50.8	0.949
Insufficient	98	49.1	
Deficient	29	48.2	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other

[c] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm

[d] Vitamin D deficiency measured in a 25% sub-sample of children

There is some evidence that children with vitamin A deficiency have a higher prevalence of investigated morbidities two weeks prior to the survey, though this difference is only significant for lower respiratory infections and fever (see Table 35). Moreover, children who consumed micronutrient powders or commercially fortified baby cereal the day before the survey have substantially lower prevalences of vitamin A deficiency, though this difference is not significant due to the small number of children. None of the other investigated indicators are significantly associated with vitamin A deficiency.

Table 35. Correlation between various factors and vitamin A deficiency in children 6-59 months of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Vit A deficiency	p-value[b]
Child had diarrhea			
Yes	92	20.8	0.346
No	1051	14.2	
Child had fever			
Yes	142	20.2	<0.05
No	1009	13.5	
Child had lower respiratory infection			
Yes	10	48.8	<0.05
No	1143	14.2	
Child's household had adequate sanitation			
Yes	978	14.4	0.466
No	178	17.7	
Child's household had safe drinking water			
Yes	1126	14.7	0.344
No	30	22.3	
Minimum dietary diversity			
Yes	97	10.0	0.4150
No	234	13.6	
Consumed commercially fortified baby cereal			
Yes	95	7.4	0.102
No	1023	15.5	
Consumed micronutrient powder			
Yes	23	2.2	0.099
No	1101	15.2	
Took multivitamin supplement in past 6 months			
Yes	199	10.6	0.365
No	943	15.5	
Child had fever			
Yes	326	13.2	0.356
No	835	15.8	
Child vitamin D status[c]			
Normal	267	11.0	0.6177
Insufficient	98	15.4	
Deficient	29	9.7	

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other
[c] Vitamin D deficiency measured in a 25% sub-sample of children

None of the investigated risk factors of vitamin D are significantly associated with vitamin D deficiency. This might, at least partially owed to the small number of children included in the analyses (see Table 36).

Table 36. Correlation between various factors and vitamin D deficiency in children 6-59 months of age, the Kyrgyz Republic 2021

Characteristic	N	%[a, c] Vitamin D deficient or insufficient	p-value[b]
Child had diarrhea			
Yes	32	33.4	0.296
No	352	23.4	
Child had fever			
Yes	41	19.3	0.511
No	349	24.9	
Child had lower respiratory infection			
Yes	3	0	0.447
No	387	24.6	
Child's household had adequate sanitation			
Yes	328	25.3	0.823
No	63	23.4	
Child's household had safe drinking water			
Yes	382	24.7	0.601
No	9	33.8	
Consumed commercially fortified baby cereal			
Yes	40	39.0	0.058
No	338	22.4	
Took multivitamin supplement in past 6 months			
Yes	64	24.5	0.961
No	320	24.2	
Took vitamin D tablets or syrup in past 6 months			
Yes	66	16.8	0.139
No	321	25.5	
Is taking vitamin D tablets or syrup at the time of the survey			
Yes	26	21.1	0.539
No	38	14.5	
Took fish oil supplements in past 6 months Took fish oil supplements in past 6 months			
Yes	25	18.8	0.556
No	360	24.4	
Is taking fish oil supplements at the time of the survey			
Yes	12	20.7	0.668
No	8	13.4	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection.

[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other

[c] Vitamin D deficiency measured in a 25% sub-sample of children

3.4. Children 5-9 years of age

3.4.1. Characteristics

Table 37 describes the demographic characteristics of children aged 5-9 years participating in the NIMAS. The characteristics of the children 5-9 years of age included in the survey are similar to those of the actual Kyrgyz population assessed in the Census 2009, except that children from Bishkek are slightly underrepresented in the survey population.

Table 37. Description of children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]	Children in Kyrgyz population (%) [63]
Age Group (in years)				
5	353	20.3	(18.4, 22.3)	21
6	352	20.3	(18.4, 22.3)	21
7	347	20.2	(18.1, 22.5)	20
8	340	19.6	(17.6, 21.7)	20
9	338	19.7	(17.8, 21.7)	19
Sex				
Male	868	49.2	(46.6, 51.7)	51
Female	860	50.8	(48.3, 53.4)	49
Residence				
Urban	632	30.4	(27.7, 33.3)	33
Rural	1098	69.6	(66.7, 72.3)	67
Region				
Batken oblast	238	10.0	(8.6, 11.5)	9
Jalal-Abad oblast	202	18.0	(15.5, 20.8)	20
Issyk-Kul oblast	168	7.6	(6.4, 9.1)	7
Naryn oblast	176	4.7	(3.9, 5.6)	4
Osh oblast	263	23.9	(21.2, 26.8)	23
Talas oblast	201	5.5	(4.7, 6.4)	4
Chui oblast	155	15.3	(13.2, 17.6)	14
Bishkek city	121	9.6	(7.9, 11.8)	15
Osh city	206	5.5	(4.7, 6.5)	4
Wealth quintile				
Lowest	466	25.8	(22.5, 29.4)	
Second	378	22.3	(19.6, 25.3)	
Middle	382	23.5	(20.6, 26.7)	
Fourth	321	18.9	(15.9, 22.3)	
Highest	177	9.5	(7.5, 11.9)	
TOTAL	1730			

Note: The N's are un-weighted numbers in each subgroup. Subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.4.2. Schooling and school feeding

As shown in Table 38, four out of five children ever attended school. Of those children attending school at the time of the survey, about 85% received school meals. Almost two-thirds of children had home schooling due to COVID, on average 175 days. For the majority of children, home-schooling had no negative effect on health.

Table 38. Schooling and school feeding of children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a], Mean	(95% CI)[b]
Child ever attended school			
Yes	1401	81.3	(79.1, 83.4)
No	329	18.7	(16.6, 20.9)
Child attended school at the time of the survey[c]			
Yes	1387	99.0	(98.3, 99.4)
No	14	1.0	(0.6, 1.7)
School meal provision			
Child received hot meal	769	54.8	(49.0, 60.5)
Child received bun and tea	403	30.0	(24.8, 35.8)
No food provided at school	196	14.0	(11.7, 16.7)
Don`t know	19	1.2	(0.7, 2.0)
Child had home schooling due to COVID-19			
Yes	844	61.9	(59.1, 64.7)
No	530	37.3	(34.5, 40.2)
Mean number of home-schooling days (mean)	833	175	(167, 184)
Home-schooling affected health of child			
Yes	112	11.2	(9.0, 14.0)
No	696	84.8	(81.8, 87.4)
Don't know	36	3.9	(2.7, 5.6)
How was child health affected[d]			
Lack of nutritious food due to absence of school meals	5	5.4	(2.0, 14.1)
Child often sick or depressed	85	76.0	(66.9, 83.3)
Lack of nutritious food & child often sick or depressed	7	5.6	(2.5, 12.3)
Don't know	13	12.9	(7.1, 22.3)

Note: The N's are the numerators for a specific sub-group. The percentages do not add up to 100% because the small proportion of the respondents that reported 'don't know' or 'not applicable' is not shown.
[a] Percentages and means weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Only including those who ever attended school.
[d] Only including those whose health was affected by home- schooling.

3.4.3. Recent illness and health indicators

More than 90% of children were weighed at birth, and of these children, less than 5% had low birth weight. The proportion of children having a lower respiratory infection and diarrhea in the two weeks preceding the survey was below 5%, and the prevalence of those suffering from fever was below 10% (see Table 39). The low morbidity burden is corroborated by the low proportion of children with elevated inflammation markers.

Table 39. Health indicators in children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a], Mean	(95% CI)[b]
Child weighed at birth			
Yes	1600	92.4	(90.5, 93.8)
No	6	0.3	(0.1, 0.8)
Don't know	124	7.3	(5.9, 9.1)
Birthweight in kilograms (mean)	1508	3310	(3281, 3340)

Low birth weight			
<2500 грамм	74	4.3	(3.3, 5.7)
2500+ грамм	1434	95.7	(94.3, 96.7)
Had lower acute respiratory infection in past 2[c]			
Yes	11	1.0	(0.5, 2.3)
No	1719	99	(97.7, 99.5)
Had diarrhea in past 2 weeks			
Yes	47	2.3	(1.5, 3.3)
No	1682	97.7	(96.6, 98.4)
Had fever in past 2 weeks			
Yes	141	9.5	(7.6, 11.7)
No	1587	90.4	(88.2, 92.3)
Inflammation[d]			
None	1098	79.6	(76.8, 82.1)
Early (High CRP, Normal AGP)	25	1.5	(1, 2.3)
Acute (High CRP, High AGP)	102	6.9	(5.4, 8.8)
Convalescent (Normal CRP, High AGP)	163	12.0	(10.1, 14.2)

Note: The N's are the numerators for a specific sub-group. The percentages do not add up to 100% because the small proportion of the respondents that reported 'don't know' or 'not applicable' is not shown.
[a] Percentages and means weighted for unequal probability of selection among regions.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Questions on recent illness were phrased according to the MICS manual [68].
[d] The various stages of inflammatory response was defined by Thurnham et al [39].

3.4.4. Dietary diversity

On average, children consumed 6.4 food groups (out of a potential 10 food groups) the day before the survey and more than two-thirds of the children had minimum dietary diversity (i.e., the consumption of ≥5 food groups). Significant differences were detected between the regions: In Batken, Jalal Abad and Osh Oblast, approximately 80% of children consumed ≥5 food groups, whereas in Chui and Bishkek less than half of the children consumed ≥5 food groups. Moreover, urban/rural residence and household wealth are significantly associated with dietary diversity. A larger proportion of children in rural areas consumed ≥5 food groups compared to children in urban centers. When examined by wealth quintile, children residing in the wealthiest households had the lowest proportion of minimum dietary diversity (~60%). Minimum dietary diversity was also significantly associated with household food security status, and a dose-response relationship was observed whereby the proportion of children with minimum dietary diversity steadily increased as the household food security status improved. No significant differences were detected between the different age groups and between boys and girls.

Table 40. Dietary diversity in children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	Consumed 5+ food groups				Mean dietary score
	N	%[a]	(95% CI)[b]	p-value[c]	
Age Group (in years)					
5	353	67.9	(62.1, 73.2)	0.677	6.2
6	352	72.3	(66.1, 77.7)		6.4
7	347	72.1	(66.2, 77.2)		6.5
8	340	70.4	(64.9, 75.4)		6.4
9	338	68.4	(62.7, 73.5)		6.4
Sex					
Male	868	69.6	(66.1, 72.8)	0.635	6.4
Female	860	70.7	(66.7, 74.4)		6.4

Residence					
Urban	632	61.3	(56.6, 65.8)	<0.001	6.0
Rural	1098	74.1	(70.5, 77.4)		6.5
Region					
Batken oblast	238	81.5	(75.8, 86.1)	<0.001	7.3
Jalal-Abad oblast	202	82.7	(76.6, 87.4)		6.9
Issyk-Kul oblast	168	76.8	(66.9, 84.4)		6.6
Naryn oblast	176	67.9	(58.4, 76.1)		6.3
Osh oblast	263	84.4	(78.0, 89.3)		6.8
Talas oblast	201	58.7	(48.9, 67.8)		5.9
Chui oblast	155	45.9	(37.1, 55.0)		5.3
Bishkek city	121	45.3	(35.1, 56.0)		5.2
Osh city	206	62.9	(57.5, 68.1)		6.0
Wealth quintile					
Highest	466	66.9	(60.5, 72.7)	<0.01	6.1
Second	378	76.6	(70.4, 81.8)		6.6
Middle	382	75.2	(68.6, 80.8)		6.7
Fourth	321	66.3	(59.0, 73.0)		6.3
Highest	177	59.3	(49.6, 68.2)		5.8
Household food security					
Secure	1097	74.0	(70.4, 77.4)	<0.001	6.4
Mildly insecure	206	73.0	(64.1, 80.3)		6.0
Moderately insecure	314	60.3	(53.6, 66.6)		5.6
Severely insecure	107	50.3	(36.3, 64.2)		4.7
TOTAL	**1730**	**70.2**	**(67.3, 73.0)**		**6.4**

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.
[c] P-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.4.5. Consumption of vitamins and supplements

As shown in Table 41 below, supplement and vitamin consumption is uncommon in children 5-9 years of age. In the past 6 months, less than 5% of children consumed vitamin A supplements and less than 10% consumed iron tablets/ syrup or vitamin D tablets/ syrup or fish oil supplements. Multivitamins were the most common supplement and were consumed by 13% of children in the six months prior to the survey.

Table 41. Consumption of iron, vitamin A and vitamin D supplements in children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Took iron tablet or syrup in past 6 months			
Yes	127	7.0	(5.5, 8.7)
No	1595	92.5	(90.5, 94.0)
Don't know	8	0.6	(0.2, 1.7)
Is still taking iron			
Yes	45	34.2	(24.1, 45.9)
No	80	65.8	(54.1, 75.9)
Took vitamin A tablets or other preparations in past 6 months			
Yes	84	4.5	(3.5, 5.7)
No	1634	94.8	(93.4, 95.9)
Don't know	12	0.7	(0.3, 1.5)

Is still taking vitamin A			
Yes	32	38.1	(26.0, 51.8)
No	45	61.9	(48.2, 74.0)
Took multivitamin tablets or other preparations in past 6 months			
Yes	237	13.0	(10.9, 15.4)
No	1483	86.6	(84.2, 88.7)
Don't know	10	0.4	(0.2, 0.8)
Is still taking multivitamins			
Yes	80	28.9	(22.2, 36.6)
No	156	71.1	(63.4, 77.8)
Took vitamin D tablets or syrup in past 6 months			
Yes	131	7.1	(5.7, 8.7)
No	1591	92.5	(90.8, 93.9)
Don't know	8	0.4	(0.2, 1.0)
Is still taking vitamin D tablets or syrup			
Yes	45	27.8	(19.8, 37.5)
No	84	72.2	(62.5, 80.2)
Took fish oil supplements in past 6 months			
Yes	111	6.3	(5.0, 7.9)
No	1608	93.2	(91.5, 94.5)
Don't know	11	0.5	(0.3, 1.1)
Is still taking fish oil supplements			
Yes	41	31.2	(22.1, 42.1)
No	80	68.8	(57.9, 77.9)

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.4.6. Short stature

As shown in Table 42 below, about one out of ten children aged 5-9 years have short stature (i.e., height-for-age z score <-2 SD). Although no significant differences were detected for any of the investigated indicators, the data suggests that short stature is more prevalent in older kids, in females, and in children living in poor households.

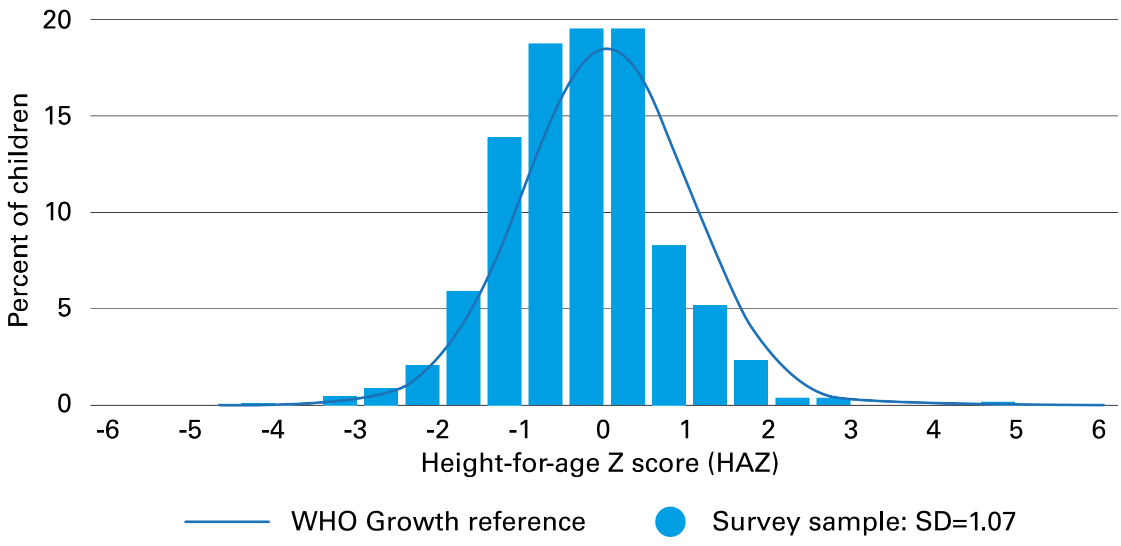


Figure 14. Distribution of height-for-age z-scores in children 5-9 years of age, the Kyrgyz Republic 2021

Figure 14 shows the distribution of the height-for-age z-score in the surveyed population of children 5-9 years of age. It shows that the distribution is very slightly shifted towards the left of the standard growth curve, indicating that height-for-age z-scores were, on average, slightly lower than those in the WHO Growth Standard population.

Table 42. Percentage of children 5-9 years of age with short stature, the Kyrgyz Republic 2021

Characteristic	N	%[a, b]	(95% CI)[c]	p-value[d]
Age Group (in years)				
5	260	2.9	(1.5, 5.4)	0.091
6	298	2.3	(1.0, 5.0)	
7	293	3.5	(1.7, 7.1)	
8	290	7.0	(3.7, 12.7)	
9	289	5.7	(3.1, 10.4)	
Low birth weight				
Yes	62	5.7	(1.8, 17.0)	0.557
No	1200	4.0	(2.9, 5.5)	
Sex				
Male	719	3.3	(2.2, 5.0)	0.118
Female	711	5.3	(3.4, 8.1)	
Residence				
Urban	485	3.9	(2.1, 7.0)	0.699
Rural	945	4.5	(3.0, 6.5)	
Region				
Batken oblast	219	5.0	(2.7, 9.1)	0.464
Jalal-Abad oblast	170	3.9	(1.5, 9.5)	
Issyk-Kul oblast	145	3.2	(1.2, 8.5)	
Naryn oblast	165	2.4	(1.0, 5.7)	
Osh oblast	217	5.3	(2.9, 9.4)	
Talas oblast	162	6.3	(2.8, 13.7)	
Chui oblast	106	5.7	(2.2, 13.9)	
Bishkek city	83	0	(0, 0)	
Osh city	163	4.0	(1.7, 8.8)	
Wealth quintile				
Highest	409	6.4	(3.7, 10.9)	0.075
Second	319	5.3	(3.1, 9.1)	
Middle	322	4.1	(2.2, 7.7)	
Fourth	246	2.4	(1.1, 5.2)	
Highest	128	0	(0, 0)	
Household food security				
Secure	887	3.9	(2.7, 5.5)	0.263
Mildly insecure	182	3.0	(0.9, 9.3)	
Moderately insecure	273	4.9	(2.5, 9.2)	
Severely insecure	82	10.5	(2.9, 31.7)	
Household sanitation[e]				
Unadequate	220	3.6	(1.7, 7.4)	0.074
Adequate	1200	4.4	(3.1, 6.2)	

Safe drinking water[f]				
Yes	1387	4.4	(3.2, 6.1)	0.676
No	35	0	(0, 0)	
TOTAL	**1430**	**4.3**	**(3.1, 5.9)**	

Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Short stature is defined as having a height-for-age z-score below -2 standard deviations from the WHO Growth reference data for 5-19 years population median.

[b] Percentages weighted for unequal probability of selection.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P-value <0.05 indicates that the variation in the values of the subgroup are significantly different from all other subgroups.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/ latrine, no facility, bush, field

[f] Composite variable of main source of drinking water and treating water to make safe for drinking

3.4.7. Thinness, overweight and obesity

As shown in Table 43, thinness is uncommon and affects less than 2% of Kyrgyz children 5-9 years of age. Thinness is only significantly associated with household food security, but there is no clear trend in the results, with children residing in "mildly food insecure" households having a significantly higher thinness prevalence than the other groups.

To our knowledge there is no classification of the overweight or obesity prevalence for children 5-9 years of age. Using the classification for children below 5 years of age, the prevalence of overweight (BMI>25) is considered "high" by WHO guidelines [70]. Overweight and obesity are significantly associated with birth weight status, residence, and household wealth quintile. Specifically, the prevalence of overweight and obesity is significantly higher among children that were not born with low birthweight. Overweight and obesity are also significantly higher in urban areas compared to rural areas, and higher amongst children residing in the wealthiest households.

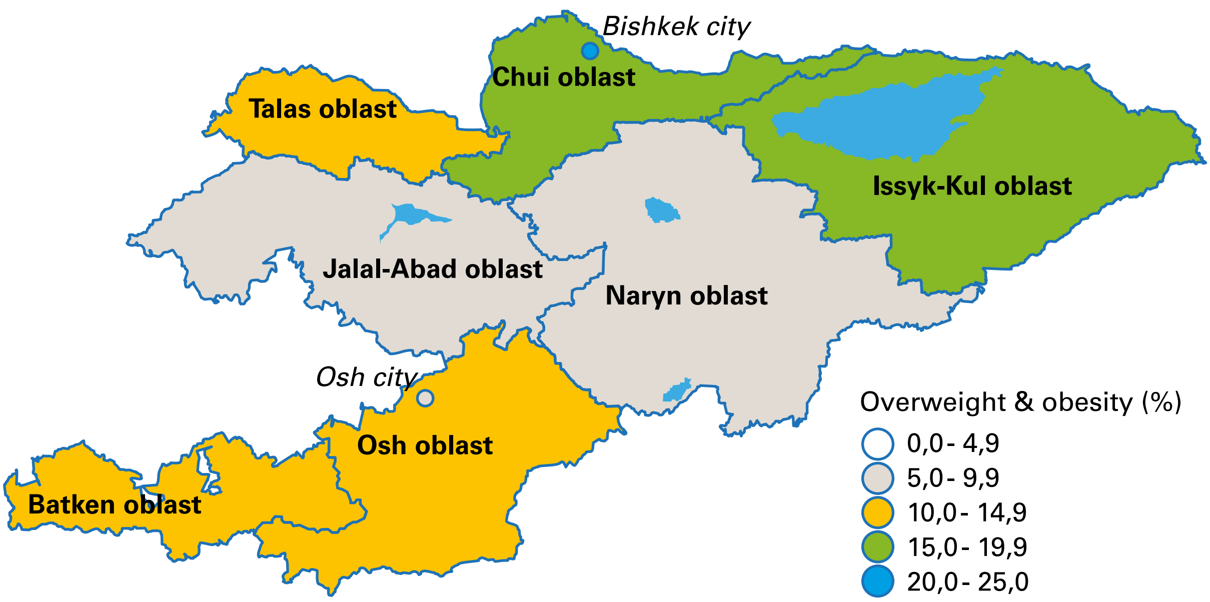


Figure 15. Prevalence of overweight and obesity in children 5-9 years of age, the Kyrgyz Republic 2021

Table 43. Prevalence of thinness, overweight and obesity in children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	Thinness[d]			Overweight[d]		Obese[d]		Overweight или obese		
		%	(95% CI)[b]	p-value[c]	%[a]	(95% CI)[b]	%	(95% CI)[b]	%	(95% CI)[b]	p-value[c]
Age (in years)											
5	259	0.7	(0.1, 3.5)	0.854	13.2	(9.5, 18.1)	2.4	(1.1, 5.4)	15.6	(11.4, 21.1)	0.402
6	297	1.7	(0.7, 4.1)		8.0	(5.0, 12.8)	3.0	(1.3, 6.7)	11.0	(7.4, 16.0)	
7	293	1.6	(0.7, 3.7)		9.5	(6.5, 13.7)	2.5	(1.0, 6.0)	12.1	(8.6, 16.6)	
8	290	1.2	(0.3, 3.8)		10.5	(7.0, 15.6)	3.1	(1.4, 6.5)	13.6	(9.6, 18.9)	
9	289	1.5	(0.6, 3.7)		10.8	(7.1, 16.2)	6.0	(2.7, 12.8)	16.8	(11.6, 23.7)	
Low birth weight											
Yes	61	2.4	(0.8, 7.3)	0.305	2.6	(0.6, 10.2)	0.0	-	2.6	(0.6, 10.2)	<0.01
No	1200	1.2	(0.7, 2.2)		10.5	(8.9, 12.5)	3.6	(2.3, 5.5)	14.1	(11.9, 16.6)	
Sex											
Male	718	1.7	(0.9, 3.3)	0.265	11.7	(9.5, 14.4)	3.5	(2, 6.2)	15.2	(12.4, 18.6)	0.213
Female	710	1.0	(0.5, 2.0)		9.0	(6.7, 11.8)	3.3	(2, 5.4)	12.3	(9.4, 15.8)	
Residence											
Urban	485	2.3	(1.1, 4.8)	0.057	12.1	(9.1, 15.8)	4.9	(2.6, 9.3)	17.0	(13.2, 21.6)	<0.05
Rural	943	0.9	(0.5, 1.8)		9.6	(7.9, 11.6)	2.8	(1.7, 4.6)	12.4	(10.2, 15)	
Region											
Batken oblast	219	1.3	(0.4, 4.0)	0.364	7.5	(4.8, 11.4)	4.4	(2.4, 8)	11.9	(8.7, 16.0)	0.105
Jalal-Abad oblast	170	2.2	(0.7, 6.4)		9.3	(6.8, 12.5)	0	(,)	9.3	(6.8, 12.5)	
Issyk-Kul oblast	144	1.3	(0.4, 4.4)		15.2	(10.7, 21.2)	3	(1.1, 7.8)	18.3	(13.6, 24.1)	
Naryn oblast	164	4.1	(2.1, 7.9)		6.6	(3.5, 12.1)	1.8	(0.6, 5.2)	8.4	(4.4, 15.4)	
Osh oblast	217	0.5	(0.1, 3.6)		8.6	(6.2, 11.7)	4.9	(2.4, 9.7)	13.4	(10.2, 17.6)	
Talas oblast	162	0.9	(0.3, 3.0)		10.6	(6.3, 17.3)	1	(0.2, 4.1)	11.6	(7.3, 18.0)	
Chui oblast	106	0.7	(0.1, 4.7)		12.4	(7.3, 20.2)	4.1	(1.5, 10.3)	16.4	(9.5, 26.9)	
Bishkek city	83	1.8	(0.5, 6.7)		13.9	(7.7, 23.8)	7.2	(1.9, 23.4)	21.1	(12.0, 34.4)	
Osh city	163	1.9	(0.4, 8.8)		11.5	(7.4, 17.4)	3.2	(1.3, 7.5)	14.7	(9.3, 22.5)	
Wealth quintile											
Highest	408	1.7	(0.8, 3.5)	0.627	8.6	(6.2, 11.8)	2.3	(1.2, 4.2)	10.8	(8.0, 14.5)	<0.01
Second	318	1.6	(0.6, 4.1)		7.0	(4.5, 10.8)	2.3	(1.1, 5.0)	9.4	(6.5, 13.3)	

Middle	322	1.1	(0.4, 2.9)		10.6	(7.6, 14.6)	3.4	(1.5, 7.6)	14.1	(10.0, 19.5)	
Fourth	246	0.6	(0.1, 2.6)		13.9	(9.7, 19.6)	4.2	(2.3, 7.8)	18.2	(13.3, 24.3)	
Highest	128	2.2	(0.6, 7.3)		15.8	(9.5, 25.3)	8.0	(2.4, 23.5)	23.8	(14.7, 36.3)	
Household food security											
Secure	887	1.0	(0.5, 1.8)	<0.001	10.3	(8.5, 12.5)	3.8	(2.4, 5.9)	14.1	(11.8, 16.8)	0.915
Mildly insecure	182	5.7	(2.6, 12.0)		11.5	(6.9, 18.5)	2.4	(0.9, 6.0)	13.9	(8.2, 22.5)	
Moderately insecure	271	0.4	(0.1, 1.8)		10.3	(7.1, 14.9)	3.2	(1.1, 8.8)	13.6	(9.4, 19.1)	
Severely insecure	82	0.0	-		8.4	(3.3, 19.7)	2.3	(0.7, 6.9)	10.7	(5.0, 21.4)	
Household sanitation e											
Unadequate	220	0.0	-	0.269	8.1	(5.2, 12.5)	2.1	(0.9, 4.9)	10.2	(6.6, 15.5)	0.250
Adequate	1198	1.6	(1.0, 2.6)		10.8	(9.1, 12.7)	3.7	(2.4, 5.6)	14.5	(12.4, 16.9)	
Safe drinking water[f]											
Yes	1385	1.4	(0.9, 2.3)	0.849	10.2	(8.7, 12.0)	3.5	(2.4, 5.3)	13.7	(11.7, 16.1)	0.807
No	35	0.0	-		16.6	(7.0, 34.7)	0.0	-	16.6	(7.0, 34.7)	
TOTAL	**1428**	**1.4**	**(0.8, 2.2)**		**10.3**	**(8.8, 12.1)**	**3.4**	**(2.3, 5.1)**	**13.8**	**(11.8, 16.0)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

CI=confidence interval, calculated taking into account the complex sampling design.

[c] P-value <0.05 indicates that at least one subgroup is significantly different from the others.

[d] Thinness is defined as BMI-for-age z-score smaller than -2, overweight is defined as having a BMI-for-age z-score greater than +2 but less than or equal to +3 standard deviations and obesity is defined as having a BMI-for-age z-score greater than +3 standard deviations from the WHO Growth reference data for age 5-19 population median.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[f] Composite variable of main source of drinking water and treating water to make safe for drinking

3.4.8. Underweight

Similar to short stature and thinness, underweight is not very common in children 5-9 years of age (see Table 44). Although none of the investigated indicators is significantly associated with underweight, data suggests that children born with low birth weight are more likely to be underweight than those who were born with normal weight. Moreover, it seems that females and children living in households of the lower wealth quintiles are more likely to be underweight than boys and children residing in wealthier households.

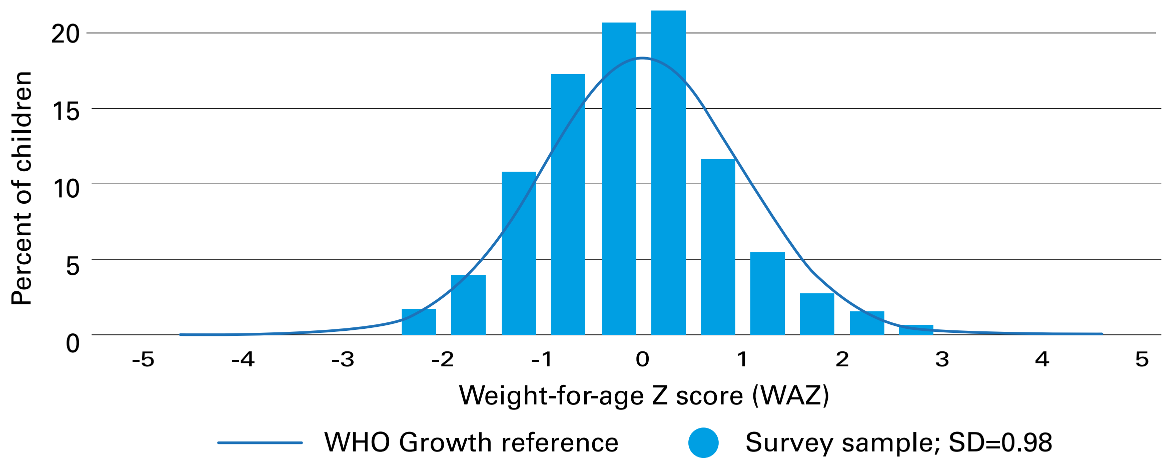


Figure 16. Distribution of weight-for-age z-scores in children 5-9 years of age, the Kyrgyz Republic 2021

Figure 16 shows the distribution of the weight-for-age z-score in the surveyed population of children 5-9 years of age. It shows that the distribution is very slightly shifted towards the left of the standard growth curve, indicating that weight-for-age z-scores were on average slightly smaller than those in the WHO Growth Standard population.

Table 45. Percentage of children 5-9 years of age with underweight, the Kyrgyz Republic 2021

Characteristic	N	%[a, b]	(95% CI)[c]	p-value[d]
Age Group (in years)				
5	260	1	(0.4, 2.9)	0.111
6	298	1.4	(0.5, 4)	
7	293	2.5	(1.2, 5.2)	
8	290	4.9	(2.1, 11)	
9	284	3	(1.2, 6.9)	
Low birth weight				
Yes	62	5.7	(1.8, 17)	0.057
No	1196	2.1	(1.3, 3.4)	
Sex				
Male	718	1.8	(0.9, 3.5)	0.118
Female	707	3.4	(1.9, 5.8)	
Residence				
Urban	483	3.4	(1.6, 6.8)	0.412
Rural	942	2.3	(1.2, 4.1)	
Region				
Batken oblast	218	2.1	(1, 4.5)	0.218

Jalal-Abad oblast	170	3.4	(1.2, 9.4)	
Issyk-Kul oblast	145	0.6	(0.1, 3.9)	
Naryn oblast	165	1.9	(0.7, 5.3)	
Osh oblast	216	1.2	(0.4, 3.8)	
Talas oblast	160	1.5	(0.5, 4.4)	
Chui oblast	106	5.5	(2, 14.3)	
Bishkek city	82	2.5	(0.6, 9.6)	
Osh city	163	3.5	(1.4, 8.8)	
Wealth quintile				
Lowest	408	3.9	(1.6, 9.1)	0.132
Second	318	4.1	(2.1, 7.8)	
Middle	320	1.6	(0.7, 3.7)	
Fourth	245	1	(0.3, 3.5)	
Highest	128	1.3	(0.3, 5.6)	
Household food security				
Secure	883	2.4	(1.5, 3.8)	0.438
Mildly insecure	182	3.6	(1.2, 10.3)	
Moderately insecure	272	1.6	(0.4, 5.6)	
Severely insecure	82	6.7	(0.9, 34.8)	
Household sanitation[e]				
Unadequate	219	2.7	(1.2, 6.3)	0.967
Adequate	1196	2.6	(1.6, 4.2)	
Safe drinking water[f]				
Yes	1382	2.7	(1.7, 4.2)	0.779
No	35	0	(0, 0)	
TOTAL	**1425**	**2.6**	**(1.6, 4.1)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] Underweight is defined as having a weight-for-age z-score below -2 standard deviations from the WHO Growth reference data for age 5-19 population median.

[b] Percentages weighted for unequal probability of selection.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P-value <0.05 indicates that the variation in the values of the subgroup are significantly different from all other subgroups.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[f] Composite variable of main source of drinking water and treating water to make safe for drinking.

3.4.9. Anemia, iron deficiency, and iron deficiency anemia

The prevalence of anemia in children 5-9 years of age is low (Table 45). While none of the children is severely anemic about half can be classified as moderately or mildly anemic (see appendix 8.3, Table 90). According to WHO, anemia in children 5-9 years of age can be considered a mild public health problem [36].

The highest anemia prevalence occurs in children 5 years of age, almost consistently decreasing with increasing age. Moreover, anemia is significantly associated with household food insecurity, with the largest proportion of anemic children living in mildly food insecure households. No associations were found between anemia and low birth weight, child's sex, urban/rural residence, region, household wealth quintile, household sanitation and household access to safe drinking water.

The distribution of hemoglobin values for children is shown in Figure 17. It is roughly symmetric with the majority of values above the cut-off point of 115 g/L. Median hemoglobin concentration among all children 5-9 years of age is 127 g/L.

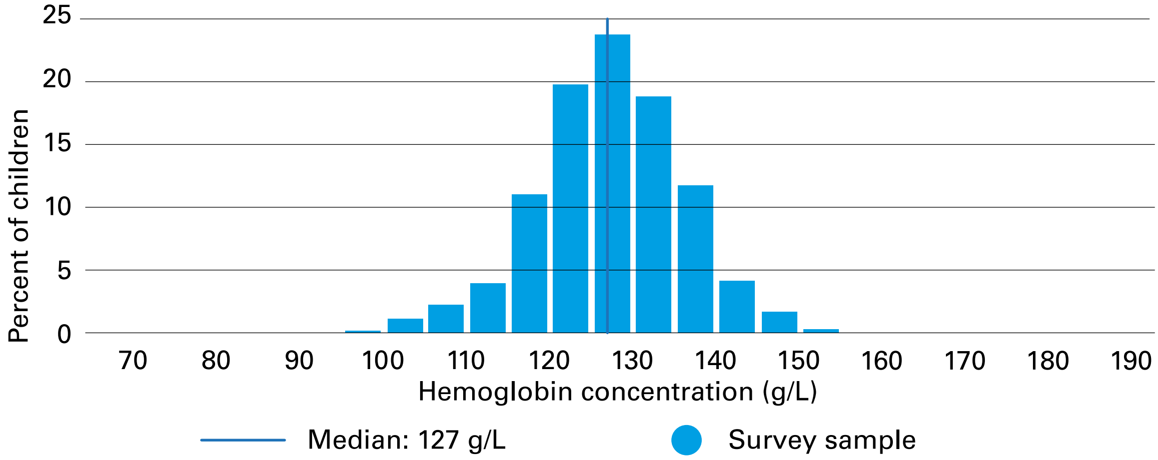


Figure 17. Distribution of adjusted hemoglobin (g/L) in children 5-9 years, the Kyrgyz Republic 2021

With about 30%, ID is much more common than anemia in children 5-9 years of age (Table 45). Similar to anemia, ID is significantly associated with the child's age and highest in young children. Other variables, such as sex, low birth weight, urban/rural residence, region, household wealth, household food security, household sanitation and access to safe drinking water are not associated with ID with statistical significance.

Almost 60% of the children who have anemia also have ID. Similar to anemia and ID, the highest prevalence of IDA was found in children 5 years of age. Also, IDA is significantly associated with household food insecurity and household sanitation. Highest prevalences were detected in children living in mildly food insecure households and in households with adequate sanitation. Other demographic variables investigated here are not significantly associated with IDA.

Figure 18 illustrates the overlap between anemia and ID in children 5-9 years of age, showing a large overlap between anemia and ID.

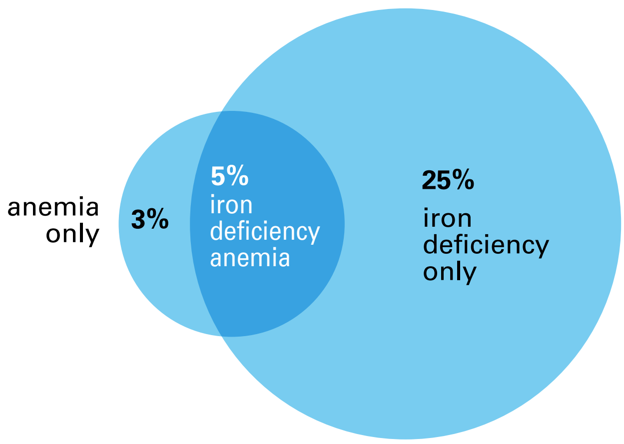


Figure 18. Venn diagram showing overlap between anemia and iron deficiency in children 5-9 years of age, the Kyrgyz Republic 2021

Table 46. Prevalence of anemia, iron deficiency, and iron deficiency anemia in children 5-9 years of age, by various demographic characteristics, the Kyrgyz Republic 2021.

Characteristic	Anemia[b]				Iron deficiency[e]				Iron deficiency anemia [f]			
	N	%[a]	95% CI[c]	p-value[d]	N	%[a]	95% CI[c]	p-value[d]	N	%[a]	95% CI[c]	p-value[d]
Age Group (in years)												
5	274	15.7	(11.5, 21.2)	<0.0001	266	33.1	(29.3, 45.0)	<0.05	263	10.3	(6.6, 15.6)	<0.001
6	289	7.7	(4.6, 12.6)		284	26.3	(26.3, 40.6)		278	4.3	(2.4, 7.9)	
7	275	6.1	(3.7, 9.8)		271	26.3	(20.4, 33.2)		268	3.5	(1.8, 6.8)	
8	282	3.4	(1.5, 7.4)		284	24.2	(20.7, 32.7)		278	1.2	(0.3, 4.2)	
9	279	6.1	(3.5, 10.5)		280	29.2	(19.0, 30.3)		276	3.3	(1.4, 7.8)	
Low birth weight												
Yes	610	7.9	(3.2, 18.0)	0.924	59	28.6	(16.1, 45.6)	0.981	59	3.7	(1.2, 11.3)	0.775
No	1181	7.5	(5.7, 9.9)		1166	28.5	(24.9, 32.2)		1150	4.4	(3, 6.5)	
Sex												
Male	697	7.7	(5.6, 10.5)	0.896	691	30.1	(25.8, 34.8)	0.615	683	5.2	(3.3, 8)	0.266
Female	700	7.9	(5.7, 10.8)		692	28.6	(24.1, 33.5)		678	3.8	(2.3, 6.3)	
Residence												
Urban	473	8.7	(6.1, 12.3)	0.505	476	32.5	(26.3, 39.3)	0.228	464	4.8	(2.9, 7.9)	0.773
Rural	928	7.4	(5.2, 10.4)		912	27.8	(23.8, 32.2)		901	4.3	(2.6, 7.1)	
Region												
Batken oblast	220	4.3	(2.1, 8.6)	0.256	218	30.6	(23.7, 38.5)	0.391	218	3.4	(1.8, 6.6)	0.580
Jalal-Abad oblast	165	4.3	(2.1, 8.6)		163	26.4	(20.4, 33.4)		157	2.4	(0.8, 7.2)	
Issyk-Kul oblast	151	9.7	(5.4, 16.9)		152	35.3	(25.7, 46.2)		151	7.2	(3.6, 13.8)	
Naryn oblast	164	11.1	(7, 17.2)		158	38.6	(30.7, 47.2)		158	7	(4.4, 10.9)	
Osh oblast	203	8.3	(4.6, 14.5)		199	23.8	(16.9, 32.3)		195	3.9	(1.8, 8.5)	
Talas oblast	160	14.8	(8.3, 25.2)		158	31.3	(24.0, 39.6)		158	8.3	(3.4, 18.9)	
Chui oblast	103	9.5	(3.9, 21.1)		101	32.0	(20.2, 46.7)		100	5.1	(1, 22)	
Bishkek city	83	7.1	(3.2, 15.0)		83	34.0	(22.2, 48.2)		81	4.8	(2.1, 11)	
Osh city	152	6.0	(3.3, 10.7)		156	25.0	(18.6, 32.8)		147	2.4	(0.9, 6)	
Wealth quintile												
Lowest	402	7.6	(5.3, 11.0)	0.857	397	29.9	(24.3, 36.3)	0.924	394	3.6	(2, 6.3)	0.411

Second	318	9.1	(5.9, 13.9)		311	27.4	(21.3, 34.5)		307	6.6	(3.8, 11.2)	
Middle	310	7.6	(3.9, 14.2)		305	30.4	(23.7, 38.1)		300	4.6	(2, 10.4)	
Fourth	239	7.6	(4.6, 12.4)		243	30.1	(22.4, 39.0)		237	3.8	(2, 7.1)	
Highest	127	5.5	(2.5, 11.7)		127	26.1	(18.2, 35.8)		122	2.8	(1, 7.9)	
Household food security												
Secure	867	6.6	(4.7, 9.3)	<0.01	860	28.2	(24.5, 32.3)	0.270	840	3.6	(2.4, 5.5)	<0.01
Mildly insecure	173	17.5	(10.2, 28.3)		174	37.6	(27.7, 48.7)		171	11.3	(5.3, 22.6)	
Moderately insecure	274	5.3	(3.2, 8.7)		269	27.4	(21.3, 34.4)		269	3.2	(1.7, 6)	
Severely insecure	82	10.5	(5.1, 20.6)		80	28.5	(17.2, 43.4)		80	4.7	(1.5, 14)	
Household sanitation[g]												
Unadequate	212	3.7	(1.8, 7.3)	0.073	215	27.2	(20.0, 35.9)	0.565	209	1.1	(0.4, 2.8)	<0.05
Adequate	1180	8.5	(6.4, 11.2)		1164	29.4	(25.6, 33.5)		1147	5.1	(3.4, 7.5)	
Safe drinking water[h]												
Yes	1357	8.0	(6.1, 10.3)	0.334	1345	29.0	(25.6, 32.6)	0.607	1322	4.6	(3.1, 6.7)	0.5435
No	37	2.0	(0.4, 9.1)		36	36.2	(17.6, 60.0)		36	1.2	(0.1, 9.1)	
TOTAL	**1401**	**7.8**	**(6.0, 10.0)**		**1388**	**29.2**	**(25.8, 32.8)**		**1365**	**4.5**	**(3.0, 6.5)**	

Note: The N's are the denominators for a specific sub-group. For iron deficiency and iron deficiency anemia, the numbers are smaller than for anemia due to unsuccessful blood collection (sufficient blood could be obtained only for the on-site analysis of hemoglobin concentration).

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Anemia defined as hemoglobin < 115 g/L adjusted for altitude.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P-value <0.05 indicates that the variation in the values of the subgroup are significantly different from all other subgroups

[e] Iron deficiency defined as inflammation adjusted plasma ferritin < 15 µg/L.

[f] Iron deficiency anaemia defined as plasma ferritin < 15.0 µg/L and hemoglobin < 115 g/L.

[g] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another house-hold. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[h] Composite variable of main source of drinking water and treating water to make safe for drinking

3.4.10. Vit A deficiency

The prevalence of vitamin A deficiency in Kyrgyz children 5-9 years of age would be classified as moderate by WHO [71], see Table 46. The prevalence tends to decrease with increasing age and tends to be higher in male than in female children. Similar to vitamin A in children 6-59 months of age, the prevalence significantly differs by region with the highest prevalence in Osh City and Chui, where the high prevalence poses a severe public health problem. Lowest prevalence of vitamin A deficiency was observed in Naryn and Jalal Abad, where the problem is of mild public health significance. Vitamin A deficiency does not significantly differ by child birth weight, household wealth, urban/rural residence, and household food security status.

Table 47. Prevalence of vitamin A deficiency in children 5-9 years of age, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	N	% a with VAD[b]	(95% CI)[c]	p-value[d]
Age Group (in years)				
5	266	20.2	(13.8, 28.5)	0.053
6	284	18.6	(13.8, 24.7)	
7	271	18.8	(12.8, 26.7)	
8	284	10.4	(7.1, 14.9)	
9	280	12.5	(8.6, 17.9)	
Low birth weight				
Yes	59	11.1	(5.4, 21.5)	0.305
No	1166	15.9	(13.1, 19.2)	
Sex				
Male	691	18.5	(14.8, 22.9)	0.074
Female	692	13.8	(10.5, 17.8)	
Residence				
Urban	476	17.2	(13.5, 21.8)	0.629
Rural	912	15.5	(12.2, 19.5)	
Region				
Batken oblast	218	19.7	(13.9, 27.1)	<0.01
Jalal-Abad oblast	163	8.2	(4.7, 13.7)	
Issyk-Kul oblast	152	13.5	(8.9, 19.9)	
Naryn oblast	158	7.5	(4.2, 12.8)	
Osh oblast	199	18.7	(12.3, 27.4)	
Talas oblast	158	10.9	(5.7, 20.0)	
Chui oblast	101	22.5	(13.5, 35.1)	
Bishkek city	83	12.3	(6.7, 21.5)	
Osh city	156	27.5	(19.9, 36.8)	
Wealth quintile				
Lowest	397	13.7	(9.4, 19.4)	0.210
Second	311	18.4	(14.1, 23.7)	
Middle	305	20.1	(14.2, 27.6)	
Fourth	243	11.5	(6.6, 19.1)	
Highest	127	16.3	(10.2, 25.2)	
Household food security				
Secure	860	14.3	(11.5, 17.7)	0.196
Mildly insecure	174	21.4	(14.6, 30.3)	

Moderately insecure	269	16.8	(11.3, 24.5)	
Severely insecure	80	24.0	(11.9, 42.4)	
TOTAL	**1388**	**16.0**	**(13.4, 19.1)**	

Note: The N's are the denominators for a specific sub-group; for VAD, the numbers are smaller than for anemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of hemoglobin concentration) or insufficient sample volumes for retinol binding protein analysis.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] VAD = Vitamin A deficiency, defined as RBP adjusted for inflammation <0.569 umol/L.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P-value <0.05 indicates that the variation in the values of the subgroup are significantly different from all other subgroups

3.4.11. Associations between micronutrient deficiencies and various factors

As can be seen in Table 47 anemia in children 5-9 years of age is strongly associated with iron deficiency, the intake of iron tablets and syrup and inflammation. The prevalence of anemia in iron deficient children is more than three times higher compared to iron sufficient children and the anemia prevalence in children with elevated inflammation markers is twice as high as in those children without inflammation. Further, the prevalence of anemia is three times higher in children who took iron syrup or tablets, possibly since iron syrup and tablets have been administered to anemic children as treatment. Moreover, anemia is more prevalent in children who ate 5 or more food groups the day before the survey compared to those children eating less than 5 food groups. Though not significant, the data indicates that a larger proportion of children with vitamin A deficiency are anemic compared to children without vitamin A deficiency. No significant associations between anemia and any of the other investigated indicators was detected.

Table 48. Correlation between various factors and anemia in children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	% [a] Anemia	p-value[b]
Child had diarrhea			
Yes	37	14.3	0.123
No	1361	7.6	
Child had fever			
Yes	105	10.1	0.388
No	1292	7.5	
Child had lower respiratory infection			
Yes	8	0.0	0.538
No	1391	7.8	
Minimum dietary diversity			
Yes	980	8.8	<0.05
No	419	5.4	
Took iron tablet or syrup in past 6 months			
Yes	108	18.4	<0.001
No	1286	6.9	
Took vitamin A tablets in past 6 months			
Yes	68	16.0	<0.05
No	1322	7.2	
Took multivitamin supplement in past 6 months			
Yes	187	11.0	0.151
No	1203	7.3	
Consumes coffee or tea during or directly after meal			
Yes	1032	6.8	0.072
No	367	10.6	

Household flour iron fortification[c]			
None	303	8.6	0.884
HeAdequate	74	7.8	
Adequately fortified	8	5.2	
Child had inflammation			
Yes	287	12.6	<0.005
No	1078	6.7	
У ребенка Iron deficiency			
Yes	423	15.0	<0.0001
No	942	4.9	
Child vitamin A deficient			
Yes	207	11.9	0.064
No	1158	7.1	

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other
[c] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm

As shown in Table 48, ID is significantly associated with fever; a significantly smaller proportion of children with fever two weeks prior to the survey are iron deficient. No other associations were detected between ID and any of the investigated factors.

Table 49. Correlation between various factors and iron deficiency in children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Iron deficiency	p-value[b]
Child had diarrhea			
Yes	35	30.8	0.845
No	1349	29.1	
Child had fever			
Yes	103	18.5	<0.05
No	1280	30.3	
Child had lower respiratory infection			
Yes	8	8.2	0.107
No	1377	29.4	
Minimum dietary diversity			
Yes	971	28.8	0.356
No	414	31.5	
Took iron tablet or syrup in past 6 months			
Yes	104	33.1	0.462
No	1276	29.0	
Took multivitamin supplement in past 6 months			
Yes	183	33.7	0.320
No	1193	28.5	
Consumes coffee or tea during or directly after meal			
Yes	1024	29.0	0.789
No	361	30.0	
Household flour iron fortificationc			
None	300	33.9	0.890
Insufficient	75	30.8	

Adequate	9	33.3	
Child had inflammation			
Yes	290	27.1	0.464
No	1098	29.7	
Child vitamin A deficient			
Yes	208	29.3	0.980
No	1180	29.2	

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other
[c] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm

There is some evidence that children with vitamin A deficiency have a higher prevalence of investigated morbidities two weeks prior to the survey, though this difference is only significant for lower respiratory infections and fever (see Table 49). Moreover, children with elevated inflammation markers have a higher prevalence of vitamin A deficiency compared to those without inflammation. None of the other investigated indicators are significantly associated with vitamin A deficiency.

Table 50. Correlation between various factors and vitamin A deficiency in children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Vit A deficiency	p-value[b]
Child had diarrhea			
Yes	35	8.3	0.376
No	1349	16.2	
Child had fever			
Yes	103	32.0	<0.005
No	1280	14.5	
Child had lower respiratory infection			
Yes	8	39.5	<0.05
No	1377	15.8	
Child's household had adequate sanitation			
Yes	1164	16.0	0.890
No	215	16.5	
Child's household had safe drinking water			
Yes	1345	8.7	0.266
No	36	16.3	
Minimum dietary diversity			
Yes	971	14.8	0.185
No	414	19.0	
Consumed vitamin A rich foods			
Yes	1051	15.0	0.175
No	334	19.4	
Took vitamin A tablets in past 6 months			
Yes	67	18.8	0.732
No	1310	16.0	
Took multivitamin supplement in past 6 months			
Yes	183	19.2	0.442
No	1193	15.6	

Child had inflammation			
Yes	290	26.5	<0.005
No	1098	13.4	

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Тест хи-квадрат; Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other

3.5. Adolescent girls

3.5.1. Characteristic

Table 50 describes the demographic characteristics of adolescent girls participating in the NIMAS. Overall, there is a good representation of urban/rural residence and the regions, although there is a slightly smaller proportion of adolescent girls from Bishkek. Further, there is an underrepresentation of older girls and an overrepresentation of younger ones.

Table 51. Description of adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]	Adolescent girls in Kyrgyz population (%) [63]
Age Group (in years)				
10-12	428	42.0	(39.0, 45.0)	37
13-15	364	38.5	(35.4, 41.8)	33
16-18	204	19.5	(17.1, 22.2)	30
Residence				
Urban	322	27.3	(24.3, 30.6)	30
Rural	674	72.7	(69.4, 75.7)	70
Region				
Batken oblast	109	7.8	(6.3, 9.6)	8
Jalal-Abad oblast	126	19.2	(16.3, 22.4)	20
Issyk-Kul oblast	96	7.7	(6.5, 9.1)	8
Naryn oblast	158	7.2	(6.0, 8.7)	5
Osh oblast	141	22.3	(19.4, 25.6)	23
Talas oblast	109	5.1	(4.0, 6.5)	5
Chui oblast	103	18.7	(15.4, 22.4)	13
Bishkek city	51	7.4	(5.6, 9.7)	13
Osh city	103	4.7	(3.7, 5.9)	4
Wealth quintile				
Lowest	291	26.9	(23.3, 30.9)	
Second	224	23.9	(20.4, 27.8)	
Middle	191	20.0	(17.0, 23.4)	
Fourth	181	19.4	(15.9, 23.4)	
Highest	105	9.8	(7.8, 12.2)	
TOTAL	**996**			

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.5.2. Recent illness and health indicators

Recent illnesses were uncommon in adolescent girls, which is also reflected in the low prevalence of elevated inflammation markers. Only about 10% of girls have one or both of the evaluated inflammatory marker (AGP, CRP) elevated, indicating some form of systemic inflammation (see Table 51).

Table 52. Health indicators in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Had lower acute respiratory infection in past 2 weeks[c]			
Yes	8	1.0	(0.5, 2.2)
No	984	99.0	(97.8, 99.5)
Had diarrhea in past 2 weeks			
Yes	54	5.3	(3.9, 7.2)
No	935	94.3	(92.4, 95.8)
Had fever in past 2 weeks			
Yes	65	7.4	(5.6, 9.7)
No	925	92.3	(90.0, 94.1)
Inflammation[d]			
None	719	88.3	(85.4, 90.7)
Early (High CRP, Normal AGP)	10	1.0	(0.5, 2.1)
Acute (High CRP, High AGP)	40	4.6	(3.3, 6.4)
Convalescent (Normal CRP, High AGP)	53	6.0	(4.4, 8.3)

Note: The N's are the numerators for a specific sub-group. The percentages do not add up to 100% because the small proportion of the respondents that reported 'don't know' or 'not applicable' is not shown.

[a] Percentages weighted for unequal probability of selection among regions.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] Questions on recent illness were phrased according to the MICS manual [68].

[d] For thresholds of inflammatory markers, refer to Thurnham et al [39].

3.5.3. Dietary diversity

As shown in Table 52 more than two-thirds of the adolescents consumed 5 or more food groups (out of a possible 10 food groups) the day before the survey, and the mean dietary score was 6.4. Significant differences were detected between the regions; while in Chui and Bishkek just about 50% of girls ate 5 or more food groups, about 80% of girls living in Batken, Jalal Abad and Osh Oblast ate five or more food groups. Significant differences were also observed by food security status, with a higher proportion of adolescent girls consuming ≥5 food groups as the household food security status improved.

Table 53. Dietary diversity in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	Consumed 5+ food groups				Mean dietary score
	N	%[a]	(95% CI)[b]	p-value[c]	
Age Group (in years)					
10-12	428	70.6	(65.4, 75.3)	0.541	6.5
13-15	364	67.2	(61.8, 72.2)		6.2
16-18	204	66.8	(58.6, 74.2)		6.5
Residence					
Urban	322	63.0	(56.1, 69.5)	0.057	6.2
Rural	674	70.7	(66.1, 74.8)		6.5

Region					
Batken oblast	109	80.7	(68.5, 89.0)	<0.001	7.1
Jalal-Abad oblast	126	83.4	(74.6, 89.7)		7.1
Issyk-Kul oblast	96	73.6	(63.2, 81.9)		6.7
Naryn oblast	158	59.8	(51.0, 68.1)		6.0
Osh oblast	141	79.8	(70.2, 86.9)		6.7
Talas oblast	109	59.6	(45.4, 72.4)		5.9
Chui oblast	103	46.7	(36.5, 57.1)		5.5
Bishkek city	51	51.6	(34.0, 68.8)		5.6
Osh city	103	63.0	(51.1, 73.6)		6.1
Wealth quintile					
Lowest	291	65.0	(57.5, 71.8)	0.184	6.1
Second	224	68.3	(59.5, 76.0)		6.5
Middle	191	77.5	(69.6, 83.8)		6.7
Fourth	181	66.9	(56.7, 75.8)		6.2
Highest	105	62.5	(50.4, 73.2)		6.4
Household food security					
Secure	602	75.9	(71.1, 80.2)	<0.001	6.8
Mildly insecure	128	59.6	(49.1, 69.3)		6.0
Moderately insecure	184	58.0	(49.1, 66.3)		5.8
Severely insecure	78	49.0	(33.1, 65.1)		5.2
TOTAL	**996**	**68.6**	**(64.8, 72.1)**		**6.4**

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.5.4. Consumption of vitamins and supplements

As shown in Table 53 Only a small proportion of adolescent girls consumed dietary supplements in the past six months prior to the survey: iron (6.2%), folic acid (3.7%), vitamin D (4.6%), vitamin A (3.7%), multivitamins (8.8%), and very few were still taking supplements at the time of the survey.

Table 54. Consumption of mineral and vitamin supplements in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Took iron tablet or syrup in past 6 months			
Yes	47	6.2	(4.2, 8.9)
No	940	92.8	(89.9, 94.9)
Don't know	9	1.0	(0.5, 2.0)
Is still taking iron			
Yes	10	20.8	(11.4, 34.8)
No	32	79.2	(65.2, 88.6)
Took folic acid supplements in past 6 months			
Yes	28	3.7	(2.3, 5.9)
No	963	95.7	(93.6, 97.2)
Don't know	5	0.5	(0.2, 1.5)

Is still taking folic acid			
Yes	5	19.0	(5.4, 49.3)
No	19	81.0	(50.7, 94.6)
Took vitamin D tablets or syrup in past 6 months			
Yes	41	4.6	(3.2, 6.6)
No	947	94.4	(92.4, 95.9)
Don't know	8	0.9	(0.4, 2.1)
Is still taking vitamin D tablets or syrup			
Yes	7	13.8	(5.2, 32.0)
No	28	86.2	(68.0, 94.8)
Took vitamin A tablets or other preparations in past 6 months			
Yes	29	3.7	(2.3, 5.9)
No	957	95.2	(93.0, 96.7)
Don't know	10	1.1	(0.5, 2.2)
Is still taking vitamin A			
Yes	2	6.9	(0.9, 37.6)
No	19	93.1	(62.4, 99.1)
Took multivitamin tablets or other preparations in past 6 months			
Yes	86	8.8	(6.9, 11.3)
No	904	90.6	(88.1, 92.6)
Don't know	6	0.6	(0.2, 1.4)
Is still taking multivitamins			
Yes	30	31.5	(20.8, 44.6)
No	55	68.5	(55.4, 79.2)
Took fish oil supplements in past 6 months			
Yes	40	4.2	(2.8, 6.2)
No	950	95.4	(93.3, 96.8)
Don't know	6	0.4	(0.2, 1.1)
Is still taking fish oil supplements			
Yes	14	35.1	(17.9, 57.3)
No	20	64.9	(42.7, 82.1)

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.5.5. Short stature

Overall, the prevalence of short stature is below 3%. Significant differences were found by region: In Talas, more than 10% of adolescents are of short stature, while no girl with short stature was found in Jalal Abad. No significant associations were found between short stature and any other investigated indicator (see Table 54).

Figure 19 shows the distribution of the height-for-age z-score in the surveyed population of adolescent girls 10-18 years of age. The distribution of the height-for-age z-scores closely matches the WHO Child Growth Standard.

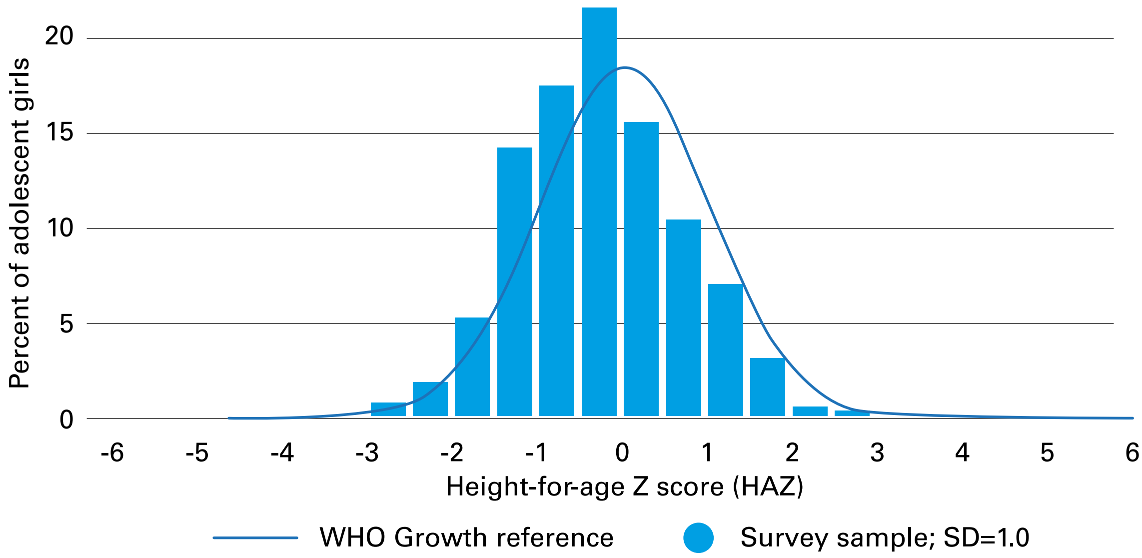


Figure 19. Distribution of height-for-age z-scores in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Table 55. Percentage of adolescent girls 10-18 years of age with short stature, the Kyrgyz Republic 2021

Characteristic	N	%[a,b]	(95% CI)[c]	p-value[d]
Age Group (in years)				
10-12	372	2.8	(1.5, 5.2)	0.920
13-15	308	2.8	(1.4, 5.6)	
16-18	174	3.4	(1.3, 9.0)	
Residence				
Urban	259	3.5	(1.7, 7.4)	0.548
Rural	595	2.7	(1.6, 4.4)	
Region				
Batken oblast	104	2.8	(0.6, 11.9)	<0.05
Jalal-Abad oblast	112	0	(0, 0)	
Issyk-Kul oblast	88	2.4	(0.6, 9.6)	
Naryn oblast	156	1.2	(0.3, 4.6)	
Osh oblast	121	3.5	(1.4, 8.5)	
Talas oblast	84	11.1	(6.6, 18.2)	
Chui oblast	63	4.6	(1.7, 12.0)	
Bishkek city	34	2.6	(0.4, 16.2)	
Osh city	92	3.2	(0.8, 12.2)	
Wealth quintile				
Lowest	262	2.4	(1.1, 5.1)	0.287
Second	202	2.2	(0.9, 5.6)	
Middle	157	5.3	(2.4, 11.0)	
Fourth	145	3.3	(1.1, 9.5)	
Highest	85	0.6	(0.1, 4.2)	

Household food security				
Secure	513	3.6	(2.2, 5.9)	0.193
Mildly insecure	112	1.6	(0.5, 5.1)	
Moderately insecure	163	1.0	(0.3, 3.6)	
Severely insecure	63	4.5	(1.2, 16.1)	
Household sanitation[g]				
Unadequate	119	5.4	(2.3, 12.2)	0.360
Adequate	730	2.5	(1.5, 4.2)	
Safe drinking water[h]				
Yes	834	3.0	(2.0, 4.5)	0.637
No	17	0	(0, 0)	
TOTAL	**854**	**2.9**	**(1.9, 4.4)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] Stunting is defined as having a height-for-age z-score below -2 standard deviations from the WHO Growth reference data for age 5-19 population median.

[b] Percentages weighted for unequal probability of selection.

[c] CI=confidence interval, calculated taking into account the complex sampling design

[d] P-value <0.05 indicates that the variation in the values of the subgroup are significantly different from all other subgroups.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/ latrine, no facility, bush, field

[f] Composite variable of main source of drinking water and treating water to make safe for drinking.

3.5.6. Thinness, overweight and obesity

Thinness is highly uncommon, affecting only about 2% of adolescent girls. No significant associations were found in the sub-group analyses, which could be owed to the small number of girls with thinness.

Overall, about 15% of adolescent girls are overweight or obese; with 4% classified as obese and 11% overweight. Although not significant, the prevalence of obesity or overweight tends to increase with age. Further, a significant association was found between overweight or obesity and household sanitation. The prevalence of overweight or obesity is about 3 times higher in households without safe drinking water. The reason for this is unclear, and may indicate that unsafe drinking water is a proxy for other characteristics associated with overweight and obesity. However, the number of households without safe drinking water is small, thus results will have to be interpreted with caution. No significant associations were found between overweight or obesity and any of the other demographic factors.

Table 56. Prevalence of thinness, overweight and obesity in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	Thinness[d]				Overweight[d]		Obese[d]		Overweight или obese		
	N	%	(95% CI)[b]	p-value[c]	%[a]	(95% CI)[b]	%	(95% CI)[b]	%	(95% CI)[b]	p-value[c]
Age (in years)											
10-12	372	3.3	(1.6, 6.5)	0.205	7.5	(4.8, 11.5)	4.1	(2.3, 7.4)	11.6	(8.2, 16.3)	0.072
13-15	309	2.5	(1.0, 6.1)		10.7	(7.7, 14.6)	4.2	(2.4, 7.2)	14.9	(11.1, 19.6)	
16-18	174	0	(0, 0)		19.1	(12.2, 28.6)	1.7	(0.5, 6.0)	20.8	(13.8, 30.2)	
Residence											
Urban	259	2.5	(1.0, 6.2)	0.900	11.6	(8.0, 16.5)	3.2	(1.5, 6.7)	14.8	(10.4, 20.6)	0.904
Rural	596	2.3	(1.2, 4.6)		10.6	(8.0, 13.8)	3.9	(2.5, 5.8)	14.4	(11.3, 18.3)	
Region											
Batken oblast	104	3.3	(0.8, 13.2)	0.811	12.8	(7.8, 20.3)	2.8	(1.0, 7.8)	15.6	(10.0, 23.5)	0.687
Jalal-Abad oblast	112	2.3	(0.6, 8.7)		15.6	(10.7, 22.1)	2.4	(0.8, 6.7)	18.0	(12.5, 25.4)	
Issyk-Kul oblast	89	1.1	(0.1, 7.5)		13.2	(7.5, 22.2)	6.6	(3.2, 13.0)	19.8	(11.8, 31.2)	
Naryn oblast	156	1.8	(0.4, 7.0)		8.9	(5.5, 14.1)	2.3	(0.7, 7.3)	11.2	(7.4, 16.6)	
Osh oblast	121	0.8	(0.1, 5.5)		9.5	(5.1, 16.9)	4.2	(1.9, 9.0)	13.7	(7.6, 23.5)	
Talas oblast	84	3.6	(0.8, 15.6)		9.0	(4.9, 15.7)	3.0	(0.7, 11.3)	11.9	(6.4, 21.3)	
Chui oblast	63	3.4	(0.9, 12.4)		5.4	(1.7, 15.6)	5.3	(2.2, 12.2)	10.7	(5.3, 20.5)	
Bishkek city	34	3.5	(0.5, 20.4)		13.2	(5.3, 28.9)	1.9	(0.2, 14.0)	15.1	(6.7, 30.6)	
Osh city	92	4.9	(1.9, 12.1)		10.8	(6.1, 18.3)	3.2	(1.2, 8.7)	14.0	(9.0, 21.1)	
Wealth quintile											
Lowest	263	3.3	(1.2, 8.6)	0.670	11.6	(7.7, 17.2)	2.8	(1.2, 6.2)	14.4	(9.9, 20.4)	0.980
Second	202	1.3	(0.2, 6.7)		11.8	(7.7, 17.6)	2.3	(1.0, 5.5)	14.1	(9.7, 20.1)	
Middle	157	1.9	(0.7, 5.1)		9.0	(5.3, 14.9)	4.6	(2.0, 10.1)	13.7	(8.7, 20.9)	
Fourth	145	3.5	(1.2, 9.3)		11.2	(6.8, 17.8)	5.0	(2.1, 11.1)	16.1	(10.6, 23.7)	
Highest	85	1.9	(0.6, 6.2)		9.9	(3.7, 24.2)	5.7	(1.8, 16.4)	15.7	(6.8, 32.3)	
Household food security											
Secure	514	1.7	(0.7, 3.7)	0.424	12.1	(9.1, 15.9)	3.4	(2.1, 5.4)	15.5	(12.0, 19.8)	0.878
Mildly insecure	112	3.3	(0.8, 12.7)		7.9	(3.7, 16.3)	4.8	(1.8, 12.5)	12.7	(6.5, 23.4)	
Moderately insecure	163	2.7	(0.8, 8.7)		10.7	(5.9, 18.6)	3.8	(1.7, 8.0)	14.5	(9.1, 22.3)	
Severely insecure	63	6.0	(1.6, 20.4)		7.5	(3.2, 16.6)	4.3	(0.9, 18.3)	11.8	(5.4, 23.7)	

Household sanitation[e]											
Unadequate	119	3.1	(0.8, 10.8)	0.896	13.3	(7.2, 23.2)	4.0	(1.5, 10.5)	17.3	(10.8, 26.5)	0.692
Adequate	731	2.3	(1.3, 4.2)		10.6	(8.2, 13.4)	3.7	(2.5, 5.4)	14.3	(11.4, 17.7)	
Safe drinking water[f]											
Yes	835	2.5	(1.4, 4.3)	0.658	10.3	(8.2, 12.9)	3.7	(2.5, 5.3)	14.0	(11.3, 17.1)	<0.001
No	17	0	(0, 0)		36.0	(16.9, 60.8)	6.2	(1.5, 22.3)	42.2	(25.7, 60.5)	
TOTAL	855	2.4	(1.4, 4.1)		10.8	(8.7, 13.5)	3.7	(2.6, 5.3)	14.5	(11.9, 17.7)	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] P-value <0.05 indicates that at least one subgroup is significantly different from the others.

[d] Thinness is defined as BMI-for-age z-score smaller than -2, overweight is defined as having a BMI-for-age z-score greater than +1 but less than or equal to +2 standard deviations and obesity is defined as having a BMI-for-age z-score greater than +2 standard deviations from the WHO Growth reference data for age 5-19 population median.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[f] Composite variable of main source of drinking water and treating water to make safe for drinking.

3.5.7. Anemia, Iron deficiency и Iron deficiency anemia

The distribution of hemoglobin values for adolescent girls is shown in Figure 20. Many adolescents are above the cut-off defining anemia of 115 g/L for girls <12 years of age and 120g/L for girls ≥12 years of age. The weighted median hemoglobin concentration is 131 g/L.

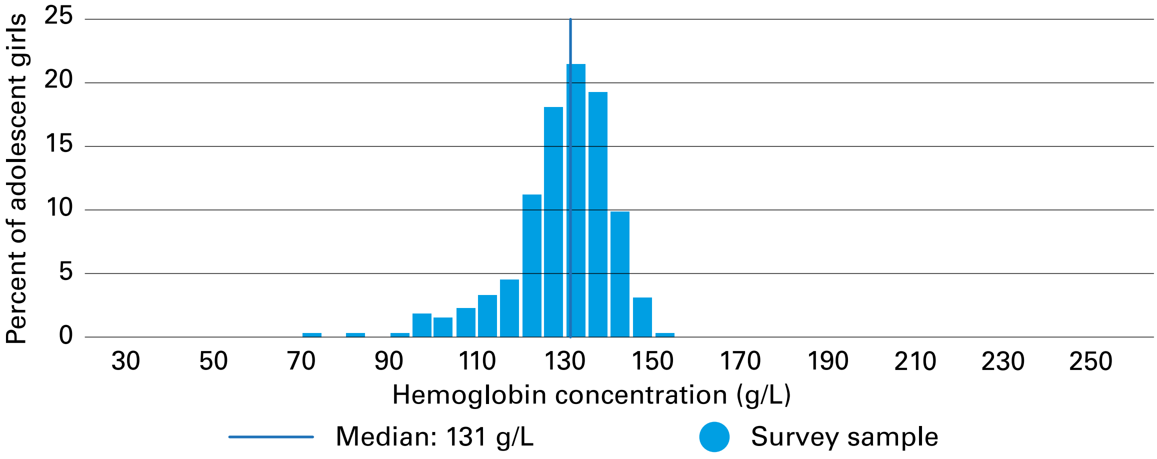


Figure 20. Distribution of adjusted hemoglobin (g/L) in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Figure 21 визуализирует долю девочек-подростков с одновременным Deficientом железа и анемией, часто именуемым железоDeficientной анемией. Из рисунка видно, что у этих подростков почти все случаи анемии сопровожYesются Deficientом железа.

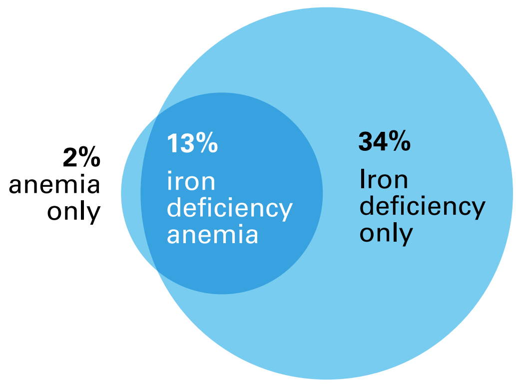


Figure 21. Venn diagram showing overlap between anemia and iron deficiency in adolescent girls 10-18 years old age, the Kyrgyz Republic 2021

As shown in Table 56 below, about 15% of adolescent girls in the Kyrgyz Republic have anemia. The public health significance at this prevalence would be classified as 'mild' by the WHO [36]. The prevalence of anemia increases with age and is significantly higher in menarche than in pre-menarche girls. Anemia prevalence would be classified as 'moderate' by WHO in girls aged 16-18 years and menarche girls. None of the other investigated indicators are significantly associated with anemia.

Severe anemia is rare, below 1% in adolescent girls. About equal proportions of girls have moderate and mild anemia (see Table 91).

Similar to anemia, ID and IDA are more common in older girls and menarche girls. None of the other investigated factors are significantly associated with ID and IDA.

Table 56. Prevalence of anemia, iron deficiency, and iron deficiency anemia in adolescent girls 10-18 years, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	Anemia				Iron deficiency[e]				Iron deficiency anemia			
	N	%[a, b]	95% CI[c]	p-value[d]	N	%[a]	95% CI[c]	p-value[d]	N	%[a, f]	95% CI[c]	p-value[d]
Age Group (in years)												
10-12	374	7.7	(4.7, 12.1)	<0.0005	353	29.3	(24.0, 35.3)	<0.001	352	5.2	(3.1, 8.7)	<0.0001
13-15	309	17.9	(13.1, 23.9)		297	56.9	(49.5, 64.0)		295	16.9	(12.2, 22.9)	
16-18	175	24.1	(16.7, 33.6)		172	65.4	(55.9, 73.8)		172	21.3	(14.4, 30.2)	
Menstruation												
Pre-menarche	361	5.9	(3.4, 10.0)	<0.0001	347	27.3	(21.2, 34.4)	<0.001	345	4.6	(2.3, 8.8)	<0.0001
Menarche	497	21.0	(16.9, 25.8)		475	61.3	(54.9, 67.3)		474	18.8	(14.9, 23.5)	
Residence												
Urban	262	14.9	(9.4, 22.7)	0.928	254	48.5	(39.8, 57.3)	0.609	253	10.8	(6.5, 17.3)	0.434
Rural	596	14.5	(11.1, 18.7)		568	45.7	(39.7, 51.9)		566	13.5	(10.1, 17.8)	
Region												
Batken oblast	104	15.9	(9.0, 26.5)	0.686	102	42.1	(31.8, 53.2)	0.813	100	15.5	(8.5, 26.8)	0.465
Jalal-Abad oblast	112	16.0	(9.6, 25.5)		103	44.6	(30.3, 59.9)		103	13.5	(7.2, 23.7)	
Issyk-Kul oblast	89	16.7	(9.5, 27.8)		89	44.8	(35.0, 55.0)		89	11.9	(6.1, 21.8)	
Naryn oblast	156	15.9	(10.9, 22.7)		150	48.4	(40.7, 56.1)		150	13.3	(9.1, 19.1)	
Osh oblast	121	8.6	(4.7, 15.3)		113	43.4	(32.7, 54.9)		113	9.4	(5.1, 16.7)	
Talas oblast	84	16.4	(9.1, 27.8)		81	59.1	(47.1, 70.1)		81	14.4	(7.8, 25.0)	
Chui oblast	63	18.3	(9.1, 33.5)		61	48.4	(33.8, 63.3)		61	18.7	(9.3, 34.0)	
Bishkek city	35	15.5	(5.0, 39.0)		35	53.5	(35.5, 70.6)		34	7.2	(2.2, 21.2)	
Osh city	94	12.9	(7.1, 22.5)		88	43.8	(33.5, 54.8)		88	6.9	(3.2, 14.2)	
Wealth quintile												
Lowest	263	14.3	(9.8, 20.3)	0.746	255	52.5	(43.7, 61.2)	0.330	254	13.6	(8.9, 20.2)	0.104
Second	202	18.0	(12.4, 25.5)		197	49.1	(40.3, 58.0)		196	16.8	(11.3, 24.2)	
Middle	157	14.6	(9.2, 22.5)		146	41.6	(31.3, 52.7)		145	14.3	(8.7, 22.7)	
Fourth	147	12.5	(7.3, 20.5)		140	43.1	(32.4, 54.4)		140	10.0	(5.1, 18.5)	
Highest	86	11.9	(4.4, 28.2)		81	37.6	(23.8, 53.8)		81	3.1	(0.8, 11.2)	

Household food security												
Secure	515	14.1	(10.6, 18.5)	0.266	491	47.7	(41.3, 54.1)	0.323	490	12.3	(9.0, 16.8)	0.176
Mildly insecure	112	10.7	(5.4, 20.2)		110	50.0	(38.6, 61.3)		110	10.9	(5.5, 20.5)	
Moderately insecure	165	15.3	(8.9, 24.9)		160	39.3	(29.3, 50.2)		159	11.3	(6.3, 19.7)	
Severely insecure	63	24.9	(13.9, 40.6)		58	53.5	(37.6, 68.7)		57	24.1	(13.2, 42.4)	
Household sanitation в ДХ[g]												
Unadequate	119	10.2	(5.7, 17.8)	0.376	114	45.6	(34.2, 57.5)	0.670	114	8.7	(4.4, 16.5)	0.435
Adequate	734	15.4	(12.2, 19.4)		703	46.6	(41.3, 52.1)		700	13.5	(10.4, 17.4)	
Safe drinking water[h]												
Yes	838	14.7	(11.7, 18.3)	0.946	802	46.1	(41.1, 51.1)	0.441	799	12.7	(9.9, 16.2)	0.702
No	17	15.1	(6.0, 33.4)		17	60.2	(25.4, 87.0)		17	15.1	(6.0, 33.4)	
TOTAL	**858**	**14.6**	**(11.6, 18.2)**		**822**	**46.5**	**(41.5, 51.6)**		**819**	**12.7**	**(9.9, 16.2)**	

Note: The N's are the denominators for a specific sub-group. For iron deficiency and iron deficiency anemia, the numbers are smaller than for anemia due to unsuccessful blood collection (sufficient blood could be obtained only for the on-site analysis of hemoglobin concentration).

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Anemia defined as hemoglobin < 115 g/L for girls <12 years of age and < 120g/L for ≥12 years of age; hemoglobin adjusted for altitude

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Iron deficiency defined as inflammation adjusted plasma ferritin < 15 µg/L.

[f] Iron deficiency anaemia defined as plasma ferritin < 15.0 µg/L and hemoglobin < 115 g/L (girls <12 years of age) or <120g/ L (girls ≥12 years of age).

[g] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[h] Composite variable of main source of drinking water and treating water to make safe for drinking.

3.5.8. Vit A deficiency

As shown in Table 57, about 7% of adolescent girls are vitamin A deficient, a prevalence classified as mild public health problem according to WHO [71]. Vitamin A deficiency prevalence is significantly higher in pre-menarche girls compared to menarche. Although not significant, the data indicates differences in prevalence by region: The prevalence in Batken, Bishkek and Osh City poses a moderate public health problem. No significant associations were found between vitamin A deficiency and any other investigated indicators.

Table 57. Prevalence of vitamin A deficiency in adolescent girls 10-18 years of age, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	N	%[a] with VAD[b]	(95% CI)[c]	p-value[d]
Age Group (in years)				
10-12	353	8.7	(6.0, 12.5)	0.472
13-15	297	5.8	(3.4, 9.6)	
16-18	172	6.1	(2.5, 14.2)	
Menstruation				
Pre-menarche	347	10.4	(7.4, 14.6)	<0.05
Menarche	475	4.5	(2.7, 7.6)	
Residence				
Urban	254	5.0	(2.4, 10.4)	0.260
Rural	568	7.9	(5.9, 10.4)	
Region				
Batken oblast	102	15.0	(8.8, 24.4)	0.180
Jalal-Abad oblast	103	3.5	(1.5, 8.2)	
Issyk-Kul oblast	89	8.4	(4.5, 14.9)	
Naryn oblast	150	4.6	(2.5, 8.2)	
Osh oblast	113	7.4	(4.1, 12.9)	
Talas oblast	81	4.9	(2.0, 11.4)	
Chui oblast	61	6.3	(2.7, 14.3)	
Bishkek city	35	9.5	(3.0, 36.7)	
Osh city	88	9.1	(4.3, 18.5)	
Wealth quintile				
Lowest	255	8.6	(5.4, 13.4)	0.536
Second	197	7.3	(4.1, 12.5)	
Middle	146	3.7	(1.6, 8.5)	
Fourth	140	5.7	(2.6, 11.9)	
Highest	81	9.1	(3.2, 23.1)	
Household food security				
Secure	491	6.5	(4.7, 9.1)	0.874
Mildly insecure	110	5.3	(1.9, 14.3)	
Moderately insecure	160	8.0	(4.1, 15.1)	
Severely insecure	58	8.2	(2.8, 22.2)	
Household sanitation[e]				
Unadequate	114	3.7	(1.5, 9.0)	0.381
Adequate	703	7.3	(5.5, 9.8)	
Safe drinking water[f]				
Yes	802	6.9	(5.2, 9.1)	0.788

No	17	5.6	(1.2, 21.8)	
TOTAL	**822**	**7.1**	**(5.4, 9.3)**	

Note: The N's are the denominators for a specific sub-group; for VAD, the numbers are smaller than for anemia due to unsuccessful blood collection (sufficient blood could only be obtained for the on-site analysis of hemoglobin concentration) or insufficient sample volumes for retinol analysis.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] VAD = Vitamin A deficiency, defined as RBP adjusted for inflammation <0.569 umol/L.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/ latrine, no facility, bush, field

[f] Composite variable of main source of drinking water and treating water to make safe for drinking.

3.5.9. Folate deficiency

The prevalence of folate deficiency in Kyrgyz adolescent girls is very high, affecting more than 4 out of 5 girls (see Table 58). Significant differences were found between pre-menarche and menarche girls with a higher folate deficiency in menarche. Moreover, the data indicates differences by region, although differences are not significant. While in Nary and Chui more than 9 out of 10 girls are folate deficient, the prevalence in Batken is only 75%. No significant associations were detected between folate deficiency and age, urban/rural residence, household wealth, household food security, household sanitation or household`s access to safe drinking water.

Table 58. Prevalence of folate deficiency in adolescent girls 10-18 years of age, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	N	%[a] with folate deficiency[b]	(95% CI)[c]	p-value[d]
Age Group (in years)				
10-12	353	80.5	(74.3, 85.5)	0.233
13-15	298	86.4	(80.6, 90.6)	
16-18	173	85.3	(77.0, 91.0)	
Menstruation				
Pre-menarche	346	78.4	(71.6, 84.0)	<0.05
Menarche	478	87.6	(82.7, 91.2)	
Residence				
Urban	256	83.6	(78.0, 88.0)	0.999
Rural	568	83.6	(78.7, 87.5)	
Region				
Batken oblast	104	75.6	(61.6, 85.7)	0.065
Jalal-Abad oblast	100	79.1	(70.9, 85.4)	
Issyk-Kul oblast	90	86.9	(76.9, 93.0)	
Naryn oblast	148	93.3	(84.3, 97.4)	
Osh oblast	112	77.4	(66.3, 85.7)	
Talas oblast	83	88.7	(77.3, 94.8)	
Chui oblast	62	91.0	(77.8, 96.7)	
Bishkek city	35	89.7	(74.5, 96.3)	
Osh city	90	81.8	(68.9, 90.1)	
Wealth quintile				
Lowest	255	86.4	(80.5, 90.8)	0.274
Second	197	80.6	(72.1, 87.0)	

Middle	146	78.5	(69.6, 85.4)	
Fourth	141	87.9	(79.5, 93.2)	
Highest	82	83.9	(71.4, 91.5)	
Household food security				
Secure	487	82.5	(77.6, 86.6)	0.670
Mildly insecure	111	87.1	(74.9, 93.9)	
Moderately insecure	161	82.3	(72.9, 88.9)	
Severely insecure	62	88.2	(76.6, 94.5)	
Household sanitation в ДХ[e]				
Unadequate	111	89.5	(80.8, 94.5)	0.090
Adequate	708	82.6	(78.4, 86.2)	
Safe drinking water[f]				
Yes	806	83.4	(79.6, 86.7)	0.846
No	15	85.1	(62.8, 95.1)	
TOTAL	**824**	**83.6**	**(79.8, 86.8)**	

Note: The N's are the denominators for a specific sub-group; for VAD, the numbers are smaller than for anemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of hemoglobin concentration) or insufficient sample volumes for retinol analysis.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Folate deficiency defined as plasma folate <10 nmol/L.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/ latrine, no facility, bush, field

[f] Composite variable of main source of drinking water and treating water to make safe for drinking.

3.5.10. Vitamin D deficiency

Nationally about 40% of adolescent girls are vitamin D deficient or insufficient (see Table 59). Young girls have a slightly lower prevalence than older girls. Moreover, the prevalence of vitamin D deficiency or insufficiency is about twice as high in urban areas compared to rural areas. No statistically significant difference in the prevalence of vitamin D deficiency and any other investigated indicator was detected.

Table 59. Prevalence of vitamin D deficiency in adolescent girls 10-18 years of age, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	Deficient[a]			Insufficient[a]		Deficient or insufficient		
	N[b]	%[c]	(95% CI)[d]	%[c]	(95% CI)[d]	%[c]	(95% CI)[d]	p-value[e]
Age Group (in years)								
10-12	82	5.1	(1.7, 14.2)	23.7	(14.5, 36.2)	28.8	(18.4, 42.1)	<0.05
13-15	72	6.5	(2.6, 15.5)	43.2	(31.8, 55.4)	49.7	(38.0, 61.5)	
16-18	47	19.1	(10.1, 33.2)	23.8	(13.3, 38.8)	42.9	(28.9, 58.2)	
Menstruation								
Pre-menarche	84	5.3	(1.7, 15.1)	28.0	(17.9, 40.9)	33.3	(22.1, 46.7)	0.196
Menarche	117	11.0	(7.0, 17.1)	32.8	(24.4, 42.5)	43.8	(34.5, 53.7)	
Residence								
Urban	65	18.6	(11.6, 28.4)	38.6	(26.4, 52.5)	57.2	(42.0, 71.1)	<0.01
Rural	136	4.8	(2.0, 11.0)	27.8	(20.5, 36.5)	32.6	(24.1, 42.3)	

Wealth quintile								
Poorest	60	8.2	(2.7, 22.3)	27.0	(16.0, 41.9)	35.2	(22.6, 50.4)	0.735
Second	52	13.1	(6.2, 25.5)	29.8	(17.8, 45.3)	42.9	(27.3, 60.0)	
Middle	35	5.0	(1.1, 20.1)	38.4	(23.3, 56.1)	43.4	(27.4, 60.8)	
Fourth	35	4.2	(1.4, 11.8)	30.2	(15.6, 50.2)	34.4	(18.9, 54.2)	
Wealthiest	18	18.5	(7.6, 38.7)	36.4	(15.4, 64.3)	54.9	(25.7, 81.1)	
Household food security								
Secure	116	10.0	(5.7, 17.1)	33.3	(24.4, 43.7)	43.4	(33.4, 53.9)	0.122
Mildly insecure	29	9.4	(2.1, 33.2)	43.5	(22.3, 67.4)	52.9	(32.0, 72.9)	
Moderately insecure	40	6.5	(2.3, 17.3)	17.3	(8.6, 31.5)	23.8	(12.8, 39.9)	
Severely insecure	15	4.2	(0.5, 26.0)	35.7	(13.8, 65.8)	39.9	(16.3, 69.3)	
Household sanitation[f]								
Unadequate	26	7.3	(1.7, 26.8)	21.0	(9.0, 41.6)	28.3	(14.4, 48.1)	0.213
Adequate	174	8.9	(5.5, 14.0)	32.5	(25.3, 40.5)	41.3	(32.9, 50.3)	
Safe drinking water[g]								
Yes	197	9.0	(5.7, 13.8)	32.2	(25.4, 39.8)	41.2	(33.2, 49.6)	0.186
No	3	0	(0, 0)	0	(0, 0)	0	(0, 0)	
TOTAL	**201**	**8.6**	**(5.5, 13.2)**	**30.7**	**(24.3, 38.1)**	**39.3**	**(31.7, 47.5)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] Deficient <12 ng/mL; Insufficient 12-19.9 ng/mL. Vitamin D concentrations below the limit of detection (<9 ng/mL; n=10) were recoded to 9 ng/mL.

[b] 25% sub-sample.

[c] Percentages weighted for unequal probability of selection.

[d] CI=confidence interval, calculated taking into account the complex sampling design.

[e] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[f] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/ latrine, no facility, bush, field

[g] Composite variable of main source of drinking water and treating water to make safe for drinking.

3.5.11. Iodine deficiency

Table 60 presents the iodine status of non-pregnant adolescent girls. The national median urinary iodine concentration (mUIC) is approximately 175 µg/L indicating an adequate iodine status. Significant differences were only observed by menstruation status, but these differences do not indicate a different iodine status categorization. Although not significant due to the small number of individuals, the data indicate that girls living in households consuming non-iodized salt tend to have lower UIC levels than girls living in households consuming inadequately and adequately iodized salt. In addition, the mUIC in all sub-groups investigated indicate an adequate iodine status.

Table 60. Moderately insecure концентрация йоYes в моче среди девочек-подростков 10-18 лет, Кыгyзская Республика, 2021 год

Characteristic	N	Median UIC[a]	(95% CI)[b]	p-value[c]
Age Group (in years)				
10-12	354	164.94	(156.85, 183.00)	0.159
13-15	287	183.01	(177.21, 202.97)	
16-18	160	186.19	(167.69, 206.85)	

Menstruation				
Menarche	458	188.43	(178.96, 200.06)	<0.05
Pre-menarche	343	164.44	(158.31, 184.85)	
Residence				
Urban	233	176.63	(161.33, 192.08)	0.913
Rural	568	175.05	(172.43, 193.39)	
Region				
Batken oblast	105	171.87	(161.33, 209.04)	0.331
Jalal-Abad oblast	100	182.33	(164.48, 203.22)	
Issyk-Kul oblast	90	221.50	(191.61, 254.76)	
Naryn oblast	156	169.33	(154.25, 189.90)	
Osh oblast	110	171.45	(148.15, 181.39)	
Talas oblast	70	281.08	(181.30, 289.05)	
Chui oblast	62	166.10	(133.24, 200.27)	
Bishkek city	26	167.76	(106.33, 213.17)	
Osh city	82	178.78	(154.82, 193.90)	
Wealth quintile				
Lowest	249	157.55	(151.99, 191.75)	0.547
Second	197	188.35	(168.06, 208.81)	
Middle	147	168.19	(161.62, 195.06)	
Fourth	132	184.16	(165.97, 203.52)	
Highest	73	193.15	(162.53, 223.78)	
Food secure				
Secure	474	180.65	(174.31, 193.51)	0.923
Mildly insecure	106	191.52	(158.09, 215.43)	
Moderately insecure	159	167.41	(157.06, 208.54)	
Severely insecure	59	161.29	(143.37, 182.83)	
Household salt iodization				
None (<5 ppm)	13	112.49	(88.87, 136.43)	0.811
Insufficient (5-14.9 ppm)	222	181.49	(163.37, 199.61)	
Adequate (15+ ppm)	532	185.02	(174.81, 195.63)	
Household sanitation[d]				
Unadequate	104	164.28	(148.96, 198.41)	0.396
Adequate	692	175.80	(173.94, 191.74)	
Safe drinking water[e]				
Yes	784	175.69	(172.74, 191.05)	0.425
No	14	172.92	(95.07, 252.98	
TOTAL	**801**	**175.05**	**(172.09, 189.55)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

a Medians are weighted for unequal selection probability; UIC = urinary iodine concentration.

b CI=confidence interval calculated by bootstrapping without taking into account the complex sampling design. Actual confidence intervals probably narrower.

c Chi-square p-value <0.05 indicates that the mean of the natural log of urinary iodine concentration in at least one subgroup is statistically significantly different from the values in the other subgroups.

d Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/ latrine, no facility, bush, field

e Composite variable of main source of drinking water and treating water to make safe for drinking.

Figure 22 shows the geographic distribution of median urinary iodine concentration by stratum.

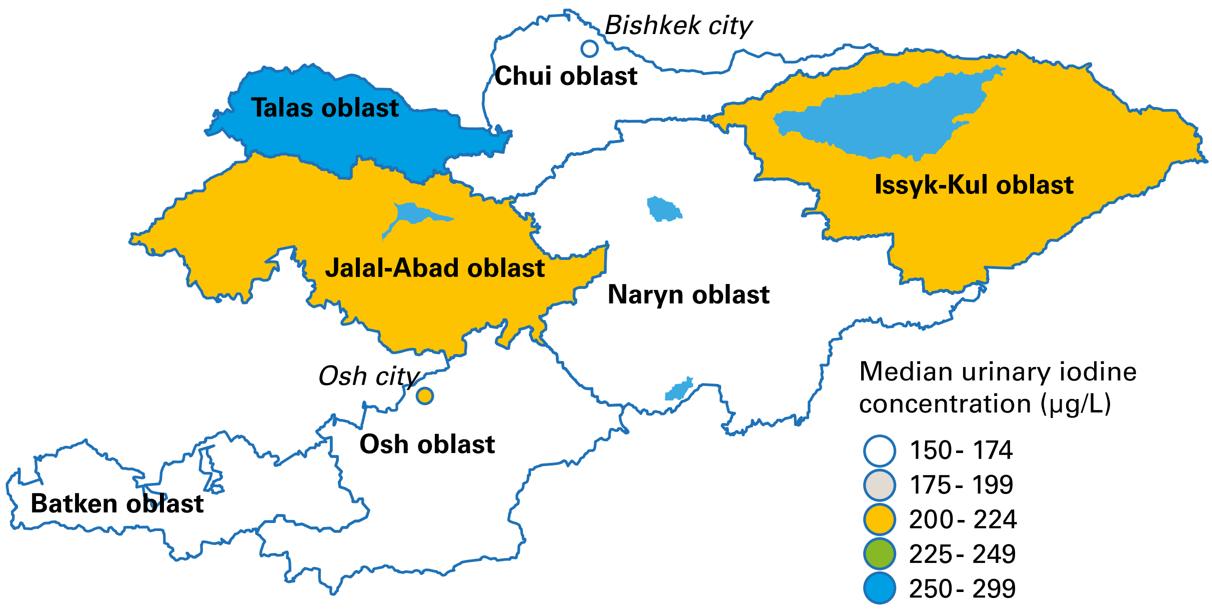


Figure 22. Geographic distribution of median urinary iodine concentration in adolescent girls, the Kyrgyz Republic 2021

3.5.12. Associations between micronutrient deficiencies and various factors

No indicators of recent morbidity are statistically significantly associated with anemia (Table 61) in adolescent girls. Moreover, none of the household indicators are significantly associated with anemia. Reported consumption of iron or multivitamin supplements is also not associated with anemia in adolescent girls. However, the consumption of folate supplements is significantly associated with anemia, with girls that consumed folate supplements having a substantially lower prevalence of anemia. Inflammation is also significantly associated with anemia, and girls with inflammation have a lower anemia prevalence compared to girls without inflammation. Of the measured micronutrient deficiencies, only iron deficiency is highly significantly associated with anemia. An association, albeit non-significant, was found between anemia and vitamin A deficiency, with a higher anemia prevalence found in girls with vitamin A deficiency.

Table 61. Correlation between various factors and anemia in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Anemia	p value[b]
Girl had diarrhea			
Yes	50	16.9	0.664
No	805	14.4	
Girl had fever			
Yes	55	16.9	0.637
No	800	14.1	
Girl had lower respiratory infection			
Yes	7	6.1	0.364
No	849	14.6	
Girl's household had adequate sanitation			
Yes	734	15.4	0.166
No	119	10.2	

Girl's household had safe drinking water			
Yes	838	14.7	0.946
No	17	15.1	
Minimum dietary diversity			
Yes	587	13.4	0.232
No	271	17.2	
Took iron tablet or syrup in past 6 months			
Yes	39	13.9	0.931
No	812	14.5	
Took folate supplements in past 6 months			
Yes	21	1.3	<0.01
No	832	15.2	
Took multivitamin supplements in past 6 months			
Yes	77	16.3	0642
No	777	14.5	
Consumes coffee or tea during or directly after meal			
Yes	704	15.6	0.152
No	154	9.9	
Household flour iron fortification[c]			
None	192	16.7	0.811
HeAdequate	56	13.7	
Adequately fortified	1	0	
Girl had inflammation			
Yes	103	8.1	<0.05
No	716	14.7	
Girl iron deficient			
Yes	391	26.9	<0.001
No	428	2.2	
Girl vitamin A deficient			
Yes	58	22.8	0.066
No	761	13.2	
Girl folate deficient			
Yes	700	14.1	0.667
No	125	12.5	
Girl vitamin D status[d]			
Normalльный		105	13.2
Insufficient	72	19.3	
Deficient	23	29.5	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other

[c] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm.

[d] Vitamin D deficiency measured in a 25% sub-sample of adolescent girls.

Of the morbidity conditions included in the survey, only lower respiratory infection is statistically significantly associated with ID (Table 62), and this association was negative. No significant association was found between ID and any other investigated indicator.

Table 62. Correlation between various factors and iron deficiency in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Iron deficiency	p value[b]
Girl had diarrhea			
Yes	50	48.9	0.785
No	770	46.3	
Girl had fever			
Yes	54	35.3	0.155
No	766	47.5	
Girl had lower respiratory infection			
Yes	7	3.1	<0.001
No	814	47.3	
Girl's household had adequate sanitation			
Yes	703	46.6	0.868
No	114	45.6	
Girl's household had safe drinking water			
Yes	802	46.1	0.441
No	17	60.2	
Minimum dietary diversity			
Yes	555	46.4	0.963
No	267	46.7	
Took iron tablets or syrup in past 6 months			
Yes	36	47.1	0.923
No	779	46.2	
Took multivitamin supplements in past 6 months			
Yes	76	50.6	0.577
No	742	46.0	
Consumes coffee or tea during or directly after meal			
Yes	674	47.9	0.225
No	148	39.7	
Household flour iron fortification[c]			
None	183	43.4	0.542
Insufficient	54	42.6	
Adequate	1	100.0	
Girl had inflammation			
Yes	103	36.9	0.094
No	719	47.8	
Girl vitamin A deficient			
Yes	59	46.1	0.954
No	763	46.5	
Girl folate deficient			
Yes	685	47.6	0.383
No	125	42.2	
Girl vitamin D status[d]			
Normal	104	38.7	0.104
Insufficient	72	53.1	
Deficient	23	63.1	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other

[c] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm

[d] Vitamin D deficiency measured in a 25% sub-sample of adolescent girls

Vitamin A deficiency prevalence is significantly correlated with inflammation (see Table 63). The prevalence of vitamin A deficiency is five times higher in adolescent girls with elevated inflammation markers compared to those without inflammation. Moreover, though not significant, most likely due to the small number of adolescent girls with illnesses, the data suggests that a larger proportion of girls with diarrhea or fever have vitamin A deficiency compared to those without.

Table 63. Correlation between various factors and vitamin A deficiency in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Vit A deficiency	p value[b]
Girl had diarrhea			
Yes	50	16.7	0.061
No	770	6.5	
Girl had fever			
Yes	54	11.4	0.169
No	766	6.4	
Girl had lower respiratory infection			
Yes	7	5.3	0.786
No	814	7.2	
Girl's household had adequate sanitation			
Yes	703	7.3	0.149
No	114	3.7	
Girl's household had safe drinking water			
Yes	802	6.9	0.788
No	17	5.6	
Minimum dietary diversity			
Yes	555	8.1	0.208
No	267	5.2	
Took vitamin A tablets in past 6 months			
Yes	25	0	0.219
No	788	7.2	
Took multivitamin supplements in past 6 months			
Yes	76	5.0	0.537
No	742	7.4	
Girl had inflammation			
Yes	103	25.5	<0.001
No	719	4.5	
Girl folate deficient			
Yes	685	6.4	0.140
No	125	11.2	
Girl vitamin D status[c]			
Normal	104	11.2	0.337

Insufficient	72	8.3	
Deficient	23	0	

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other
[c] Vitamin D deficiency measured in a 25% sub-sample of adolescent girls

Folate deficiency in adolescent girls is significantly associated with minimum dietary diversity, with a larger proportion of girls being folate deficient who did not eat at least 5 food groups the day before the survey. Moreover, of the morbidity conditions included in the survey, only diarrhea is statistically significantly associated with folate deficiency (Table 64), and this association is negative. None of the other sub-group analyses yielded any significant associations.

Table 64. Correlation between various factors and folate deficiency in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Folate deficiency	p value[b]
Girl had diarrhea			
Yes	50	66.0	<0.05
No	773	84.7	
Girl had inflammation			
Yes	54	89.1	0.303
No	769	83.0	
Girl had lower respiratory infection			
Yes	7	94.7	0.244
No	817	83.4	
Girl's household had adequate sanitation			
Yes	708	82.6	0.136
No	111	89.5	
Girl's household had safe drinking water			
Yes	806	83.4	0.846
No	15	85.1	
Minimum dietary diversity			
Yes	558	80.7	<0.05
No	266	89.5	
Took folate supplements in past 6 months			
Yes	20	76.8	0.333
No	799	84.2	
Took multivitamin supplements in past 6 months			
Yes	76	82.7	0.851
No	744	83.6	
Household flour iron fortification			
None	183	82.1	0.627
Insufficient	54	75.7	
Adequate	1	100	
Girl had inflammation			
Yes	100	83.7	0.959
No	710	83.4	

Girl vitamin D status[d]			
Normal	103	87.7	0.828
Insufficient	73	84.2	
Deficient	23	85.0	

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other
[c] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm
[d] Vitamin D deficiency measured in a 25% sub-sample of adolescent girls.

As shown in Table 65, no significant correlations were found between vitamin D deficiency and any of the investigated indicators.

Table 65. Correlation between various factors and vitamin D deficiency in adolescent girls 10-18 years of age, The Kyrgyz Republic 2021

Characteristic[c]	N	%[a] Vitamin D deficient or insufficient	p value[b]
Girl had diarrhea			
Yes	15	27.8	0.363
No	186	40.2	
Girl had inflammation			
Yes	16	25.6	0.228
No	185	41.2	
Girl had lower respiratory infection			
Yes	2	0	0.277
No	199	40.9	
Girl's household had adequate sanitation			
Yes	174	41.3	0.213
No	26	28.3	
Girl's household had safe drinking water			
Yes	197	41.2	0.186
No	3	0	
Minimum dietary diversity			
Yes	138	41.1	0.541
No	63	35.7	
Took multivitamin supplements in past 6 months			
Yes	22	58.8	0.146
No	176	37.4	
Took vitamin D supplements in past 6 months			
Yes	7	61.4	0.255
No	191	38.9	
Girl had inflammation			
Yes	24	30.5	0.426
No	175	40.0	

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] Chi-square test; P-value <0.05 indicates that the groups are statistically significantly different from each other
[c] Vitamin D deficiency measured in a 25% sub-sample of adolescent girls.

3.6. All females 15-49 years of age

3.6.1. Pregnancy and birth history

Table 66 below shows the distribution of pregnancy related variables among all females 15-49 years of age. About every tenth participating female was pregnant and about one-quarter of them was breastfeeding at the time of the survey. One-quarter of the surveyed females have never been pregnant, and about 20% of women had 5 or more pregnancies. Almost 60% of females took iron or folic acid supplements and about 13% vitamin A supplements during their last pregnancy.

Table 66. Distribution of pregnancy and birth variables in all females 10-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Currently Pregnant			
Yes	176	11.6	(10.0, 13.6)
No	1315	87.1	(85.0, 88.9)
Don't know	16	1.3	(0.7, 2.3)
Currently lactating[c]			
Yes	243	23.2	(20.6, 26.0)
No	831	76.8	(74.0, 79.4)
Number of pregnancies			
0	389	26.0	(23.8, 28.4)
1	137	9.9	(8.3, 11.7)
2	189	13.2	(11.4, 15.4)
3	230	14.9	(12.8, 17.3)
4	219	14.3	(12.5, 16.3)
5+	332	21.8	(19.7, 24.0)
Number of births (live and still)			
0	44	4.4	(3.2, 6.1)
1	161	15.2	(12.9, 17.8)
2	236	21.7	(18.9, 24.7)
3	269	23.5	(20.5, 26.7)
4	238	21.7	(19.1, 24.6)
5+	159	13.5	(11.4, 16.0)
Took iron or folic acid supplements during last or current pregnancy			
Yes	79	59.8	(49.3, 69.4)
No	48	36.6	(27.2, 47.1)
Don't know	4	3.6	(1.2, 10.4)
Took vitamin A capsules during last or current pregnancy			
Yes	148	13.5	(11.3, 16.2)
No	872	81.5	(78.5, 84.1)
Don't know	54	5.0	(3.6, 6.9)
TOTAL	**1507**		

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Adolescent girls and women that a) had not yet had menarche, b) had never been pregnant, or c) were pregnant but had never delivered a child were excluded from the analysis of current breastfeeding.

3.7. Non-pregnant women of reproductive age

3.7.1. Characteristic

Table 67 describes the demographic characteristics of non-pregnant women participating in the NIMAS. About two-thirds of non-pregnant women included in the survey sample are from rural areas. About four out of five women completed secondary school or higher. Most of the women are married and about one-quarter was breastfeeding at the time of the survey. Systematic inflammation is present in about 15% of women, indicating overall a low level of infection.

Table 67. Description of non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Age Group (in years)			
15-19	337	23.8	(21.5, 26.3)
20-29	300	22.0	(19.6, 24.7)
30-39	421	30.8	(27.8, 33.9)
40-49	327	23.3	(20.9, 25.9)
Residence			
Urban	556	35.7	(33.3, 38.1)
Rural	829	64.3	(61.9, 66.7)
Region			
Batken oblast	149	7.5	(6.4, 8.7)
Jalal-Abad oblast	163	17.4	(15.6, 19.4)
Issyk-Kul oblast	130	7.5	(6.4, 8.8)
Naryn oblast	151	4.9	(4.2, 5.7)
Osh oblast	173	18.8	(16.9, 20.8)
Talas oblast	153	5.1	(4.5, 5.7)
Chui oblast	136	17.3	(15.4, 19.3)
Bishkek city	162	16.2	(14.3, 18.3)
Osh city	168	5.4	(4.5, 6.5)
Wealth quintile			
Lowest	307	19.7	(17.1, 22.7)
Second	303	21.8	(19.0, 24.9)
Middle	264	21.2	(18.5, 24.2)
Fourth	280	20.8	(17.7, 24.3)
Highest	227	16.5	(13.6, 19.8)
Educational level			
Basic secondary or less	301	22.2	(19.7, 24.9)
Complete secondary or more	1016	77.8	(75.1, 80.3)
Marital Status			
Currently not married	468	33.9	(31.2, 36.7)
Currently married	917	66.1	(63.3, 68.8)
Currently breastfeeding a child			
Yes	239	26.2	(23.3, 29.3)
No	696	73.8	(70.7, 76.7)
Inflammation[c]			
None	964	84.3	(81.7, 86.5)

Early (High CRP, Normal AGP)	58	4.7	(3.5, 6.2)
Acute (High CRP, High AGP)	52	4.5	(3.3, 6.2)
Convalescent (Normal CRP, High AGP)	75	6.6	(5.1, 8.5)
TOTAL	**1385**		

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI=confidence interval, calculated taking into account the complex sampling design.
[c] For thresholds of inflammatory markers, see Thurnham et al [39].

3.7.2. Dietary diversity

As described in Table 68, non-pregnant women consumed, on average, more than 6 food groups in the 24 hours prior to the interview. About 70% met the minimum dietary diversity by eating at least 5 food groups during this period. The mean number of food groups significantly differed by urban/rural residence and between the regions. Significantly more women in rural areas were meeting minimum dietary diversity than women living in urban centers. Meeting minimum dietary diversity was most common in Batken, Jalal Abad and Osh Oblast. Meanwhile, fewer women were meeting minimum dietary diversity in Chui, Bishkek and Osh City. Regarding food security status, a dose-response relationship is observed, with the proportion of women achieving minimum dietary diversity increasing as household food security status improves.

Table 68. Dietary diversity in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	Consumed 5+ food groups				Mean dietary score
	N	%[a]	(95% CI)[b]	p-value[c]	
Age Group (in years)					
15-19	337	64.2	(57.9, 70.0)	0.219	6.2
20-29	300	71.1	(64.7, 76.8)		6.5
30-39	421	70.3	(65.4, 74.7)		6.5
40-49	327	72.3	(66.3, 77.5)		6.6
Residence					
Urban	556	65.5	(60.3, 70.3)	<0.05	6.2
Rural	829	71.7	(68.6, 74.6)		6.6
Region					
Batken oblast	149	81.2	(70.6, 88.6)	<0.001	7.2
Jalal-Abad oblast	163	81.2	(73.6, 86.9)		7.3
Issyk-Kul oblast	130	75.2	(66.4, 82.3)		6.8
Naryn oblast	151	63.2	(52.9, 72.4)		6.2
Osh oblast	173	81.3	(74.3, 86.7)		6.9
Talas oblast	153	67.0	(58.1, 74.8)		6.1
Chui oblast	136	52.9	(46.7, 59.1)		5.6
Bishkek city	162	58.6	(50.2, 66.5)		5.9
Osh city	168	60.1	(52.8, 66.9)		5.9
Wealth quintile					
Lowest	307	62.4	(55.7, 68.6)	0.080	6.3
Second	303	70.0	(62.9, 76.2)		6.5
Middle	264	74.5	(67.7, 80.3)		6.7
Fourth	280	73.0	(66.7, 78.5)		6.5
Highest	227	65.9	(57.8, 73.1)		6.2

Household food security					
Secure	924	74.9	(71.8, 77.8)	<0.001	6.7
Mildly insecure	139	65.5	(55.2, 74.5)		6.2
Moderately insecure	240	57.6	(51, 63.9)		5.8
Severely insecure	78	46.1	(32.1, 60.7)		5.3
TOTAL	1385	69.5	(66.8, 72.0)		6.5
Note: The N's are the denominators for a specific sub-group.					

3.7.3. Consumption of vitamins and supplements

As shown in Table 69, the consumption of vitamin and mineral supplements is very low in the Kyrgyz Republic: About only one out of ten women had taken iron, folic acid, vitamin D and/or multivitamin supplements in the past six months prior to the survey and very few were still taking those supplements at the time of the survey.

Table 69. Consumption of vitamin and mineral supplements in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a]	(95% CI)[b]
Took iron tablets or syrup in past 6 months			
Yes	147	11.1	(9.1, 13.5)
No	1228	88.3	(85.9, 90.4)
Don't know	10	0.6	(0.3, 1.2)
Is still taking iron			
Yes	46	26.9	(20.3, 34.7)
No	101	73.1	(65.3, 79.7)
Took folic acid supplements in past 6 months			
Yes	119	9.3	(7.7, 11.0)
No	1256	90.1	(88.2, 91.7)
Don't know	10	0.7	(0.3, 1.4)
Is still taking folic acid			
Yes	35	27.6	(20.5, 36.1)
No	84	72.4	(63.9, 79.5)
Took vitamin D tablets or syrup in past 6 months			
Yes	105	8.2	(6.7, 10.1)
No	1267	91.1	(89.2, 92.7)
Don't know	13	0.7	(0.3, 1.3)
Is still taking vitamin D tablets or syrup			
Yes	39	32.1	(22.2, 44.0)
No	66	67.9	(56.0, 77.8)
Took vitamin A tablets or other preparations in past 6 months			
Yes	92	7.5	(5.8, 9.5)
No	1279	91.5	(89.4, 93.2)
Don't know	14	1.0	(0.6, 1.8)
Is still taking vitamin A			
Yes	24	25.7	(16.1, 38.3)
No	63	74.3	(61.7, 83.9)

Took multivitamin tablets or other preparations in past 6 months			
Yes	157	12.6	(10.4, 15.2)
No	1214	86.5	(83.9, 88.8)
Don't know	14	0.9	(0.5, 1.6)
Is still taking multivitamins			
Yes	51	29.3	(22.3, 37.5)
No	105	70.7	(62.5, 77.7)
Took fish oil supplements in past 6 months			
Yes	84	6.5	(5.0, 8.5)
No	1291	93.0	(91.0, 94.5)
Don't know	10	0.5	(0.3, 1.1)
Is still taking fish oil supplements			
Yes	35	35.3	(22.8, 50.2)
No	47	64.7	(49.8, 77.2)

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.7.4. Anthropometry

The prevalence of undernutrition and overweight/obesity, as measured by body mass index, is shown in Table 70 and Figure 23 below. The prevalence of undernutrition and overweight/obesity by age is shown in Figure 24 and the distribution of BMI is shown in Figure 25.

Relatively few women are underweight, about one-half have a normal BMI, about one-quarter of women are overweight, and 17% are obese. Although undernutrition is somewhat present in Kyrgyz women, almost all women with low BMI had BMIs between 17.0-18.4 and as such, were only considered "at risk" for chronic energy deficiency.

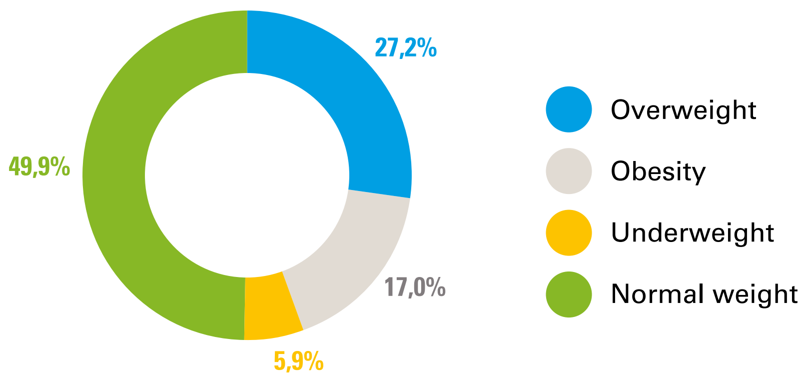


Figure 23. Prevalence of underweight, normal weight, overweight and obesity in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

On the other hand, overweight and obesity are very common in Kyrgyz women and increase with age (Figure 24). In the youngest age group only about 10% of women are overweight or obese, increasing up to about 77% in women 45-49 years of age. Women living in rural areas are more likely to be overweight or obese compared to those living in urban centers. Moreover, the prevalence of overweight or obesity is significantly higher in married women than in women who are not married. Also, women with a higher education level are statistically significantly more likely to be overweight or obese than women with a lower educational level (see Table 70).

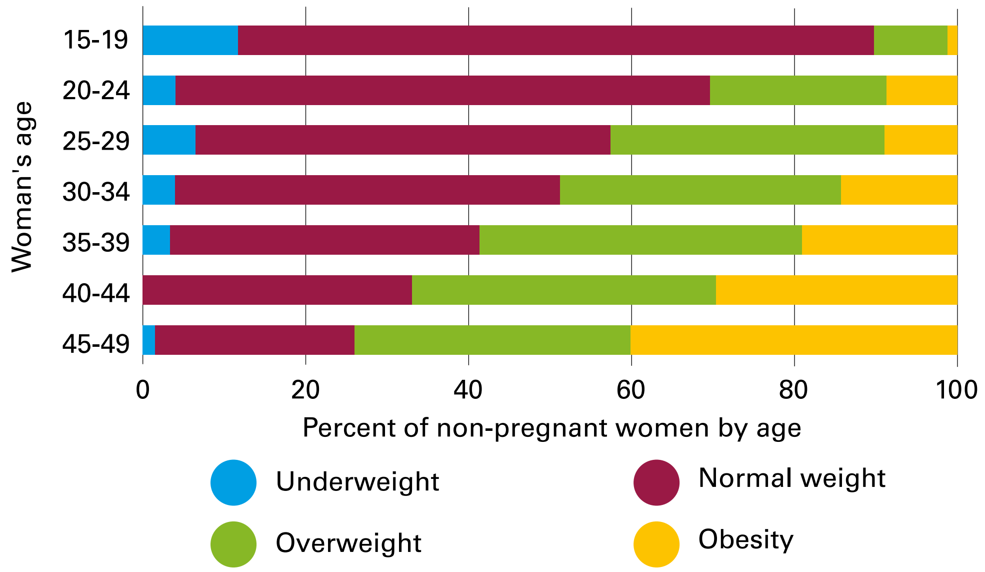


Figure 24. Prevalence of underweight, normal weight, overweight, and obesity in non-pregnant women 15-49 years of age, by age group, the Kyrgyz Republic 2021

As shown in Figure 25 the median BMI of women aged 15-49 years is 24.3, while the mean BMI is above 25 (see Table 70).

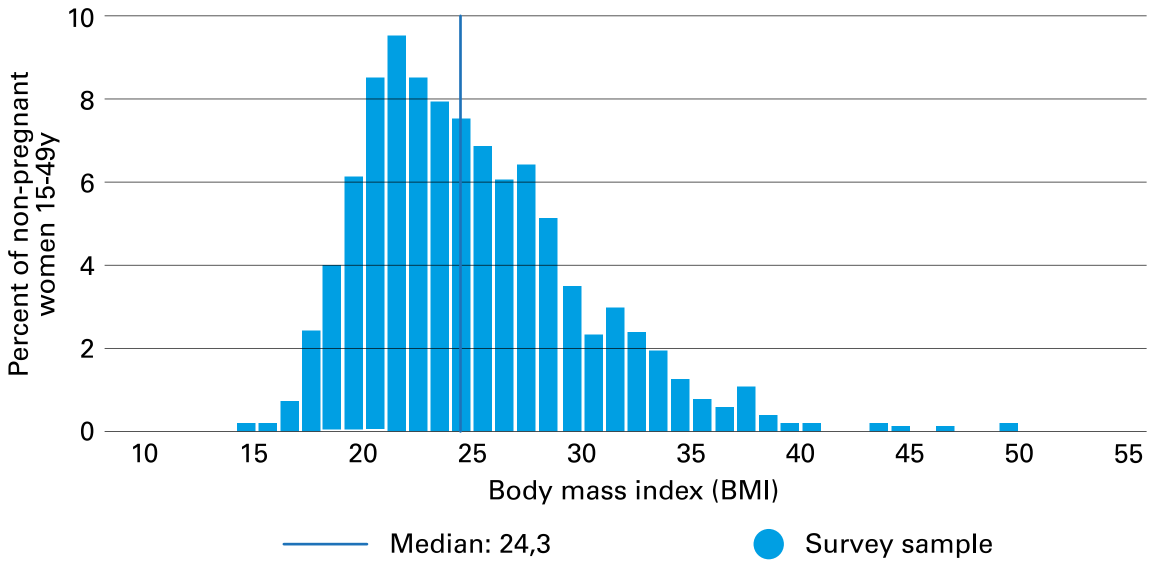


Figure 25. Distribution of BMI values in non-pregnant women 15-49 years of age, The Kyrgyz Republic 2021

Table 70. Prevalence of low and high BMI in non-pregnant women 15-49 years of age, by various demographic characteristics, the Kyrgyz Republic 2021[a]

Characteristic	N	Низкая масса тела[b]					% Normal[b]	% Overwt[b]	% Obese[b]	% Overwt or obesity (BMI ≥25)[b]	p value[c]
		Mean BMI	% Severe	% Moderate	% At risk	% Any					
Age Group (in years)											
15-19	280	21.9	1.0	0.9	10.1	12.0	77.6	9.4	1.0	10.4	<0.001
20-29	258	24.0	0.4	1.1	3.5	5.0	57.8	28.7	8.6	37.3	
30-39	366	26.4	0.5	1.0	4.5	6.0	42.0	35.7	16.3	52.0	
40-49	285	28.8	0	0	0.6	0.6	28.4	30.5	40.5	71.0	
Residence											
Urban	463	25.3	0.2	1.2	5.9	7.3	54.7	23.8	14.2	38.0	<0.05
Rural	726	25.6	0.6	0.5	3.8	4.9	47.2	29.2	18.6	47.9	
Region											
Batken oblast	136	26.4	0	0.6	2.8	3.5	52.5	30.2	13.8	44.1	0.251
Jalal-Abad oblast	142	25.7	0	1.6	2.4	4.0	45.3	33.3	17.4	50.7	
Issyk-Kul oblast	121	24.4	0	0	5.8	5.8	56.7	24.9	12.5	37.5	
Naryn oblast	147	23.9	1.2	0.6	4.5	6.3	57.3	28.1	8.3	36.4	
Osh oblast	150	25.7	0.7	0.8	3.9	5.4	46.1	25.9	22.7	48.5	
Talas oblast	120	26.2	1.1	0	3.8	4.9	44.7	29.9	20.4	50.3	
Chui oblast	93	24.9	1.0	0	8.7	9.7	48.2	24.0	18.0	42.0	
Bishkek city	129	25.8	0	1.6	3.5	5.0	57.4	24.1	13.5	37.6	
Osh city	151	25.5	0.5	0.5	4.3	5.3	47.1	28.5	19.0	47.5	
Wealth quintile											
Lowest	277	24.8	0.1	0	6.0	6.2	52.6	27.5	13.7	41.2	0.202
Second	264	25.5	1.7	1.4	4.3	7.4	45.1	29.6	17.9	47.5	
Middle	226	26.0	0	0.3	1.9	2.2	48.0	30.7	19.0	49.8	
Fourth	231	25.4	0.1	0.7	7.1	7.9	48.8	23.6	19.6	43.2	
Highest	187	25.6	0.2	1.6	3.4	5.2	58.4	23.4	13.0	36.4	

Educational level											
Basic secondary or less	258	23.3	1.0	1.0	11.9	13.8	65.7	11.6	8.9	20.5	<0.001
Complete secondary or more	882	26.1	0.3	0.7	2.4	3.5	45.7	31.7	19.2	50.8	
Marital Status											
Currently not married	390	23.9	1.0	0.5	8.2	9.7	63.9	14.3	12.0	26.3	<0.001
Currently married	799	26.3	0.2	0.9	2.8	3.8	43.0	33.6	19.5	53.1	
Currently lactating											
Yes	210	25.7	0.2	1.5	2.0	3.7	45.4	35.5	15.4	50.9	0.381
No	609	26.7	0.1	0.6	3.3	3.9	41.1	32.0	23.0	55.0	
TOTAL	**1189**	**25.5**	**0.5**	**0.8**	**4.6**	**5.8**	**49.9**	**27.2**	**17.0**	**44.3**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Severe undernutrition defined as BMI <16.0; moderate undernutrition defined as BMI 16.0-16.9; at risk of undernutrition defined as BMI 17.0-18.4; normal weight defined as BMI 18.5 – 24.9; overweight defined as BMI 25.0-29.9; obesity defined as BMI >30.

[c] P value <0.05 indicates that one subgroup is significantly different from the other.

3.7.5. Anemia, Iron deficiency и Iron deficiency anemia

As shown in Table 71, about 25% of non-pregnant women in the Kyrgyz Republic are anemic. Less than 1% of non-pregnant women are severely anemic, whereas moderate and mild anemia are present in 11.3% and 13.1% of women, respectively (see Table 92 in appendix 8.5). Overall median hemoglobin in non-pregnant women is 128g/L. The distribution of hemoglobin concentration is shown in Figure 26, showing that most measurements are greater than the anemia cut-off of 120 g/L.

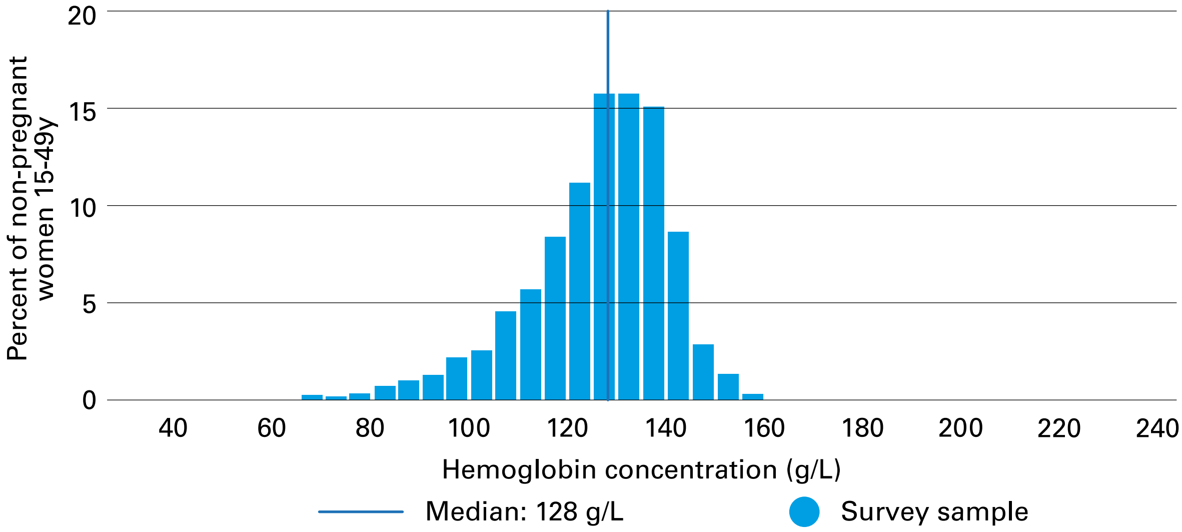


Figure 26. Distribution of adjusted hemoglobin (g/L) in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Figure 27 illustrates the overlap between anemia and ID in non-pregnant women, showing a very large overlap between anemia and ID.

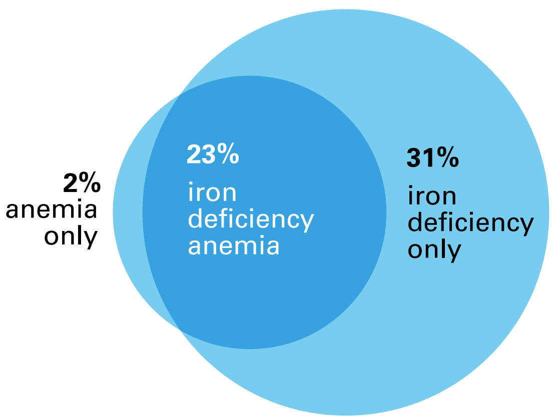


Figure 27. Venn diagram showing overlap between anemia and iron deficiency in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

As shown in Table 71, more than half of the women in the Kyrgyz Republic have ID and about one-quarter IDA. While none of the investigated demographic indicators are significantly associated with anemia and IDA prevalence, the prevalence of ID significantly differs by age: young women have the highest and women aged 40-49 years the lowest prevalence of ID. Significant differences in ID were also found by household wealth and ID was highest in women living in the poorest households.

Table 71. Prevalence of anemia, iron deficiency, and iron deficiency anemia in non-pregnant women 15-49 years of age, by various demographic characteristics, the Kyrgyz Republic 2021.

Characteristic	Anemia[b]				Iron deficiency e				Iron deficiency anemia [f]			
	N	% a	95% CI[c]	p-value[d]	N	%[a]	95% CI[c]	p-value[d]	N	%[a]	95% CI[c]	p-value[d]
Age Group (in years)												
15-19	281	28.0	(22.3, 34.7)	0.289	273	63.0	(56.5, 69.1)	<0.001	273	26.2	(20.3, 33.1)	0.190
20-29	262	22.5	(16.9, 29.5)		251	56.9	(48.9, 64.5)		249	20.8	(15.2, 27.8)	
30-39	375	27.8	(22.7, 33.5)		356	60.2	(53.7, 66.4)		355	25.8	(20.6, 31.8)	
40-49	285	22.0	(16.8, 28.1)		269	42.1	(34.5, 50.0)		268	18.7	(14.1, 24.5)	
Residence												
Urban	471	25.0	(20.2, 30.4)	0.875	454	58.2	(51.6, 64.5)	0.388	453	22.7	(18.1, 28.2)	0.854
Rural	732	25.5	(21.6, 29.8)		695	54.5	(49.3, 59.7)		692	23.3	(19.5, 27.7)	
Region												
Batken oblast	140	32.8	(25.4, 41.3)	0.107	132	60.9	(52.4, 68.8)	0.132	131	32.9	(25.6, 41.0)	0.280
Jalal-Abad oblast	145	23.1	(15.1, 33.6)		134	47.8	(36.6, 59.2)		134	18.3	(11.2, 28.5)	
Issyk-Kul oblast	120	34.8	(24.8, 46.3)		121	56.9	(48.1, 65.4)		119	27.6	(18.0, 39.9)	
Naryn oblast	147	32.5	(24.2, 42.2)		145	57.7	(48.2, 66.8)		145	27.0	(19.3, 36.3)	
Osh oblast	150	17.4	(11.7, 25.0)		144	47.2	(39.4, 55.1)		144	17.6	(11.7, 25.7)	
Talas oblast	123	32.1	(23.2, 42.6)		113	62.9	(52.5, 72.2)		113	28.1	(19.6, 38.5)	
Chui oblast	93	23.8	(16.4, 33.3)		91	61.0	(46.2, 74.0)		90	23.6	(16.0, 33.2)	
Bishkek city	133	26.1	(18.4, 35.6)		127	62.7	(53.1, 71.4)		127	25.0	(17.1, 35.1)	
Osh city	152	26.7	(19.9, 34.8)		142	55.7	(46.1, 64.8)		142	21.8	(15.5, 29.8)	
Wealth quintile												
Lowest	279	28.4	(22.7, 35.0)	0.103	267	64.5	(57.3, 71.2)	<0.05	267	26.4	(20.7, 33.1)	0.209
Second	266	31.6	(25.0, 39.1)		259	55.7	(48.4, 62.8)		256	28.0	(22.0, 34.9)	
Middle	228	20.7	(14.6, 28.6)		219	45.5	(37.7, 53.6)		218	19.1	(13.1, 26.9)	
Fourth	235	23.9	(18.0, 31.1)		217	57.7	(48.2, 66.7)		217	22.0	(16.0, 29.4)	
Highest	191	20.6	(14.3, 28.7)		183	56.2	(46.7, 65.2)		183	18.8	(12.4, 27.5)	
Household food security												
Secure	794	25.3	(21.4, 29.7)	0.5294	749	55.5	(50.7, 60.2)	0.7708	748	23.2	(19.3, 27.6)	0.3960
Mildly insecure	127	20.6	(12.8, 31.4)		125	51.9	(36.7, 66.6)		124	18.2	(11, 28.8)	

Moderately insecure	216	26	(19.8, 33.2)		214	57.3	(48.9, 65.3)		212	23.4	(17.6, 30.4)	
Severely insecure	62	33.4	(19.9, 50.2)		57	62.7	(45.4, 77.3)		57	33.4	(19.2, 51.4)	
Educational level												
Basic secondary or less	259	25.4	(19.3, 32.7)	0.874	253	56.7	(47.1, 65.7)	0.753	253	23.7	(17.8, 30.9)	0.747
Complete secondary or more	893	24.8	(21.6, 28.4)		849	55.0	(50.6, 59.4)		845	22.5	(19.2, 26.3)	
Marital Status												
Currently not married	394	23.9	(18.8, 29.8)	0.504	381	53.9	(46.7, 60.9)	0.440	380	22.1	(17.0, 28.1)	0.638
Currently married	809	26.0	(22.6, 29.8)		768	56.9	(52.5, 61.1)		765	23.6	(20.2, 27.4)	
Currently lactating												
Yes	212	20.0	(14.5, 26.9)	0.061	199	51.8	(42.8, 60.7)	0.425	198	18.1	(12.5, 25.5)	0.108
No	615	27.3	(23.3, 31.8)		589	56.4	(50.7, 61.9)		586	24.8	(20.7, 29.5)	
TOTAL	**1203**	**25.3**	**(22.3, 28.6)**		**1149**	**55.9**	**(51.8, 59.9)**		**1145**	**23.1**	**(20.1, 26.5)**	

Note: The N's are the denominators for a specific sub-group. For iron deficiency and iron deficiency anemia, the numbers are smaller than for anemia due to unsuccessful blood collection (sufficient blood could be obtained only for the on-site analysis of hemoglobin concentration).

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Anemia defined as hemoglobin < 120g/L; hemoglobin adjusted for altitude.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Iron deficiency defined as inflammation adjusted plasma ferritin < 15 µg/L.

[f] Iron deficiency anaemia defined as plasma ferritin < 15.0 µg/L and hemoglobin < 120g/ L.

3.7.6. Vit A deficiency

About 4% of non-pregnant women are vitamin A deficient, denoting a public health problem with mild significance according to WHO. Only household food security status was significantly associated with vitamin A deficiency, with a higher vitamin A deficiency prevalence found among women residing in severely food insecure households (see Table 72).

Table 72. Prevalence of vitamin A deficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	N	%[a] with VAD[b]	(95% CI)[c]	p-value[d]
Age Group (in years)				
15-19	273	6.1	(3.2, 11.5)	0.451
20-29	251	3.0	(1.5, 6.0)	
30-39	356	4.2	(2.5, 6.8)	
40-49	269	4.0	(2.2, 7.4)	
Residence				
Urban	454	4.3	(2.4, 7.8)	0.961
Rural	695	4.3	(3.0, 6.0)	
Region				
Batken oblast	132	7.9	(3.8, 15.6)	0.284
Jalal-Abad oblast	134	3.5	(1.5, 7.6)	
Issyk-Kul oblast	121	7.3	(3.7, 14.2)	
Naryn oblast	145	2.9	(0.9, 8.7)	
Osh oblast	144	2.8	(1.2, 6.5)	
Talas oblast	113	3.1	(1.2, 7.8)	
Chui oblast	91	2.5	(0.8, 7.2)	
Bishkek city	127	6.1	(2.5, 14.1)	
Osh city	142	5.6	(2.8, 10.7)	
Wealth quintile				
Lowest	267	7.0	(4.1, 11.8)	0.280
Second	259	2.2	(0.9, 5.3)	
Middle	219	4.1	(2.2, 7.4)	
Fourth	217	3.6	(1.6, 7.8)	
Highest	183	5.0	(1.9, 12.3)	
Household food security				
Secure	749	3.5	(2.3, 5.4)	<0.05
Mildly insecure	125	4.4	(1.9, 9.8)	
Moderately insecure	214	4.6	(2.1, 10.0)	
Severely insecure	57	13.8	(5.5, 30.4)	
Educational level				
Basic secondary or less	253	6.6	(3.5, 11.8)	0.086
Complete secondary or more	849	3.5	(2.3, 5.1)	
Marital Status				
Currently not married	381	5.8	(3.5, 9.6)	0.115
Currently married	768	3.5	(2.4, 5.1)	
Currently lactating				
Yes	199	4.6	(3.3, 6.4)	0.228

No	589	2.9	(1.3, 6.0)	
TOTAL	**1149**	**4.3**	**(3.1, 5.9)**	

Note: The N's are the denominators for a specific sub-group; for VAD, the numbers are smaller than for anemia due to unsuccessful blood collection (only sufficient blood could be obtained for the on-site analysis of hemoglobin concentration) or insufficient sample volumes for retinol binding protein analysis.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] VAD = Vitamin A deficiency, defined as RBP adjusted for inflammation [42] <0.569 umol/L.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.7.7. Folate deficiency

As shown in Table 73, and similar to adolescent girls, the prevalence of folate deficiency in non-pregnant women aged 15-49 years is high in the Kyrgyz Republic. Folate deficiency significantly differs by household wealth, with the largest proportion of women with folate deficiency living in households of the lowest and fourth wealth quintile. Moreover, lactating women are more likely to be deficient in folate than those not lactating. Other sub-group analyses did not yield significant correlations.

Table 73. Prevalence of folate deficiency in non-pregnant women 15-49 years of age by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	N	% a with folate deficiency[b]	(95% CI)[c]	p-value[d]
Age Group (in years)				
15-19	273	85.7	(79.4, 90.3)	0.412
20-29	257	86.3	(80.3, 90.7)	
30-39	359	81.1	(75.4, 85.8)	
40-49	274	80.7	(72.3, 87.1)	
Residence				
Urban	459	82.1	(76.1, 86.8)	0.561
Rural	704	83.8	(80.5, 86.7)	
Region				
Batken oblast	137	82.5	(76.1, 87.4)	0.102
Jalal-Abad oblast	131	75.8	(69.2, 81.3)	
Issyk-Kul oblast	121	90.3	(83.1, 94.6)	
Naryn oblast	144	88.6	(79.3, 94.0)	
Osh oblast	143	82.1	(74.6, 87.7)	
Talas oblast	118	85.1	(79.5, 89.4)	
Chui oblast	92	80.4	(67.6, 89.0)	
Bishkek city	128	88.9	(80.7, 93.9)	
Osh city	149	84.7	(78.6, 89.4)	
Wealth quintile				
Lowest	270	87.2	(81.2, 91.5)	<0.05
Second	258	83.9	(76.7, 89.2)	
Middle	222	74.6	(66.8, 81.2)	
Fourth	224	87.2	(81.0, 91.6)	
Highest	185	83.3	(75.1, 89.1)	
Household food security				
Secure	760	81.8	(78.9, 84.3)	0.329
Mildly insecure	124	80.5	(61.4, 91.5)	

Moderately insecure	215	86.6	(79.8, 91.4)	
Severely insecure	60	93.6	(83.6, 97.6)	
Educational level				
Basic secondary or less	252	83.1	(73.9, 89.5)	0.935
Complete secondary or more	865	83.4	(80.0, 86.3)	
Marital Status				
Currently not married	382	82.8	(76.1, 87.9)	0.859
Currently married	781	83.4	(80.1, 86.3)	
Currently lactating				
Yes	204	89.0	(83.4, 92.9)	<0.05
No	597	81.0	(76.9, 84.6)	
TOTAL	1163	83.2	(80.3, 85.8)	

Note: The N's are the denominators for a specific sub-group; for folate, the numbers are smaller than for anemia due to unsuccessful blood collection (sufficient blood could only be obtained for the on-site analysis of hemoglobin concentration) or insufficient sample volumes for folate analysis.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Folate deficiency defined as plasma folate <10 nmol/L.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.7.8. Vitamin D deficiency

Although no significant differences were found between any of the investigated indicators and vitamin D deficiency, data indicates that the prevalence is lower in young women compared to older women (see Table 74).

Table 74. Prevalence of vitamin D deficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	Deficient[a]			Insufficient[a]		Deficient or insufficient		
	N[b]	%[c]	(95% CI) [d]	%[c]	(95% CI)[d]	%[c]	(95% CI)[d]	p-value[e]
Age Group (in years)								
15-19	76	15.7	(8.7, 26.6)	21.7	(13.9, 32.2)	37.4	(27.1, 49.0)	0.070
20-29	67	15.9	(7.8, 29.7)	46.3	(34.0, 59.0)	62.2	(48.4, 74.2)	
30-39	107	14.6	(8.7, 23.4)	36.2	(26.6, 46.9)	50.7	(39.7, 61.7)	
40-49	65	17.3	(9.6, 29.0)	38.0	(25.2, 52.6)	55.2	(40.6, 69.0)	
Residence								
Urban	131	19.9	(14.9, 26.1)	37.0	(29.1, 45.7)	57.0	(47.4, 66.1)	0.148
Rural	184	13.0	(8.1, 20.3)	34.5	(28.5, 41.2)	47.6	(39.2, 56.1)	
Wealth quintile								
Lowest	71	9.0	(3.6, 20.8)	33.8	(23.3, 46.2)	42.8	(31.4, 55.1)	0.688
Second	63	20.7	(11.8, 33.7)	29.4	(18.8, 42.7)	50.1	(36.1, 64.0)	
Middle	64	20.1	(10.1, 36.1)	34.6	(23.1, 48.2)	54.7	(40.4, 68.3)	
Fourth	63	13.8	(6.4, 27.4)	35.9	(24.8, 48.7)	49.7	(35.5, 64.0)	
Highest	52	14.3	(7.9, 24.7)	42.1	(29.6, 55.6)	56.4	(42.1, 69.7)	
Household food security								
Secure	194	15.6	(10.9, 21.8)	38.9	(32.2, 46.0)	54.4	(45.7, 63.0)	0.505
Mildly insecure	36	6.1	(1.4, 22.7)	41.9	(26.0, 59.8)	48.0	(30.8, 65.7)	

Moderately insecure	66	20.1	(10.3, 35.6)	22.9	(14.6, 33.9)	43.0	(30.8, 56.1)	
Severely insecure	17	20.3	(6.2, 49.4)	26.4	(10.4, 52.5)	46.7	(23.0, 71.9)	
Educational level								
Basic secondary or less	72	17.9	(11.1, 27.6)	25.5	(17.0, 36.5)	43.4	(33.0, 54.4)	0.198
Complete secondary or more	231	14.6	(9.9, 20.8)	38.0	(31.6, 44.8)	52.5	(44.7, 60.2)	
Marital Status								
Currently not married	106	20.0	(13.3, 28.8)	28.5	(20.8, 37.8)	48.5	(39.5, 57.6)	0.485
Currently married	209	13.4	(8.9, 19.7)	38.9	(32.2, 46.1)	52.4	(44.6, 60.0)	
Currently lactating								
Yes	65	10.9	(4.6, 23.6)	46.7	(33.7, 60.2)	57.6	(43.3, 70.8)	0.512
No	151	15.5	(10.3, 22.7)	36.7	(29.0, 45.0)	52.2	(43.0, 61.2)	
TOTAL	**315**	**15.6**	**(11.7, 20.4)**	**35.5**	**(30.5, 40.7)**	**51.1**	**(44.6, 57.5)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data

[a] Deficient <12 ng/mL (<30nmol/L); Insufficient 12-19.9 ng/mL (30nmol/L-<50nmol/L). Vitamin D concentrations below the limit of detection (<9 ng/mL; n=34) were recoded to 9 ng/mL.

[b] 25% sub-sample.

[c] Percentages weighted for unequal probability of selection.

[d] CI=confidence interval, calculated taking into account the complex sampling design.

[e] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.7.9. Iodine deficiency

Table 75 presents the iodine status of non-pregnant non-lactating women 15-49 years of age. Nationally, the national mUIC is approximately 167 μg/L, indicating that non-pregnant women in the Kyrgyz Republic have sufficient iodine status. Significant differences were observed by age group, region, and education level. Despite these differences, all sub-groups indicated an adequate iodine status (i.e., mUIC 100-299 μg/L).

Table 75. Median urinary iodine concentration in non-pregnant non-lactating women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	Median UIC[a]	(95% CI)[b]	p-value[c]
Age Group (in years)				
15-19	252	186.19	(168.80, 202.24)	<0.05
20-29	127	160.82	(143.83, 185.28)	
30-39	277	157.69	(149.39, 175.29)	
40-49	262	164.68	(136.03, 172.41)	
Residence				
Urban	343	164.34	(147.84, 165.13)	0.829
Rural	575	169.84	(165.20, 184.73)	
Region				
Batken oblast	114	199.67	(168.05, 216.82)	<0.001
Jalal-Abad oblast	91	167.19	(168.05, 216.83)	
Issyk-Kul oblast	104	195.85	(153.40, 193.70)	
Naryn oblast	129	160.82	(171.21, 223.17)	
Osh oblast	106	156.61	(129.27, 192.37)	

Talas oblast	93	202.04	(132.03, 180.58)	
Chui oblast	75	166.10	(155.22, 262.94)	
Bishkek city	103	154.08	(123.64, 168.11)	
Osh city	103	151.71	(139.94, 168.24)	
Wealth quintile				
Lowest	228	157.94	(155.85, 186.79)	0.684
Second	208	175.17	(157.16, 190.98)	
Middle	162	159.29	(136.94, 181.31)	
Fourth	179	169.84	(145.67, 174.62)	
Highest	138	174.81	(142.21, 188.39)	
Educational level				
Basic secondary or less	234	186.19	(170.39, 204.23)	<0.001
Complete secondary or more	645	159.98	(151.76, 169.02)	
Household food security				
Secure	604	162.91	(154.51, 174.34)	0.291
Mildly insecure	97	173.35	(148.04, 181.72)	
Moderately insecure	165	184.16	(157.6, 199.78)	
Severely insecure	49	152.17	(125.1, 179.24)	
Household salt iodization				
None (<5 ppm)	11	147.81	(97.12, 187.95)	0.367
Insufficient (5-14.9 ppm)	234	162.39	(151.68, 176.93)	
Adequate (15+ ppm)	630	175.07	(162.57, 184.15)	
Household sanitation[d]				
Unadequate	128	160.38	(151.45, 174.45)	0.741
Adequate	783	169.85	(159.59, 179.07)	
Safe drinking water				
Yes	903	166.60	(158.82, 174.32)	0.192
No	12	201.34	(95.6, 298.84)	
TOTAL	**918**	**167.19**	**(158.26, 174.9)**	

Note: The N's are un-weighted denominators in each subgroup; the sum of subgroups may not equal the total because of missing data

[a] Medians are weighted for unequal selection probability; UIC = urinary iodine concentration.

[b] CI=confidence interval calculated by bootstrapping without taking into account the complex sampling design. Actual confidence intervals probably narrower.

[c] Chi-square p-value <0.05 indicates that the mean of the natural log of urinary iodine concentration in at least one subgroup is statistically significantly different from the values in the other subgroups.

[d] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[e] Composite variable of main source of drinking water and treating water to make safe for drinking.

Figure 28 presents the geographic distribution of mUIC by region, and shows that mUIC in all regions is adequate — ranging between 100 and 299 µg/L; only Talas has a mUIC>200.

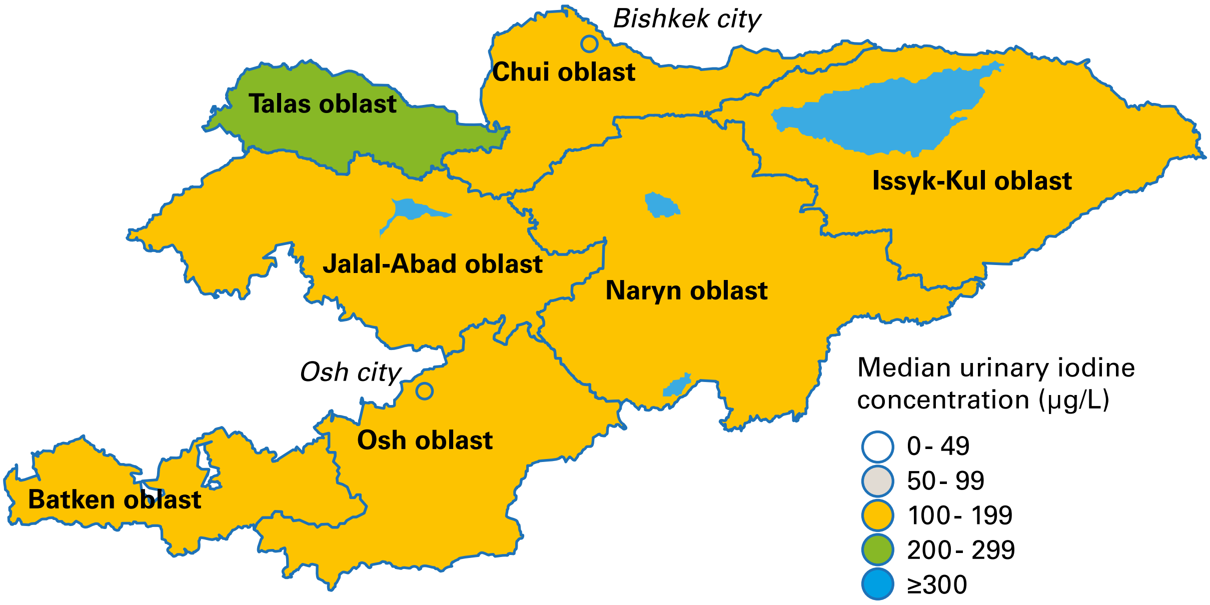


Figure 28. Geographic distribution of median urinary iodine concentration in non-pregnant non-lactating women 15-49 years of age, the Kyrgyz Republic 2021

Table 76 presents the iodine status of non-pregnant lactating women. The national median urinary iodine concentration (mUIC) is approximately 134 μg/L indicating an adequate iodine status. No significant differences were observed between any of the sub-groups, which might be owed to the relatively small number of non-pregnant lactating women. However, sub-group analyses indicate that iodine status of certain sub-groups might be insufficient. Those are women living in severely food insecure households and women who live in households using salt that was not iodized. Of note, numbers in the sub-group analyses are small and results will have to be interpreted with caution.

Table 76. Median urinary iodine concentration in non-pregnant lactating women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	Median UIC[a]	(95% CI)[b]	p-value[c]
Age Group (in years)				
15-19	6	128.09	(38.03, 218.78)	0.251
20-29	113	124.35	(115.66, 140.49)	
30-39	75	149.60	(131.12, 166.99)	
40-49	5	195.38	(124.75, 266.00)	
Residence				
Urban	81	142.74	(115.69, 164.44)	0.875
Rural	118	130.51	(119.47, 145.04)	
Region				
Batken oblast	22	103.28	(95.64, 171.82)	0.449
Jalal-Abad oblast	33	128.01	(105.26, 150.91)	
Issyk-Kul oblast	18	128.07	(33.15, 228.96)	
Naryn oblast	17	150.29	(106.70, 200.26)	
Osh oblast	36	133.58	(104.00, 160.10)	
Talas oblast	12	237.3.	(72.50, 274.44)	
Chui oblast	15	179.85	(56.83, 233.47)	
Bishkek city	11	124.35	(45.42, 203.27)	
Osh city	35	140.07	(100.26, 174.64)	

Wealth quintile				
Lowest	34	115.74	(91.30, 162.70)	0.970
Second	46	134.26	(124.83, 157.80)	
Middle	52	134.46	(109.56, 152,98)	
Fourth	38	125.96	(104.22, 161.38)	
Highest	28	156.08	(91.17, 186.35)	
Educational level				
Basic secondary or less	6	108.96	(30.89, 182.34)	0.800
Complete secondary or more	191	134.46	(127.12, 147.77)	
Household food security				
Secure	127	120.01	(120.86, 140.16)	0.086
Mildly insecure	23	188.60	(141.80, 221.91)	
Moderately insecure	39	151.19	(101.63, 200.75)	
Severely insecure	9	85.33	(27.45, 190.46)	
Household salt iodization				
None (<5 ppm)	2	48.99	(0, 336.84)	0.547
Insufficient (5-14.9 ppm)	54	126.88	(111.01, 151.48)	
Adequate (15+ ppm)	140	137.26	(124.58, 150.75)	
Household sanitation[d]				
Unadequate	31	128.09	(91.00, 165.18)	0.186
Adequate	167	134.88	(126.09, 148.81)	
Safe drinking water[e]				
Yes	192	134.04	(123.74, 144.98)	0.246
No	6	246.45		
TOTAL	**199**	**134.26**	**(124.03, 145.74)**	

Note: The N's are un-weighted denominators in each subgroup; the sum of subgroups may not equal the total because of missing data.

[a] Medians are weighted for unequal selection probability; UIC = urinary iodine concentration.

[b] CI=confidence interval calculated by bootstrapping without taking into account the complex sampling design. Actual confidence intervals probably narrower.

[c] Chi-square p-value <0.05 indicates that the mean of the natural log of urinary iodine concentration in at least one subgroup is statistically significantly different from the values in the other subgroups.

[d] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation = open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field

[e] Composite variable of main source of drinking water and treating water to make safe for drinking.

Figure 28 presents the geographic distribution of mUIC by region, and shows that mUIC in all regions is adequate — ranging between 100 and 299 µg/L; only Talas has a mUIC>200.

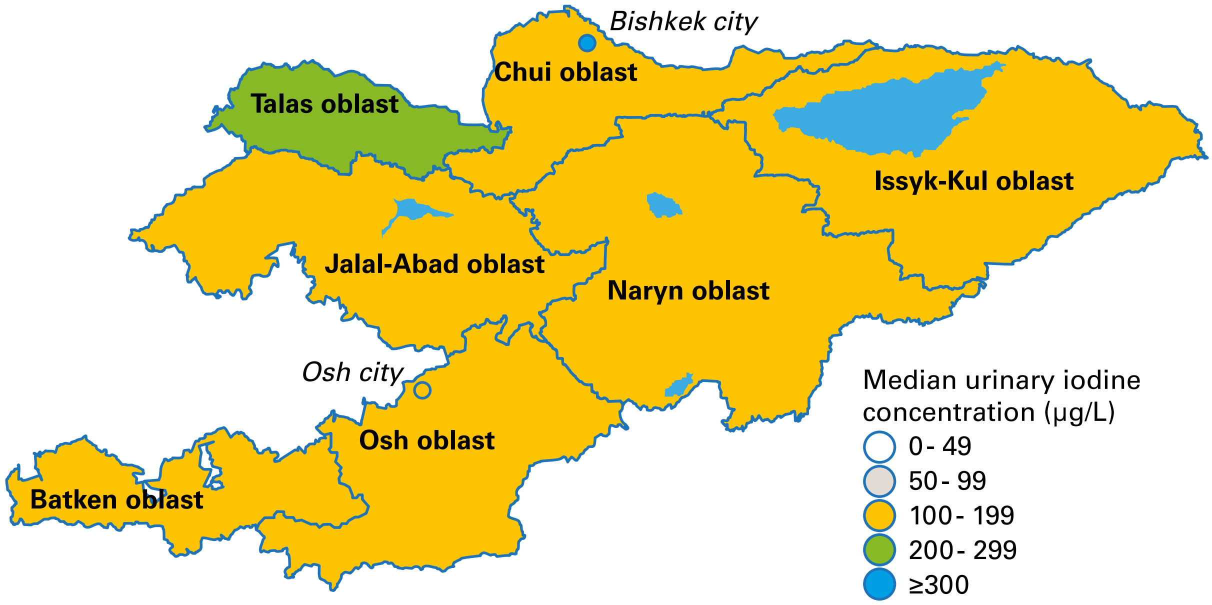


Figure 29. Geographic distribution of median urinary iodine concentration in non-pregnant lactating women 15-49 years of age, the Kyrgyz Republic 2021

3.7.10. Associations between micronutrient deficiencies and various factors

Iron, as well as vitamin A deficiency are highly significantly associated with anemia in women 15-49 years of age, as can be seen in Table 77. Moreover, women living in households without access to safe drinking water have a significantly higher prevalence of anemia. Moreover, although the difference is not significant, the data indicates that women drinking coffee or tea during or directly after their meals have a higher prevalence of anemia compared to those who don't. Anemia is not associated with the intake of mineral and vitamins in the past 6 months prior to the survey, which is not surprising since only very few women still took supplements at the time of the survey.

Table 77. Correlation between various factors and anemia in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Anemic	p value[b]
Woman's household had adequate sanitation			
Yes	1011	25.3	0.888
No	184	24.7	
Woman's household had safe drinking water			
Yes	1178	24.7	<0.001
No	21	52.7	
Minimum dietary diversity			
Yes	837	24.3	0.347
No	366	27.5	
Took iron tablets or syrup in past 6 months			
Yes	129	28.6	0.389
No	1067	24.8	
Took folate supplements in past 6 months			
Yes	96	21.7	0.472
No	1099	25.6	

Took vitamin A tablets in past 6 months			
Yes	78	27.9	0.723
No	1115	25.2	
Took multivitamin supplements in past 6 months			
Yes	138	26.0	0.896
No	1054	25.4	
Took vitamin D supplements in past 6 months			
Yes	90	28.9	0.518
No	1102	25.2	
Consumes coffee or tea during or directly after meal			
Yes	1036	26.7	0.057
No	167	18.0	
Household flour iron fortification[c]			
None	386	26.5	0.971
HeAdequate	125	25.2	
Adequately fortified	8	26.9	
Woman had inflammation			
Yes	185	24.3	0.821
No	960	25.3	
Woman iron deficient			
Yes	650	41.4	<0.001
No	495	4.5	
Woman vitamin A deficient			
Yes	55	53.9	<0.001
No	1090	23.8	
Woman folate deficient			
Yes	981	25.9	0.237
No	183	21.4	
Woman vitamin D status[d]			
Normal	130	30.0	0.578
Insufficient	126	24.9	
Deficient	60	22.9	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

[c] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm.

[d] Vitamin D deficiency measured in a 25% sub-sample of women.

The prevalence of ID was significantly higher in women without access to safe drinking water, as shown in Table 78. Moreover, women drinking coffee or tea during or directly after their meals have a higher prevalence of ID compared to those who don't. Further, the prevalence of ID is higher in folate deficient women compared to those with normal folate status. Though the difference is not significant, data suggests that women with vitamin A deficiency are more likely to be iron depleted than those without. The intake of supplements is not associated with ID, possibly since very few women consumed supplements at the time of the survey.

Table 78. Correlation between various factors and iron deficiency in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Iron deficiency	p value[b]
Woman's household had adequate sanitation			
Yes	964	55.6	0.855
No	177	56.6	
Woman's household had safe drinking water			
Yes	1125	55.3	<0.05
No	20	76.0	
Minimum dietary diversity			
Yes	798	54.0	0.129
No	351	60.2	
Took iron tablet or syrup in past 6 months			
Yes	123	56.9	0.831
No	1020	55.6	
Took folate supplements in past 6 months			
Yes	88	52.2	0.587
No	1053	56.1	
Took multivitamin supplements in past 6 months			
Yes	132	62.2	0.241
No	1006	54.8	
Consumes coffee or tea during or directly after meal			
Yes	988	57.8	<0.05
No	161	45.5	
Household flour iron fortification[c]			
None	376	54.2	0.340
HeAdequate	119	48.6	
Adequately fortified	7	72.1	
Woman had inflammation			
Yes	185	47.4	0.054
No	964	57.4	
Woman vitamin A deficient			
Yes	55	71.5	0.079
No	1090	55.2	
Woman folate deficient			
Yes	961	58.6	<0.05
No	177	45.6	
Woman vitamin D status[d]			
Normal	126	61.6	0.454
Insufficient	123	53.6	
Deficient	60	53.2	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

c Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm.

[d] Vitamin D deficiency measured in a 25% sub-sample of women.

As shown in Table 79, women with elevated inflammation markers are more likely to be vitamin A deficient than those who do not have elevated markers. None of the other investigated factors is associated with vitamin A status.

Table 79. Correlation between various factors and vitamin A deficiency in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Vit A deficiency	p value[b]
Woman's household had adequate sanitation			
Yes	964	4.3	0.922
No	177	4.1	
Woman's household had safe drinking water			
Yes	1125	4.3	0.748
No	20	3.3	
Minimum dietary diversity			
Yes	798	4.7	0.349
No	351	3.4	
Took iron tablet or syrup in past 6 months			
Yes	123	2.2	0.190
No	1020	4.6	
Took vitamin A tablets in past 6 months			
Yes	76	3.3	0.693
No	1063	4.4	
Took multivitamin supplements in past 6 months			
Yes	132	2.3	0.227
No	1006	4.6	
Woman had inflammation			
Yes	185	9.8	<0.005
No	964	3.3	
Woman folate deficient			
Yes	961	3.9	0.208
No	177	6.5	
Woman vitamin D status[c]			
Normal	126	5.8	0.427
Insufficient	123	3.1	
Deficient	60	7.6	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

[c] Vitamin D deficiency measured in a 25% sub-sample of women.

Although the prevalence of folate deficiency is higher in women who did not consume folic acid supplements in the past 6 months prior to the survey, this difference is not significant. Of the women that reported consuming folic acid in the past 6 months, only those women who were consuming folic acid supplements during the survey had a significantly lower prevalence of folate deficiency than those that had taken folic acid previously. None of the other investigated factors is significantly correlated with folate deficiency in women.

Table 80. Correlation between various factors and folate deficiency in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Folate deficiency	p value[b]
Woman's household had adequate sanitation			
Yes	979	83.3	0.734
No	176	81.9	
Took iron tablet or syrup in past 6 months			
Yes	126	79.4	0.315
No	1030	83.7	
Took folate supplements in past 6 months			
Yes	93	78.4	0.270
No	1062	83.6	
Currently taking folate supplements			
Yes	28	49.3	<0.001
No	65	90.2	
Took multivitamin supplements in past 6 months			
Yes	135	83.6	0.917
No	1017	83.2	
Household flour iron fortification[c]			
None	377	86.2	0.833
Insufficient	122	84.7	
Adequate	7	91.1	
Woman had inflammation			
Yes	182	79.1	0.193
No	956	84.0	
Woman vitamin D status[d]			
Normal	129	81.3	0.293
Insufficient	125	84.9	
Deficient	60	92.6	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

[c] Folate part of the fortification premix, flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm.

[d] Vitamin D deficiency measured in a 25% sub-sample of women.

Although the prevalence of vitamin D deficiency is 20 percentage point higher in women who did not take vitamin D supplements compared to those taking supplements in the 6 months prior to the survey, this difference is not significant, most likely due to the small number of observations. None of the other indicators was significantly associated with vitamin D deficiency.

Table 81. Correlation between various factors and vitamin D deficiency in non-pregnant women 15-49 years of age, the Kyrgyz Republic 2021

Characteristic	N	%[a] Vitamin D deficient or insufficient	p value[b]
Woman's household had adequate sanitation			
Yes	271	52.4	0.101
No	41	39.6	
Woman's household had safe drinking water			
Yes	309	51.1	0.354
No	4	26.2	
Minimum dietary diversity			
Yes	215	52.3	0.591
No	100	48.4	
Took multivitamin supplements in past 6 months			
Yes	41	49.0	0.717
No	271	52.2	
Took vitamin D supplements in past 6 months			
Yes	21	34.3	0.113
No	291	53.2	
Woman had inflammation			
Yes	51	49.3	0.735
No	258	52.2	

Note: The N's are the denominators for a specific sub-group.

[a] Percentages weighted for unequal probability of selection among regions.

[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

3.8. Pregnant women

3.8.1. Characteristics

As shown in Table 82 below, the NIMAS recruited 176 pregnant women, approximately 60% of which resided in rural areas. About 40% were in the third trimester of the pregnancy, and almost nine out of ten pregnant women had completed at least secondary school. The majority of pregnant women enrolled in the NIMAS was between 20-39 years of age, and as there were only a few pregnant women <20 and ≥40 years of age, only two age sub groups have been used for bivariate analyses presented below (i.e., 18-29 years, 30-45 years).

Table 82. Description of pregnant women, the Kyrgyz Republic 2021

Characteristic	N	%[a]
Age (in years)		
18-19	8	5.3
20-29	92	49.8
30-39	70	41.1
40-45	6	3.8
Urban/rural		
Urban	82	40.1
Rural	94	59.9

Region		
Batken oblast	19	7.4
Jalal-Abad oblast	20	16.8
Issyk-Kul oblast	17	7.3
Naryn oblast	12	3.3
Osh oblast	21	17.1
Talas oblast	17	4.5
Chui oblast	21	20.6
Bishkek city	22	16.8
Osh city	27	6.3
Wealth quintile		
Lowest	30	15.2
Second	37	24.0
Middle	38	24.2
Fourth	42	21.8
Highest	28	14.7
Educational level		
Basic secondary or less	18	13.5
Complete secondary or more	158	86.5
Trimester of pregnancy		
1	54	32.8
2	47	27.2
3	70	40.1
TOTAL	**176**	**100.0**

Note: The N's are un-weighted numbers in each subgroup. Subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection among regions.

3.8.2. Dietary diversity and consumption of vitamins and mineral supplements

As shown in Table 83, pregnant women consumed, on average, more than 6 food groups in the 24 hours prior to the interview. Almost 70% of pregnant women met the minimum dietary diversity and ate ≥ 5 food groups during this time period. Only one-third consumed iron tables in the past 6 months, and just over half of the pregnant women took folic acid supplements. .

Table 83. Dietary diversity and consumption of vitamin and mineral supplement in pregnant women, the Kyrgyz Republic 2021

Characteristic	N	%[a] or mean	(95% CI)[b]
Number of food groups consumed (mean)	**173**	**6.4**	**(6.0, 6.7)**
Meet minimum dietary diversity (5+ food groups)			
Yes	120	66.5	(57.6, 74.4)
No	53	33.5	(25.6, 42.4)
Took iron tablets or syrup in past 6 months			
Yes	70	37.9	(30.2, 46.2)
No	101	61.0	(52.5, 68.9)
Don't know	2	1.1	(0.2, 5.5)

Consumed folic tablets in past six months			
Yes	97	56.2	(47.3, 64.7)
No	74	42.7	(34.2, 51.6)
Don't know	2	1.1	(0.2, 5.4)
Took multivitamin supplements in past 6 months			
Yes	47	24.1	(18.2, 31.1)
No	125	75.7	(68.6, 81.5)
Don't know	1	0.2	(0, 1.7)

Note: The N's are the numerators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection among regions.
[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.8.3. Mid-upper arm circumference

Mid-upper arm circumference (MUAC) measurements were successfully collected for 133 pregnant women. Mean MUAC was 26.9 cm (95%CI: 26.0, 27.8), and the unweighted standard deviation was 3.94 cm. The percentage of pregnant women considered underweight (i.e., MUAC <23 cm) was 6.9% (95%CI: 3.1, 14.5). Due to the small sample size of pregnant women, no sub-group analysis could be conducted.

3.8.4. Anemia

Approximately 49% of pregnant women in the Kyrgyz Republic are anemic, with significant differences by pregnancy trimester (see Table 84). Anemia during the first and second trimesters were similar, and denoted a moderate public health problem, whereas anemia in the third trimester is classified as a severe public health problem and affects more than 70% of women. As shown in Figure 30, severe anemia was rare (1.4%; 95% CI: 0.3, 6.9; n=2), with most anemia cases classified as moderate (27.8%; 95% CI: 20.0, 37.2; n=32) or mild (19.8%; 95% CI: 14.1, 27.1; n=30).

Table 83. Prevalence of anemia in pregnant women, by various demographic characteristics, the Kyrgyz Republic 2021

Characteristic	n	%[a, b]	(95% CI)[c]	p-value[d]
Age (in years)				
18-29	80	44.4	(31.0, 58.6)	0.354
30-45	60	54.5	(40.5, 67.9)	
Urban/rural				
Urban	59	51.5	(36.6, 66.2)	0.681
Rural	81	47.5	(36.2, 59.2)	
Wealth quintile				
Lowest	26	53.5	(32.1, 73.7)	0.970
Second	29	51.1	(29.3, 72.5)	
Middle	30	45.6	(27.3, 65.2)	
Fourth	36	45.3	(30.0, 61.7)	
Highest	18	45.5	(24.4, 68.4)	
Educational level				
Basic secondary or less	12	56.7	(26.4, 82.7)	0.598
Complete secondary or more	128	47.9	(38.6, 57.4)	

Trimester of pregnancy				
1	40	31.5	(17.9, 49.1)	<0.01
2	38	36.5	(19.3, 57.9)	
3	58	71.8	(55.5, 83.9)	
Household flour iron fortification[c]				
None	19	49.0	(23.0, 75.5)	0.661
Insufficient	8	53.8	(17.4, 86.5)	
Adequate	1	100.0	-	
TOTAL	142	49.3	(39.8, 58.2)	

Note: The N's are the denominators for a specific sub-group. Sub-group Ns that do not sum to the total occur because of a) missing data, or b) when a small number of pregnant women had to be excluded from the sub-group analysis as they were the only pregnant women residing in their particular strata, which prevented the correct weighting of the survey results.

[a] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.

[b] Percentages weighted for unequal probability of selection among regions.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] Flour sample collected in a 25% sub-sample of households, inadequately fortified: iron EDTA 5-<15ppm; ferrous sulfate, ferrous fumarate 5-<60ppm; adequately fortified: iron EDTA ≥15ppm; ferrous sulfate, ferrous fumarate ≥60ppm.

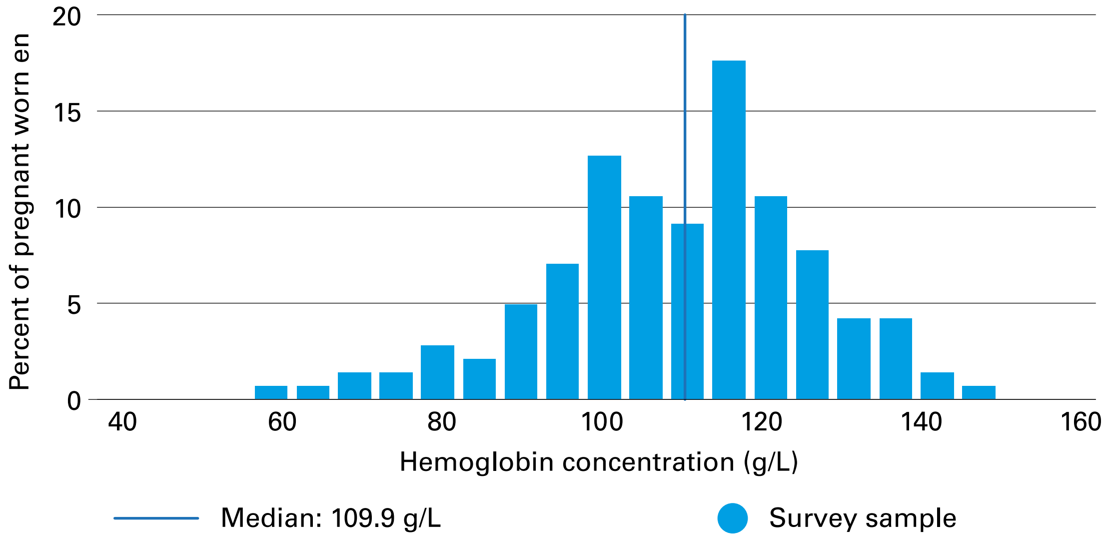


Figure 30. Distribution of hemoglobin (g/L) in pregnant women, the Kyrgyz Republic 2021

3.8.5. Iodine deficiency

The mUIC for pregnant women is presented in Table 85. As a mUIC between 150-249 μg/L is considered adequate for pregnant women, only pregnant women residing in households in the highest wealth quintile would be classified with inadequate iodine status. All other sub-groups would be considered adequate. Of note, pregnant women 18-19 years of age have an mUIC of approximately 249 μg/L, and were thus just below the threshold for being classified with excess iodine intake (data not shown).

Table 85. Median urinary iodine concentration in pregnant women, the Kyrgyz Republic 2021

Characteristic	N	Median UIC[a]	(95% CI)[b]
Age (in years)			
18-29	62	195.17	(142.24, 209.61)
30-45	48	180.49	(121.55, 195.64)
Urban/rural			
Urban	43	209.08	(120.20, 219.49)
Rural	67	180.49	(142.12, 207.32)
Wealth quintile			
Lowest	18	213.66	(146.75, 315.80)
Second	26	188.46	(135.43, 229.13)
Middle	22	160.78	(84.24, 239.93)
Fourth	29	214.86	(114.79, 210.82)
Highest	14	125.13	(38.91, 200.36)
Educational level			
Basic secondary or less	9	167.16	(101.14, 233.18)
Complete secondary or more	101	185.07	(146.00, 198.67)
Trimester of pregnancy			
1	32	180.49	(132.90, 207.04)
2	31	174.72	(100.47, 226.30)
3	43	219.44	(149.78, 260.01)
Household salt iodization			
None (<5 ppm)	0	-	-
Insufficient (5-14.9 ppm)	37	177.13	(111.76, 195.91)
Adequate (15+ ppm)	72	180.49	(143.14, 207.68)
TOTAL	**110**	**180.49**	**(146.28, 198.36)**

Note: The N's are un-weighted denominators in each subgroup; the sum of subgroups may not equal the total because of missing data.

[a] Medians are weighted for unequal selection probability; UIC = urinary iodine concentration.

[b] CI=confidence interval calculated by bootstrapping without taking into account the complex sampling design. Actual confidence intervals probably narrower. No p-values could be estimated because of the small number of subjects within each sub-group.

4. DISCUSSION AND CONCLUSIONS

4.1. Household level findings

Almost all households in the Kyrgyz Republic use safe water for drinking and have access to adequate sanitation facilities, and about four out of five households use clean fuel for cooking. These results are consistent with the MICS 2018 [11].

Household level data show that food security is a notable problem in the Kyrgyz Republic, particularly in Issyk Kul, Naryn, and Chui, where just about half of the households report to be food insecure and about every tenth household is severely food insecure. Food insecurity in the Kyrgyz Republic is mainly driven by poverty, which is reflected in the NIMAS data as a large proportion of severely food insecure households are in the lowest wealth quintile. Moreover, household food insecurity is significantly associated with numerous nutrition indicators across multiple population groups, such as wasting and iron deficiency anemia among children 6-59 months of age, thinness, anemia and iron deficiency among children 5-9 years of age, and vitamin A deficiency in non-pregnant women. In addition, food security status is associated with minimum dietary diversity in children 6-23 months of age, children 5-9 years of age, adolescent girls and non-pregnant women, suggesting that poor household food security limits individual diets.

While in 2020, more than 25% of the Kyrgyz Republic's population lived below the poverty line, the situation worsened in 2021, mainly due to the global food crises and the COVID 19 pandemic and poverty increased to 33% [7]. Almost half of the households included in the NIMAS reported that COVID had a negative impact on the income and about 90% stated that prices for food have increased since the outbreak of the pandemic, only about every seventh household received assistance.

Salt was sampled from almost all households and analyzed qualitatively using rapid test kits and quantitatively using the iReader device. Qualitative analyses showed that about 99% of the salt is iodized, which is slightly higher than estimated in 2018 [11] and in agreement with the respondents perception of the salt iodization status. According to WHO, salt should contain 15-45mg iodine/kg to prevent iodine deficiency disorders [58]. Using the iReader we found that about 98% of households use iodized salt (concentration ⩾ 5ppm), 75% use adequately iodized salt (⩾ 15 ppm) and about 13% of the salt used by the households was found to be inadequately iodized. Excess iodization in the Kyrgyz Republic is rare, with less than 4% of the salt having an iodine concentration >45ppm, the vast majority below 55ppm. However, using the cut-off set by the Kyrgyz government (40±15mg iodine/kg salt), only about 31% of the salt can be classified as adequately iodized. According to WHO, an iodization program should reach a coverage of >90% of households with adequately iodized salt [58] to be considered "universal". This threshold was only met in Bishkek, where about 95% of the households used adequately iodized salt using the WHO cut-off of ⩾ 15 ppm. Significant differences in iodine salt concentration also exist between the different salt brands, and only two salt brands, "Extra" and "Extra Povarenok", were found to have approximately 90% of samples adequately iodized. Nevertheless, particularly when taking into consideration the iodine status of adolescent girls and women, the iodine fortification program in the Kyrgyz Republic is functioning well.

The Law of the Kyrgyz Republic "on fortification of baking flour", which was amended in 2015, decreed that domestically-produced and imported premium and first grade flour should be fortified. Specifically, every entrepreneur active in the field of production, transportation, storage and sale of fortified flour is obliged to guarantee its safety and quality in accordance with requirements of technical regulations or normative legal acts and standards. Further, manufacturers or suppliers should carry out certification or declaration of fortified flour on conformity. Almost all households had flour at home at the time of the NIMAS. More than half of the households reported to use fortified flour (by perception), which is in accordance with the results of a flour fortification monitoring report from 2017 [72]. About three-quarter of the households with flour had it in its original package, and most of the packages stated that the flour was fortified. Nevertheless, only one quarter of all samples collected were fortified and just about 2% adequately fortified. Moreover, no difference in fortification status were found between flours that were labelled as fortified on the package and those that were not. Further, no differences were observed between flour produced in the Kyrgyz Republic and imported flour.

As wheat flour producers typically fortify with micronutrient premix, our results of the iron in the Kyrgyz Republic's wheat flour indicate that the levels of the other micronutrients mandated by the Kyrgyz Republic's fortification standards (i.e., vitamin B1, B2, B3, zinc, and folic acid) were also only present at adequate levels in about 2% of samples.

4.2. Under- and overnutrition

The NIMAS identified 7% of children 6-59 months of age as being stunted, which is lower than the 11% of children classified as stunted in the MICS 2018 [11]. Although classified as a mild public health problem at the national level, stunting is considered a problem with medium public health significance for certain sub-groups, such as children with low birth weight, children living in Batken, and children whose households are of the lowest wealth quintile, severely food insecure, and children residing in households with no adequate sanitation or no safe drinking water.

Wasting and underweight in children 6-59 months of age living in the Kyrgyz Republic is rare with a prevalence of less than 1%, which is in alignment with the MICS 2018 [11].

The prevalence of overweight and obesity in children 6-59 months of age can be classified as a problem with "medium" public health significance. A low prevalence in overweight and obesity in early childhood is important to prevent or minimize upward trends and increased risk of overweight and obesity in older children and adolescents [70]. Our data show that the prevalence of overweight and obesity steadily increases with increasing age and affects about 20% of adolescent girls aged 15-18 years. Since overweight and obesity have been associated with type 2 diabetes in children and adolescents [73,74], these conditions could become public health problems in the Kyrgyz Republic in the near future if overweight and obesity prevalence continue to increase. The NIMAS estimates that nearly 45% of non-pregnant women 15-49 years of age are overweight or obese, which is an increase of 9 percentage points compared to 2018 [11]. The prevalence of overweight and obesity clearly increases with age: More than 75% of women 45-49 years of age are either overweight or obese. Obesity is often associated with low grade inflammation and the development of metabolic disorders such as type 2 diabetes and certain cardiovascular diseases [75,76] and plays a central role in the development of the metabolic syndrome [77]. As a result, the Kyrgyz Republic may expect a rise in the incidence of several chronic diseases associated with overweight and obesity.

4.3. Anemia and iron deficiency

Both anemia and iron deficiency (ID) are common in women and children 6-59 months of age in the Kyrgyz Republic. Anemia would be considered a "moderate" public health problem in non-pregnant women and children 6-59 months of age and a severe public health problem in pregnant women according to the criteria published by the World Health Organization[36]. Anemia is less common in children 5-9 years of age and adolescent girls, posing a "mild" public health problem [36]. Compared to the micronutrient survey conducted in 2009 — which measured hemoglobin using the HemoCue 301 —the prevalence in children 6-59 months of age fell by five percentage points and increased by three percentage points in non-pregnant women. Our results are therefore in alignment with the results from 2009 and could indicate that the much higher prevalence observed in the DHS 2012 — which measured hemoglobin using the HemoCue 201+ device — is due to the use of different HemoCue models used. Recent literature has assessed the potential bias introduced by using of different pre-analytical techniques (e.g. capillary vs. venous samples) but also equipment-induced differences, suggesting that there are systematically lower readings of the hemoglobin concentrations when the HemoCue 201+ was used compared to the HemoCue 301 or CBC analyzers [46,78]. On the other hand, there is also some evidence that the HemoCue 301, which was used by the NIMAS, yields higher hemoglobin concentrations compared to CBC analyzers [79]. Of note, the NIMAS used venous blood for all hemoglobin measurements in children 6-59 months of age, children 5-9 years of age, and non-pregnant adolescent girls and women. The use of venous blood prevented any bias in all population groups except pregnant women that could potentially arise from capillary blood samples, which can have variable hemoglobin concentrations depending on the drop (i.e., first, second, third, etc) that is taken [80]. In order to validate the HemoCue 301 results, hemoglobin was measured in a sub-sample of the NIMAS survey population using a CBC analyzer. We found a good correlation between the HemoCue and the CBC analyzer (see Appendix 8.7). The CBC analyzer yielded a 4g/L lower mean hemoglobin concentration, indicating that the real prevalence of anemia is likely somewhat higher than estimated, particularly since a large part of the population has hemoglobin concentration around the anemia cut-off. However, the results also confirm that the classification of the anemia public health relevance, which is based on the HemoCue 301 results, is in agreement with both methods.

The prevalence of both anemia and iron deficiency in the Kyrgyz Republic is higher in poor, food insecure households, particularly in rural areas and in certain regions such as Naryn and Issyk Kul. Regardless, the NIMAS survey results show that the prevalence of anemia and iron deficiency is comparable to neighboring countries with recent data [81].

Iron deficiency has been identified in this survey as a strong putative risk factor for anemia in all population groups, and a large proportion of individuals with anemia have concurrent iron deficiency, ranging from 60% of the anemic children 5-9 years of age to 95% of the anemic adolescent girls. This proportion of individuals with concurrent anemia and iron deficiency is higher than estimated by meta-analyses, which calculated that about half of the anemia is associated with iron deficiency in countries where anemia is a moderate public health problem [82]. In children 6-59 months of age, the NIMAS found that iron deficiency was the only investigated risk factor associated with anemia. For children 5-9 years of age, anemia was also found to be more prevalent in those with elevated inflammation markers, indicating that anemia of inflammation and chronic disease also contribute to the overall anemia burden, but most likely to a lower extent than anemia due to iron deficiency.

For women and adolescent girls, vitamin A deficiency was also found to be highly associated with anemia. Vitamin A deficiency reduces hemoglobin concentration via multiple mechanisms, including increased frequency and severity of infectious diseases and poor mobilization of iron stores from tissues. Moreover, recent data indicates that vitamin A deficiency has direct effects on anemia, possibly independent of the mechanisms listed above [83].

Anemia was significantly lower in adolescent girls who took folate supplements in the past six months prior to the survey indicating that also megaloblastic anemia might contribute to the overall anemia prevalence. Folate deficiency is not identified as a risk factor for anemia in the survey, which could be due to the fact that the definition of folate deficiency the NIMAS used is the WHO-recommended serum folate concentration cutoff of <10 nmol/L, which (according to the biomedical literature) is the folate concentration at which homocysteine levels begin to increase[40]. Homocysteine concentrations start rising at a very early stage of folate deficiency, thus a large part of those diagnosed with folate deficiency have no megaloblastic changes in the blood and bone marrow. Second, anemia is multifactorial and almost all women and adolescent girls have concomitant anemia and iron deficiency.

4.4. Vitamin A deficiency

Vitamin A deficiency is present in all population groups and poses a mild public health problem in adolescent girls and non-pregnant women, and a moderate public health problem in children. Compared to the micronutrient survey conducted in 2009, the vitamin A deficiency prevalence in children 6-59 months of age and non-pregnant women increased by 11 and 4 percentage points, respectively. It is likely that the termination of the vitamin A supplementation program in 2011 and the discontinuation of the "Gulazyk" micronutrient powder program in 2018 led to the substantial increase in vitamin A deficiency prevalence from 2009 to 2021. While vitamin A status poses a mild to moderate public health problem nationally, the problem can be classified as severe in certain regions. Specifically, the problem is severe in children 6-59 months of age living in Bishkek and in children 5-9 years of age living in Chui and Osh City. Moreover, vitamin A deficiency is highly associated with elevated inflammation markers in children, adolescent girls and women, highlighting the important role of vitamin A in immune health.

4.5. Folate deficiency

Folate deficiency is very high in Kyrgyz adolescent girls and non-pregnant women. As already mentioned above, the NIMAS uses a serum folate concentration as threshold for folate deficiency at which homocysteine levels start to rise; thus women in the very yearly stages of folate deficiency are classified as deficient. Using the threshold for more severe folate deficiency at which megaloblastic changes tend to appear would have resulted in a lower prevalence. This was, however, not possible since WHO only recommends a cut-off based on megaloblastic changes using microbiologic assays and not protein-binding assays, which has been used in this survey. The 2009 survey measured folate in red blood cells and found that almost 40% of non-pregnant women were deficient and 98% had insufficient folate status. The high prevalence of folate deficiency found in the NIMAS merits attention, particularly since folate deficiency is the main cause of neural tubes defects and increases the risk of preterm delivery, infant low birth weight, and fetal growth retardation. A recent micronutrient survey conducted in Uzbekistan, using the same deficiency threshold, also reported a very high prevalence of folate deficiency in non-pregnant women [84]. Though the prevalence in Uzbekistan was about 45% nationally, it was higher in certain regions and highest in those bordering the Kyrgyz Republic (almost 60%). The higher prevalence observed in the Kyrgyz Republic might be explained by the very low proportion of adequately fortified flour and the small number of adolescent girls and non-pregnant women consuming supplements containing folic acid.

4.6. Vitamin D deficiency

The prevalence of vitamin D deficiency in children 6-59 months of age is only 5% and increases to 9% and 15% in adolescent girls and non-pregnant women, respectively. Similarly, the proportion of individuals with insufficient vitamin D status is lowest in young children and highest in non-pregnant women. Compared to other countries with vitamin D deficiency prevalence data [85–87], the prevalence in the Kyrgyz Republic is relatively low. Significant differences were detected in children 6-59 months of age with respect to vitamin D deficiency or insufficiency prevalence: About half of the children 6-11 months of age and half of the children living in the wealthiest households have suboptimal vitamin D status. The large proportion of young children with suboptimal status could be related to the relatively large proportion of women with vitamin D deficiency or insufficiency (about 50%) since foetal vitamin D status depends on maternal status. Though vitamin D deficiency prevalence in the Kyrgyz Republic can be considered low, the high prevalence of children 6-59 months of age with suboptimal status merits attention due to the important role of vitamin D in the processes of cell proliferation, differentiation, and maturation.

4.7. Iodine deficiency

Nationally, the mUIC in adolescent girls, non-pregnant and pregnant women indicate an adequate iodine status in all population groups. Though significant differences were observed for some sub-groups, only pregnant women residing in households in the highest wealth quintile were identified with inadequate iodine status. Of note, pregnant women 15-19 years of age and non-pregnant adolescent girls living in Talas have an mUIC just below the threshold for being classified with excess iodine intake.

5. STRENGTHS AND LIMITATIONS

The NIMAS yielded national and region-specific prevalence estimates for a variety of micronutrient and nutrition biomarkers in children 6-59 months of age, children 5-9 years of age, adolescent girls 10-18 years of age, non-pregnant women 15-49 years of age and pregnant women, which will guide future decisions of national stakeholders and inform national nutrition programs.

The NIMAS yielded satisfactory response rates for households, children 5-9 years of age, adolescent girls and non-pregnant women. However, a relatively high refusal rate for blood sampling among children 6-59 months of age and some technical difficulties to successfully collect venous blood samples in young children were experienced, which resulted in a slightly smaller number of children with blood samples than initially estimated. Hence, while the survey yielded national estimates with satisfactory precision for children 6-59 months of age, the reduced sample size led to slightly lower precision for stratum- and age-specific prevalence estimates than initially calculated.

Although previous surveys have measured the coverage of iodized salt qualitatively, the NIMAS measured household salt samples both qualitatively and quantitatively, which yielded a more accurate estimation of household coverage with adequately iodized salt than previous surveys.

The inclusion of children 5-9 years of age and adolescent girls enables for the first time a comprehensive assessment of the nutritional status in these age groups. Survey planners expected difficulty in enrolling children 5-9 years of age and adolescent girls because they would be away from home for much of the day. However, contrary to these expectations, their inclusion did not prove to be a major difficulty because field teams adjusted their work schedules to the school schedules of eligible children and girls. This meant sometimes returning to a household later in the day after children or girls had returned home from school. Overall response rates in both age groups were satisfactory. Another challenge when including children 5-9 years of age and adolescent girls in a nutrition survey is the interpretation of laboratory testing results. For several blood biomarkers, no established cutoff points defining normal values exist for children 5-9 years of age. Although there are WHO-recommended cut-off points to define anemia and iron deficiency [36,38], there are no recommended cut-off points for defining minimum dietary diversity, vitamin A, vitamin D, or folate deficiencies. Where available, we used cut-off points from biomedical literature, or, when lacking, cut-off points recommended for other population groups.

Similar to the 2009 micronutrient survey, the NIMAS collected venous blood samples, which removed potential pre-analytical biases, which can occur with capillary sampling, such as the potential of sample dilution from interstitial fluid. Moreover, both surveys measured hemoglobin concentrations on a portable device (HemoCue 301). The anemia prevalence between the two surveys are comparable and importantly, are much lower than reported in the DHS 2012. The DHS used capillary blood to measure hemoglobin on a different portable hemoglobinometer (Hemocue 201+). As previously noted, recent research indicates that hemoglobin measurements from capillary blood samples and the HemoCue 201+ yield reduced hemoglobin concentrations and thus, increased an anemia prevalence. On the other hand, there is some evidence that the HemoCue 301 device yields slightly increased hemoglobin concentration and thus a lower anemia prevalence. To validate the hemoglobin results obtained from the HemoCue 301, the NIMAS measured hemoglobin on a complete blood counter in a sub-sample of children 6-59 months of age, children 5-9 years of age, adolescent girls and non-pregnant women. The mean hemoglobin concentration measured by the CBC is 4g/L (~3%) lower than the concentration obtained by the HemoCue 301 across all population groups. Hence, though the actual prevalence of anemia might be slightly higher than estimated, the classification of public health significance of anaemia would remain.

6. RECOMMENDATIONS

Using the findings presented in this report and an understanding of the Kyrgyz Republic's programmatic and research environment, the following programmatic and research recommendations have been developed. While these recommendations describe policy and programmatic options that can be taken, they do not specify what governmental or non-governmental agencies are responsible for addressing each recommendation. Moving forward, nutrition stakeholders in the Kyrgyz Republic, including the Scale Up Nutrition (SUN) Multi-Stakeholder Platform should review these recommendations to determine which agencies are best placed to address certain issues and improve the nutrition situation of children and women in the Kyrgyz Republic.

6.1. Reduce poverty

Many international organizations, such as FAO, WB, WFP, UNDP, Mercy Corps and UNICEF are actively supporting the Government of the Kyrgyz Republic combating poverty in the Kyrgyz Republic. In 2018, the Kyrgyz government and WFP jointly implemented a programme to deliver school meals, provide food assistance and cash based transfers, support poor smallholder farmers, build resilience to shocks, and strengthen climate change adaptation [88]. Nevertheless, the proportion of households living under the poverty line remains high and is expected to further increase mainly due to the crisis in Ukraine and the ongoing pandemic, the effects of climate change, rising food prices, poor job opportunities, and a continued cooling of the economy [89]. Existing programs must be adapted to the current situation in order to counteract a further increase in poverty and, if possible, reduce the number of people living below the poverty line. This could include the expansion of social safety net programs, such as food and cash and voucher assistance to vulnerable households. The multi-sectoral nature of the integrated approach still depends on bringing together social protection stakeholders with agricultural stakeholders and services in a coherent and sustainable way, to ensure poor smallholder households can increase their capacity to produce, diversify their diets and income and sustainably move out of poverty. Indeed, despite the fact that social protection programs have been shown to improve household food security and nutrition, and there is evidence that these programs are strengthened when incorporating food and nutrition education, there are important knowledge gaps regarding the operational options of linking them with broader agricultural interventions. Alternatively, new programs to reduce poverty can be designed to meet the Kyrgyz Republic's economic and seasonal conditions to increase households' food security throughout the year. Development of the new Food Security and Nutrition Programme in the Kyrgyz Republic would enable multiple stakeholders to work towards agreed set of results and allocation of responsibilities for their implementation and achievement among different sectors.

6.2. Improve household access to food

Household food insecurity is a leading risk factor of multiple forms of malnutrition. The NIMAS data found that household food security status is significantly associated with wasting and iron deficiency anemia among children 6-59 months of age, thinness, anemia and iron deficiency among children 5-9 years of age, and vitamin A deficiency in non-pregnant women 15-49 years of age. Moreover, food security status is associated with dietary diversity in children 6-23 months of age, children 5-9 years of age, and non-pregnant women 15-49 years of age, showing that household level food security plays an important role in ensuring good quality nutrition for nutritionally vulnerable household members. It is therefore recommended that policies and programmes aimed at reducing malnutrition should include interventions to address households' access to healthy and nutritious food.

6.3. Amend the salt iodization law

The NIMAS generally found that adolescent girls, non-pregnant women, and pregnant women have adequate iodine status, indicating that the iodization programme is functioning well. Sub-group analyses, however, reveal a relatively large variation in urinary iodine: pregnant women living in wealthy households with low median iodine concentration and non-pregnant adolescent girls in Talas and young pregnant women being on the edge of excess iodine intake. To reduce that variability and have a more consistent iodine intake it would make sense to consider aligning the national fortification threshold with the international cut-off of 15ppm and strengthen the law enforcement at the level of salt production, importation, and distribution. Moreover, since the iodine status of the population is at the high end of adequacy, programs designed to reduce salt intake would not have a serious effect on iodine status.

6.4. Strengthen wheat flour fortification

Although anemia was found to be a moderate public health problem in the Kyrgyz Republic, the prevalence of iron deficiency was high. As iron deficiency was significantly associated with anemia, addressing iron deficiency could likely reduce the anemia prevalence. Fortification of wheat flour has been shown to reduce the prevalence of iron deficiency and folate deficiency in Central Asia [22], and has been proven a successful approach to reduce birth defects [90]. Findings of the NIMAS reveal that only one third of the flour is fortified with iron and less than 2% of the flour is fortified according to the standards, with only marginal differences between the locally produced and the imported flour. Therefore, adherence to fortification standards of locally-produced wheat flour should be strengthened at the level of production and distribution, and monitoring activities for imported flour should be extended to enforce appropriate fortification of imported flour. In addition, the government of the Kyrgyz Republic should consider the possibility of creating economic incentives for flour producers; direct purchase and distribution of premix from the state budget and/or creation of a revolving fund are two potential methods to create economic incentives for fortification.

Law enforcement, taking into consideration the accession of the Kyrgyz Republic into Eurasian Economic Union, would also be expected to increase coverage with adequately fortified wheat flour and to provide additional micronutrients. If both recommendations are implemented, reduction of anemia, iron and folate deficiencies is plausible. Moreover, adding vitamin D to the fortification program might then be a viable strategy to combat vitamin D deficiency. Lastly, public awareness of the positive effects of consuming fortified flour remains low because there is no strategy to inform the public and other parties involved about the importance of fortified flour. The 'Report on Monitoring the Implementation of the Bakery Flour Fortification Law' (2017) state that 83.2 percent never check whether the flour is fortified or not when buying flour. To create demand for fortified flour it is recommended to develop a national communication strategy on nutrition.

6.5. Reduce the prevalence of overweight and obesity

Overweight and obesity is a public health problem with medium relevance in young children and a serious public health concern in women, particularly in older women and should be addressed through governmental policies and programs. According to the WHO, though numerous societal and environmental factors influence weight gain and retention, "dietary factors and physical activity patterns are considered to be the major modifiable factors underlying excessive weight gain that, if corrected, can serve to prevent obesity"[91]. Programs targeted to pregnant and lactating women are also an entry point for reducing overweight and obesity in young children as well as adult women, as postpartum weight retention is a risk factor of long term overweight and obesity [92]. It is thus recommended that antenatal and postnatal care be expanded to include behavior change messages and counselling for mothers. Further, it is advisable to ideally instil appropriate eating behaviors early in life, since such changes are often more easily induced in younger people. As such schools could provide the platform to deliver messages about good nutrition and provide nutrition education to school age children and adolescent girls. Moreover, children of all ages have unique, age-specific nutritional needs, problems, and challenges, and healthy child growth and development also require adequate nutrition before conception and during pregnancy and lactation. Considering these needs and challenges across the life cycle, development of food-based dietary guideline to educate consumers on healthy diets and provide direction for programs and policies aiming to ensure healthy diets for all is critical. Further, to support consumers to make informed food purchases and healthier eating choices, front-of-pack labelling of ultra-processed foods and beverages high in salt, sugar and/or fat is needed. Another recommendation is to set up the epidemiological surveillance of non-communicable diseases, as this could help policy makers to a) identify the health outcomes (e.g., diabetes, cardiovascular diseases) caused by overweight and obesity, and b) plan and implement programs to prevent non-communicable diseases and the risk factors (e.g., overweight and obesity) of non-communicable diseases.

6.5.1. Strengthen other strategies to tackle micronutrient deficiencies

To increase the vitamin A stores in the overall population, policy makers should consider implementing a vitamin A fortification program. Vegetable oil is an ideal vehicle for vitamin A fortification as it protects vitamin A from oxidation during storage and might be a suitable vehicle in the Kyrgyz Republic since it is consumed in adequate amounts. To achieve a high coverage with fortified vegetable oil, regulatory importation requirements will have to be set in place, similar to those for fortified wheat flour, since a significant proportion of the vegetable oil consumed in the Kyrgyz Republic is imported. Other staple foods widely used for vitamin A fortification and potentially suitable for the Kyrgyz Republic are wheat flour and sugar since they are widely consumed. However, food fortification of staple foods may not be the most appropriate approach to reach young children 6-23 months of age; since their caloric intake is limited compared against their micronutrient need, programs to provide micronutrient powders may be envisioned to tackle iron and vitamin A deficiencies in young children. As The Kyrgyz Republic has successfully implemented a micronutrient powder program in the past, insights from programmers and policy makers from the previous program should be sought.

Moreover, campaigns that raise the awareness of folate, vitamin A and iron deficiencies and promote the consumption of nutrient rich foods should be implemented. This type of intervention could include promoting local food products rich in micronutrients.

Lastly, supplementation is a viable, though more costly, alternative to fortification to address micronutrient deficiencies. Overall, vitamin and mineral supplement consumption is low in women and children. It is therefore recommended that the Kyrgyz Republic's health system promote and expand the distribution of these supplements to achieve a high level of coverage and consumer compliance. General awareness campaigns can also be considered but should only be conducted when distribution channels are in place guaranteeing access to supplements. Universal iron and folic acid (IFA) supplementation for anemia prevention among pregnant women is one high impact intervention to improve maternal survival and gestational outcomes. To increase the coverage of IFA supplement consumption, pregnant women can be targeted at their prenatal and postnatal care visits. Moreover, the drastic increase in vitamin A deficiency since 2009 clearly indicates that a functioning vitamin A supplementation program can counteract the development of vitamin A deficiency. In addition, vitamin A supplementation would strengthen children's immune systems and reduce the risk of mortality due to measles, diarrhea, and other illnesses. For easier implementation, consider linking the vitamin A supplementation with vaccination programs in order to achieve a high vitamin A supplementation coverage.

6.5.2. National Nutrition Information System

A national surveillance system that facilitates monitoring of maternal, newborn and infant nutritional health status should be developed. Such a system would enable policy makers and stakeholders to track various health outcomes on a regular basis and could be used to monitor the health impact of nutrition and health programs. Such a system should include a suite of indicators that are internationally recognized and can be readily collected from health facilities. Ideally, data in this system would be disaggregated by socioeconomic status and other variables and reported routinely.

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8. APPENDICES

8.1. ADDITIONAL HOUSEHOLD TABLES

Table 87. Distribution of household interview results for households randomly selected for participation, the Kyrgyz Republic 2021

	Interview completed		No household member or competent respondent at home during visit		Entire household absent for long period or moved away		Interview refused		Dwelling vacant or not found		Other[b]	
Characteristic	**N**	**%[a]**	**N**	**%[a]**	**N**	**%[a]**	**N**	**%[a]**	**N**	**%[a]**	**N**	**%[a]**
Residence												
Urban	1370	86.2	17	1.1	62	3.9	111	7	1	0.1	29	1.8
Rural	1692	90.9	11	0.6	45	2.4	66	3.5	4	0.2	44	2.4
Region												
Batken oblast	298	89.8	2	0.6	18	5.4	11	3.3	2	0.6	1	0.3
Jalal-Abad oblast	321	87	0	0	21	5.7	11	3	0	0	16	4.3
Issyk-Kul oblast	352	86.5	22	5.4	5	1.2	14	3.4	0	0	14	3.4
Naryn oblast	312	90.4	0	0	1	0.3	9	2.6	0	0	23	6.7
Osh oblast	332	92.2	0	0	3	0.8	13	3.6	0	0	12	3.3
Talas oblast	283	94.6	0	0	1	0.3	15	5	0	0	0	0
Chui oblast	308	83.7	0	0	22	6	35	9.5	2	0.5	1	0.3
Bishkek city	476	86.2	2	0.4	22	4	49	8.9	0	0	3	0.5
Osh city	380	90.5	2	0.5	14	3.3	20	4.8	1	0.2	3	0.7
TOTAL	**3062**	**88.7**	**28**	**0.8**	**107**	**3.1**	**177**	**5.1**	**5**	**0.1**	**73**	**2.1**

Note: The N's are the denominators for a specific sub-group.
a Percentages not weighted for unequal probability of selection.
[b] Other: included dwelling destroyed or other reasons noted by interviewer.

Table 88. Agricultural land and livestock of participating households, Kyrgyzatan 2021

Characteristic	N	%[a]	(95% CI)[b]
Member of household owns any agricultural land			
Yes	1497	51.5	(48.8, 54.3)
No	1565	48.5	(45.7, 51.2)
Average size of agricultural land			
Mean (hectare)[c]	1440	18.5	(10.8, 26.1)
Household owns any livestock			
Yes	1416	46.0	(43.3, 48.8)
No	1646	53.8	(51.0, 56.6)
Household owns livestock, specific[d]			
Cattle	1416	75.0	(71.8, 78.0)
Horses, donkeys, mules	1416	23.9	(20.3, 27.8)
Goats	1416	13.4	(10.9, 16.4)
Sheep	1416	47.7	(43.8, 51.6)
Pigs	1416	0.4	(0.2, 1.0)
Chicken	1416	59.7	(56.3, 63.1)
Other poultry	1416	4.1	(2.5, 6.6)

Note: The N's are the denominators for a specific sub-group.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] N for mean hectares is not equal to 1497 as some respondents (n=57) did not know the size of their household's agricultural land holdings.
[d] Question only asked to households responding "Yes" to livestock ownership

Table 89. Household food insecurity score (HFIAS) categories, by residence, region, and wealth quintile, the Kyrgyz Republic 2021

Characteristic	N	Food secure, %[a]	(95% CI)[b]	Mild food insecurity, %[a]	(95% CI)[b]	Moderate food insecurity, %[a]	(95% CI)[b]	Severe food insecurity, %[a]	(95% CI)[b]
Residence									
Urban	1691	68.1	(65.1, 71.0)	10.3	(8.8, 11.9)	15.0	(12.9, 17.2)	6.7	(5.4, 8.2)
Rural	1370	73.9	(70.0, 77.4)	9.8	(7.9, 12.1)	12.5	(10.6, 14.8)	3.8	(2.6, 5.6)
Region									
Batken oblast	298	77.4	(70.8, 82.9)	8.0	(4.8, 13.0)	9.4	(6.3, 14.0)	5.1	(2.8, 9.2)
Jalal-Abad oblast	320	85.3	(79.4, 89.8)	8.4	(5.5, 12.8)	5.3	(3.0, 9.3)	0.9	(0.3, 2.8)
Issyk-Kul oblast	352	56.4	(49.7, 62.9)	16.0	(12.0, 21.0)	21.0	(17.1, 25.6)	6.6	(3.9, 10.8)
Naryn oblast	312	53.2	(49.0, 57.3)	16.7	(12.6, 21.9)	21.5	(18.0, 25.3)	8.6	(6.2, 11.8)
Osh oblast	332	75.2	(69.4, 80.3)	5.4	(3.6, 8.0)	13.1	(9.1, 18.6)	6.2	(4.5, 8.6)
Talas oblast	283	60.4	(53.9, 66.4)	14.9	(12.0, 18.3)	18.6	(14.7, 23.3)	6.2	(3.8, 9.9)
Chui oblast	308	52.2	(46.8, 57.7)	14.6	(11.3, 18.7)	22.1	(18.1, 26.6)	11.0	(7.8, 15.5)
Bishkek city	476	78.5	(73.2, 83.0)	7.0	(4.7, 10.1)	11.8	(9.3, 15.0)	2.7	(1.3, 5.7)
Osh city	380	73.7	(69.4, 77.6)	11.0	(8.1, 14.8)	9.5	(6.8, 13.0)	5.8	(3.7, 9.0)
Wealth quintile									
Lowest	686	53.4	(48.6, 58.2)	11.2	(8.8, 14.3)	21.6	(18.3, 25.3)	13.7	(10.6, 17.7)
Second	594	65.6	(61.1, 69.8)	12.2	(9.6, 15.4)	16.9	(13.6, 20.7)	5.4	(3.8, 7.6)
Middle	572	76.2	(72.6, 79.5)	9.8	(7.5, 12.6)	11.0	(8.4, 14.3)	3.0	(1.7, 5.4)
Fourth	603	77.1	(72.7, 80.7)	9.8	(7.4, 12.9)	9.7	(7.4, 12.5)	3.6	(2.2, 5.8)
Highest	606	79.9	(74.6, 84.3)	7.4	(5.0, 10.9)	10.8	(8.2, 14.0)	2.0	(1.1, 3.4)
TOTAL	3061	70.4	(68.3, 72.4)	10.1	(8.69, 11.3)	14.0	(12.6, 15.5)	5.5	(4.6, 6.6)

Note: Note: The N's are the denominators for a specific sub-group; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

[c] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

8.2. ADDITIONAL CHILD TABLES

Table 90. Proportion of mild, moderate and severe anemia in children 6-59 months of age, the Kyrgyz Republic 2021

		Severe anemia			Moderate anemia			Mild anemia		
Characteristic	**N**	**%[a, b]**	**(95% CI)[c]**	**p-value[d]**	**%[a, b]**	**(95% CI)[c]**	**p-value[d]**	**%[a, b]**	**(95% CI)[c]**	**p-value[d]**
Age Group (in months)										
6-11	120	0	(0, 0)	0.656	14.7	(8.8, 23.6)	<0.001	22.2	(13.6, 34.0)	<0.001
12-23	240	0.4	(0.1, 2.7)		15.0	(8.7, 24.5)		21.0	(16.4, 26.5)	
24-35	302	0.4	(0.1, 1.6)		7.2	(4.4, 11.5)		15.0	(10.8, 20.5)	
36-47	283	0	(0, 0)		2.0	(0.8, 4.9)		10.7	(6.6, 16.8)	
48-59	265	0	(0, 0)		2.4	(1.1, 5.1)		5.0	(2.7, 9.0)	
Sex										
Male	593	0.3	(0.1, 1.1)	0.093	6.5	(4.4, 9.4)	0.513	13.8	(10.9, 17.4)	0.822
Female	614	0	(0, 0)		7.8	(4.8, 12.3)		13.3	(10.2, 17.1)	
Residence										
Urban	452	0.3	(0, 1.8)	0.594	4.9	(2.5, 9.3)	0.189	8.9	(6.6, 12.0)	0.002
Rural	759	0.1	(0, 0.5)		8.1	(5.5, 11.7)		15.6	(12.7, 18.9)	
Region										
Batken oblast	172	0	(0, 0)	0.057	3.5	(1.1, 10.7)	0.005	16.5	(11.6, 22.9)	0.032
Jalal-Abad oblast	164	0	(0, 0)		2.1	(0.7, 5.8)		9.0	(5.5, 14.3)	
Issyk-Kul oblast	118	1.8	(0.4, 7.4)		18.8	(11.2, 29.8)		13.3	(8.4, 20.5)	
Naryn oblast	141	0	(0, 0)		9.6	(5.1, 17.3)		23.2	(16.5, 31.5)	
Osh oblast	140	0	(0, 0)		6.8	(3.0, 14.6)		15.4	(10.1, 22.8)	
Talas oblast	120	0.9	(0.1, 6.2)		13.6	(7.9, 22.2)		18.7	(12.0, 27.9)	
Chui oblast	76	0	(0, 0)		12.3	(4.8, 28.3)		16.9	(10.3, 26.3)	
Bishkek city	90	0	(0, 0)		3.5	(1.0, 11.5)		7.3	(3.6, 14.4)	
Osh city	190	0	(0, 0)		3.2	(1.5, 6.6)		8.5	(4.3, 16.0)	
Wealth quintile										
Lowest	294	0.4	(0.1, 1.7)	0.448	11.8	(6.3, 21.0)	0.092	15.5	(11.1, 21.2)	0.329
Second	272	0	(0, 0)		4.1	(2.4, 6.8)		13.3	(9.1, 18.9)	
Middle	274	0	(0, 0)		6.9	(3.9, 12.1)		16.3	(11.7, 22.3)	

Fourth	230	0	(0, 0)		7.1	(4.0, 12.3)		11.1	(7.0, 17.2)	
Highest	137	0.8	(0.1, 5.8)		5.1	(1.9, 12.7)		8.3	(4.3, 15.5)	
Household sanitation[g]										
Unadequate	187	0	(0, 0)	0.472	1.4	(0.4, 4.8)	0.002	10.6	(6.2, 17.7)	0.306
Adequate	1019	0.2	(0.1, 0.7)		8.3	(5.9, 11.5)		14.2	(11.8, 17.0)	
TOTAL	**1211**	**0.2**	**(0.1, 0.6)**		**7.1**	**(5.1, 9.9)**		**13.6**	**(11.4, 16.1)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Severe anemia: <70 g/L, moderate anemia: 70-99 g/L, mild anemia: 100-109 g/L; all adjusted for altitude.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field.

8.3. ADDITIONAL SCHOOL CHILD TABLES

Table 91. Proportion of mild, moderate and severe anemia in school children 5-9 years of age, the Kyrgyz Republic 2021

Characteristic	N	Severe anemia			Moderate anemia			Mild anemia		
		%[a, b]	(95% CI)[c]	p-value[d]	%[a, b]	(95% CI)[c]	p-value[d]	%[a, b]	(95% CI)[c]	p-value[d]
Age Group (in months)										
5	274	0	(0, 0)	0.759	8.0	(5.2, 12.3)	<0.05	7.7	(4.5, 12.8)	<0.005
6	289	0	(0, 0)		3.8	(2.1, 7.0)		3.9	(2.0, 7.5)	
7	275	0.2	(0, 1.3)		4.3	(2.2, 7.9)		1.7	(0.9, 3.2)	
8	282	0	(0, 0)		2.4	(0.9, 6.4)		1.0	(0.3, 3.6)	
9	279	0	(0, 0)		3.1	(1.6, 6.1)		3.0	(1.4, 6.2)	
Sex										
Male	697	0	(0, 0)	0.326	3.7	(2.3, 5.8)	0.272	4.0	(2.6, 6.2)	0.329
Female	700	0.1	(0, 0.5)		4.9	(3.1, 7.6)		2.9	(1.8, 4.6)	
Residence										
Urban	473	0.1	(0, 0.9)	0.125	4.8	(3.0, 7.5)	0.671	3.8	(2.2, 6.6)	0.634
Rural	928	0	(0, 0)		4.1	(2.5, 6.7)		3.3	(2.2, 4.7)	

Region										
Batken oblast	220	0	(0, 0)	0.385	1.7	(0.7, 4.2)	0.648	2.6	(1.0, 6.3)	<0.01
Jalal-Abad oblast	165	0	(0, 0)		3.8	(1.9, 7.6)		0.5	(0.1, 3.6)	
Issyk-Kul oblast	151	0	(0, 0)		6.9	(3.3, 14.0)		2.8	(1.1, 7.0)	
Naryn oblast	164	0	(0, 0)		7.0	(3.8, 12.6)		4.1	(1.7, 9.5)	
Osh oblast	203	0	(0, 0)		4.8	(2.1, 10.6)		3.5	(1.8, 6.7)	
Talas oblast	160	0.6	(0.1, 4.4)		2.5	(1.0, 5.7)		11.7	(6.0, 21.7)	
Chui oblast	103	0	(0, 0)		5.0	(1.3, 17.1)		4.5	(1.9, 10.0)	
Bishkek city	83	0	(0, 0)		3.8	(1.5, 9.5)		3.2	(1.0, 10.0)	
Osh city	152	0	(0, 0)		2.9	(1.1, 7.6)		3.1	(1.4, 6.8)	
Wealth quintile										
Lowest	402	0.1	(0, 1.0)	0.934	3.4	(1.9, 6.1)	0.692	4.1	(2.4, 6.8)	0.208
Second	318	0	(0, 0)		4.5	(2.6, 7.8)		4.6	(2.4, 8.8)	
Middle	310	0	(0, 0)		5.7	(2.7, 11.4)		2.0	(0.8, 4.9)	
Fourth	239	0	(0, 0)		3.4	(1.6, 6.9)		4.3	(2.1, 8.4)	
Highest	127	0	(0, 0)		4.7	(2.0, 10.9)		0.7	(0.2, 3.0)	
Household sanitation[g]										
Unadequate	212	0	(0, 0)	0.682	1.3	(0.4, 4.0)	<0.05	2.4	(1.0, 5.7)	0.385
Adequate	1180	0	(0, 0.3)		4.8	(3.3, 7.0)		3.6	(2.6, 5.0)	
ALL CHILDREN	**1401**	**0**	**(0, 0.3)**		**4.3**	**(3.0, 6.2)**		**3.4**	**(2.5, 4.7)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Severe anemia: <80 g/L, moderate anemia: 80-109 g/L, mild anemia: 110-115 g/L; all adjusted for altitude.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field.

8.4. ADDITIONAL ADOLESCENT GIRL TABLES

Table 92. Proportion of mild, moderate and severe anemia in adolescent girls 10-18 years of age, the Kyrgyz Republic 2021

Characteristic	N	Severe anemia			Moderate anemia			Mild anemia		
		%[a, b]	(95% CI)[c]	P value[d]	%[a, b]	(95% CI)[c]	P value[d]	%[a, b]	(95% CI)[c]	P value[d]
Age Group (in years)										
10-12	374	1.1	(0.0, 3.1)	0.237	3.0	(1.5, 5.8)	<0.001	3.6	(1.6, 8.0)	<0.05
13-15	309	0	(0, 0)		8.0	(5.0, 12.5)		9.9	(6.9, 14.0)	
16-18	175	0.8	(0.1, 5.8)		13.6	(8.1, 21.8)		9.7	(5.7, 16.2)	
Residence										
Urban	262	0.3	(0, 1.8)	0.256	6.9	(4.0, 11.6)	0.984	7.7	(4.1, 14.1)	0.754
Rural	596	0.8	(0.3, 2.1)		6.8	(4.6, 10.0)		6.9	(4.8, 9.8)	
Region										
Batken oblast	104	0	(0, 0)	0.714	6.6	(3.1, 13.5)	0.645	9.3	(4.4, 18.5)	0.838
Jalal-Abad oblast	112	1.6	(0.4, 5.9)		8.2	(3.7, 17.1)		6.2	(3.4, 11.1)	
Issyk-Kul oblast	89	0	(0, 0)		9.3	(4.6, 18.0)		7.4	(2.4, 20.9)	
Naryn oblast	156	1.2	(0.3, 4.8)		7.7	(4.4, 13.0)		7.0	(4.2, 11.5)	
Osh oblast	121	0.8	(0.1, 5.4)		3.4	(1.1, 9.8)		4.4	(2.1, 9.1)	
Talas oblast	84	0	(0, 0)		4.9	(2.1, 10.6)		11.6	(5.0, 24.6)	
Chui oblast	63	0	(0, 0)		9.4	(4.0, 20.5)		8.9	(3.6, 20.4)	
Bishkek city	35	0	(0, 0)		6.8	(2.1, 19.9)		8.7	(1.7, 34.0)	
Osh city	94	1.4	(0.2, 9.8)		5.3	(2.4, 11.5)		6.1	(2.4, 14.0)	
Wealth quintile										
Lowest	262	0.6	(0.1, 4.0)	0.714	6.7	(4.1, 10.9)	0.071	7.0	(4.0, 11.8)	0.693
Second	201	0.7	(0.1, 4.8)		11.7	(6.8, 19.5)		5.6	(3.2, 9.7)	
Middle	154	1.3	(0.3, 5.0)		2.9	(1.1, 7.0)		10.5	(5.8, 18.0)	
Fourth	147	0	(0, 0)		6.1	(2.7, 13.6)		6.3	(3.2, 12.1)	
Highest	85	0.7	(0.1, 4.9)		4..3	(1.3, 13.5)		6.9	(1.5, 27.1)	
Household sanitation										
Yes	119	2.3	(0.6, 8.4)	<0.05	3.7	(1.1, 11.5)	0.251	4.3	(1.7, 10.3)	0.223
No	734	0.4	(0.1, 1.3)		7.4	(5.0, 10.3)		7.6	(5.5, 10.5)	

TOTAL	**852**	**0.6**	**(0.3, 1.6)**		**6.8**	**(4.9, 9.4)**		**7.1**	**(5.2, 9.7)**

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among regions.

[b] < 12 years: Severe anemia: <80 g/L, moderate anemia: 80-109 g/L, mild anemia: 110-115 g/L; ≥12 years: Severe anemia: <80 g/L, moderate anemia: 80-109 g/L, mild anemia: 110-119 g/L; all adjusted for altitude.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field.

8.5. ADDITIONAL WOMAN TABLES

Table 93. Proportion of mild, moderate, and severe anemia in non-pregnant women (15-49 years), the Kyrgyz Republic 2021

Characteristic	N	Severe anemia			Moderate anemia			Mild anemia		
		%[a, b]	(95% CI)[c]	P value[d]	%[a, b]	(95% CI)[c]	P value[d]	%[a, b]	(95% CI)[c]	P value[d]
Age Group (in years)										
15-19	281	0.5	(0.1, 3.4)	0.128	13.0	(8.7, 18.9)	0.436	14.5	(10.4, 19.9)	0.083
20-29	262	0.6	(0.1, 2.5)		8.2	(5.2, 12.8)		13.8	(9.4, 19.7)	
30-39	375	0.6	(0.2, 1.6)		11.9	(8.5, 16.3)		15.4	(11.9, 19.6)	
40-49	285	2.1	(0.9, 4.9)		11.7	(8.4, 16.2)		8.2	(5.4, 12.2)	
Residence										
Urban	471	0.9	(0.3, 2.8)	0.989	12.3	(9.2, 16.3)	0.463	11.8	(8.9, 15.5)	0.340
Rural	732	0.9	(0.5, 1.8)		10.7	(8.3, 13.7)		13.9	(11.3, 17.0)	
Region										
Batken oblast	140	1.4	(0.4, 5.5)	0.501	10.2	(5.8, 17.2)	0.133	21.2	(13.9, 31.1)	0.297
Jalal-Abad oblast	145	1.2	(0.3, 4.6)		7.5	(3.8, 14.4)		14.3	(8.7, 22.6)	
Issyk-Kul oblast	120	2.6	(0.9, 7.3)		16.7	(9.5, 27.7)		15.5	(10.0, 23.2)	
Naryn oblast	147	1.3	(0.4, 4.8)		14.2	(8.1, 23.8)		17.0	(12.8, 22.2)	
Osh oblast	150	0	(0, 0)		7.6	(4.5, 12.5)		9.8	(5.9, 15.8)	
Talas oblast	123	1.5	(0.4, 5.8)		18.7	(12.1, 27.7)		11.9	(6.6, 20.4)	
Chui oblast	93	0.8	(0.1, 5.8)		10.4	(5.9, 17.6)		12.6	(8.2, 18.8)	
Bishkek city	133	0.6	(0.1, 3.8)		14.7	(9.2, 22.6)		10.8	(6.8, 16.8)	
Osh city	152	0.6	(0.1, 4.5)		13.1	(8.2, 20.1)		13.0	(8.6, 19.2)	

Wealth quintile										
Lowest	279	1.8	(0.8, 4.2)	0.315	15.0	(10.6, 20.8)	0.195	11.6	(7.9, 16.7)	0.192
Second	266	0.8	(0.3, 2.3)		12.5	(8.5, 17.9)		18.3	(13.1, 24.9)	
Middle	228	0.5	(0.1, 3.4)		7.2	(4.4, 11.6)		13.0	(8.7, 18.9)	
Fourth	235	1.3	(0.4, 4.6)		10.5	(7.0, 15.4)		12.2	(8.2, 17.7)	
Highest	191	0	(0, 0)		10.6	(5.9, 18.2)		10.0	(6.3, 15.7)	
Household sanitation										
Unadequate	184	2.2	(0.9, 5.8)	0.040	10.1	(6.2, 16.2)	0.680	12.3	(8.1, 18.2)	0.719
Adequate	1011	0.7	(0.3, 1.4)		11.3	(9.2, 13.9)		13.3	(11.1, 15.8)	
ALL WOMEN	**1203**	**0.9**	**(0.5, 1.6)**		**11.3**	**(9.3, 13.6)**		**13.1**	**(11.1, 15.5)**	

Note: The N's are the denominators for a specific sub-group. Subgroups that do not sum to the total have missing data.

[a] All percentage estimates except region-specific estimates are weighted for unequal probability of selection among regions.

[b] Severe anemia: <80 g/L, moderate anemia: 80-109 g/L, mild anemia: 109-119 g/L; all adjusted for altitude.

[c] CI=confidence interval, calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush or pour flush toilet or pit latrine with slab not shared with another household. Inadequate sanitation= open pit, bucket latrine, hanging toilet/latrine, no facility, bush, field.

8.6. COMPARISON OF PLASMA RETINOL AND PLASMA RETINOL BINDING PROTEIN

Because retinol binding protein (RBP) is not a WHO-recommended biomarker for the assessment of vitamin A status [37], extra plasma specimens from children 6-59 months of age, children 5-9 years of age, and non-pregnant adolescent girls and women (AG-NPW) were analyzed for plasma retinol as a comparison and validations of RBP measurements. Analysis of plasma retinol was undertaken at two laboratories: 1) VitMin Lab (Freiburg, Germany), which is the same laboratory that measured RBP, and 2) the Swiss Nutrition and Health Foundation (SNH) laboratory (Lausanne, Switzerland), an independent laboratory that has a demonstratable external quality assurance track record of analyzing plasma retinol.

The VitMin Lab analyzed retinol using aliquots that had remaining plasma volume, and samples with remaining plasma volume were transported frozen by GroundWork using frozen salt water packs (-20°C) from VitMin Lab to SNH. As the transit time for the samples was very small (~4 hours) and the samples were frozen throughout, there was no risk of degradation. Furthermore, as the same aliquot was used for the measurement of both biomarkers, there is no possibility of labelling errors, which is a potential issue faced by other large-scale surveys that compare RBP and retinol results. In addition, both laboratories used the same analytic method (i.e., HPLC) to measure retinol concentrations in the plasma samples. As mentioned in Section 2.6.2, RBP was measured using the ELISA technique by VitMin Lab.

Figure 31 below presents the correlation plot and regression equation comparing retinol and RBP for both children and women combined. The figure displays the Retinol/RBP comparisons that were conducted using results from the SNH and VitMin laboratories (SNH-VitMin) and the comparisons using the results from VitMin Lab alone (VitMin-Internal) for each population group. Using 136 cases (42 PSC, 50 SAC, 44 AG-NPW), we found a good correlation between RBP and plasma retinol values ($R2=0.84$). The estimated slope was 0.8025, showing that RBP values were consistently lower than their plasma retinol counterparts in both laboratories.

Based on these results, the vitamin A deficiency cut-off was adjusted for RBP. Using the WHO recommended cut-off [37] for retinol of 0.7 µmol/L and the regression equation in Figure 31, the RBP cut-off was calculated to be 0.56885 µmol/L [(0.8025 × 0.7) + 0.0071 = 0.56885].

Similar results were obtained when a regression equation was calculated separately for each laboratory comparison (i.e., SNH-VitMin or VitMin-Internal), resulting in RBP cut-offs of 0.555 0.590 μmol/L, respectively.

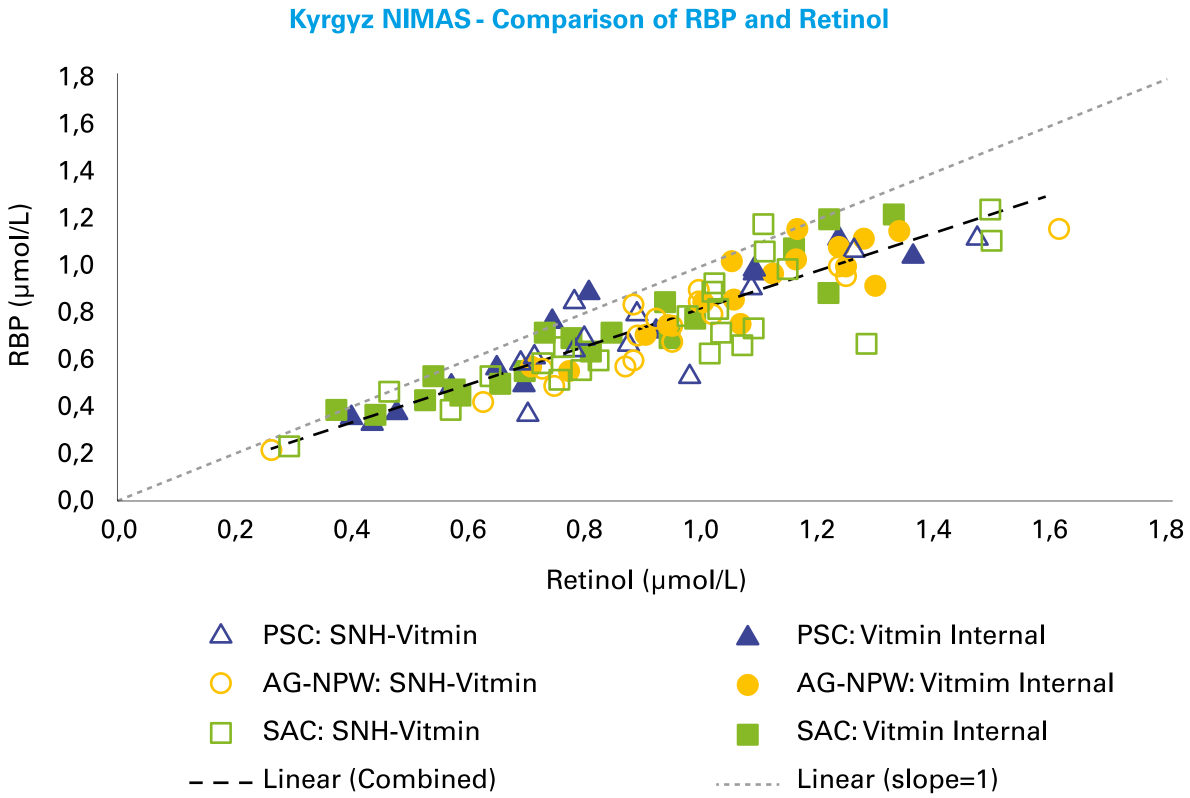


Figure 31. Combined comparison of retinol and retinol binding protein concentrations in children 6-59 months of age (PSC), children 5-9 years of age (SAC), and adolescent girls and non-pregnant women (AG-NPW), the Kyrgyz Republic 2021

8.7. HEMOGLOBIN COMPARISON – HEMOCUE 301 AND COMPLETE BLOOD COUNT

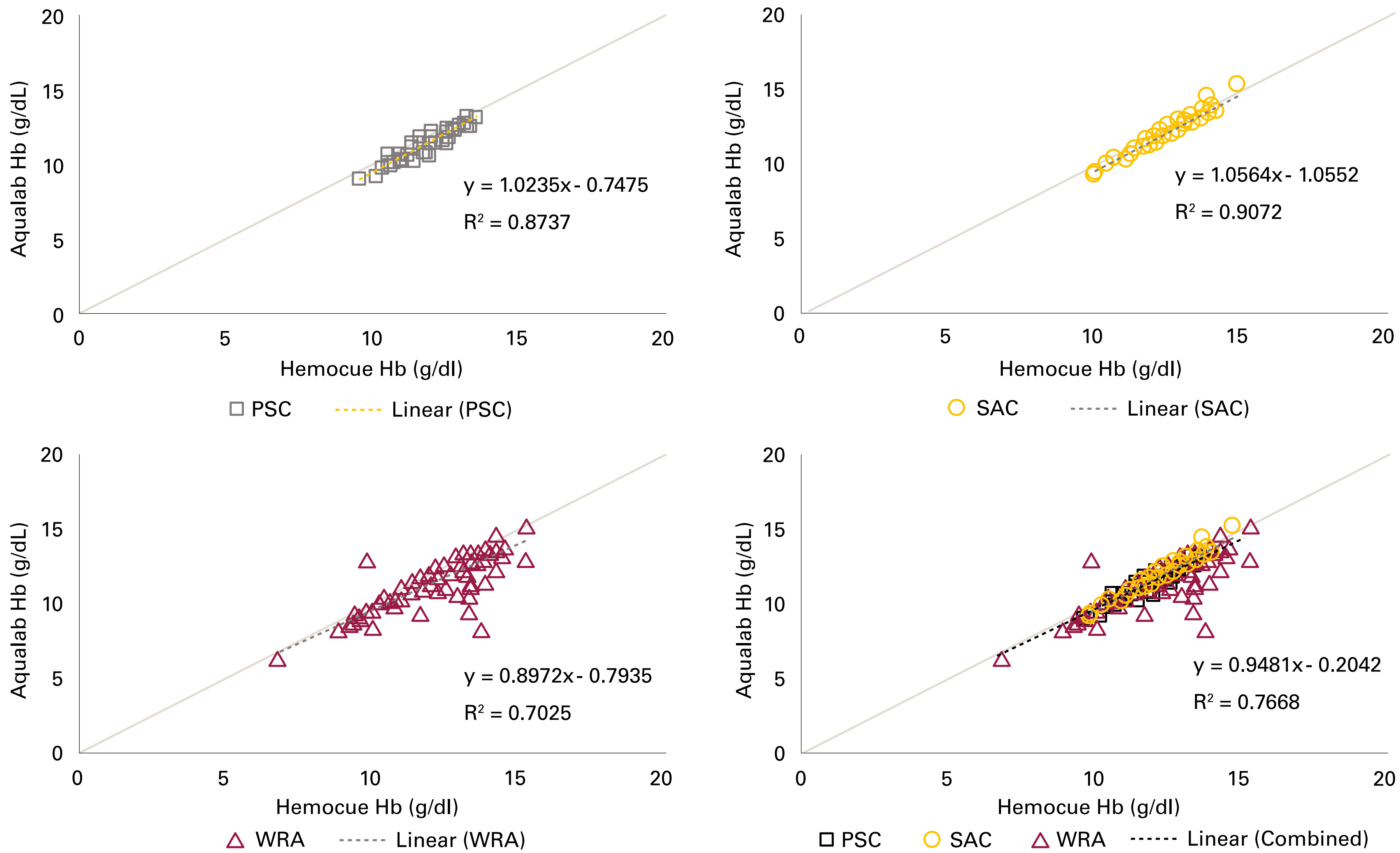


Figure 32. Comparison of hemoglobin measured using Hemocue 301 and complete blood count in in children 6-59 months of age (PSC), children 5-9 years of age (SAC), and women of reproductive age (WRA), the Kyrgyz Republic 2021

8.8. A PRIORI SAMPLE SIZE CALCULATIONS

Table 93 shows the precision that will be obtained for stratum specific and national anemia estimates with the planned sample size of 3465 households selected for the survey if the assumptions regarding the anemia prevalence hold true. Estimated prevalence and design effect are from most recently available data. These estimates assume a design effect of 1.5 and the recruitment of children 6-59 months of age, school children and adolescent girls in all selected households. Non-pregnant women will only be enrolled in every second household.

Table 94.Assumptions and results of sample size calculation, including conversion to number of households, and the anemia precision obtained by the planned sample size of 3465 households, by target group, taking into account household and individual response rates

	# HHs selected	# HHs consen-ting	# PSC in enrolled HHs	Anemia precision PSC	# NPW in enrolled HHs	Anemia precision NPW	# PW in enrolled HHs	Anemia precision PW	# SAC in enrolled HHs	Anemia precision SAC	# AG in enrolled HHs	Anemia precision AG
Bishkek city	555	513	133	±11.1	332	±9.2	37	--	133	±10.5	89	±12.6
Batken oblast	330	310	196	±9.2	263	±10.4	23	--	174	±9.0	86	±12.6
Chui oblast	375	366	146	±10.4	267	±10.4	27	--	161	±9.8	91	±12.6
Jalal-Abad oblast	375	372	219	±7.9	305	±9.4	27	--	184	±8.6	98	±11.6
Naryn oblast	345	332	154	±10.2	247	±10.9	24	--	174	±9.4	109	±11.5
Osh oblast	360	354	234	±8.1	353	±9.1	26	--	215	±8.1	144	±9.9
Talas oblast	300	299	159	±9.9	233	±11.3	22	--	190	±9.4	98	±12.3
Issyk-Kul oblast	405	404	150	±10.4	271	±10.6	29	--	200	±9.2	118	±11.3
Osh city	420	407	222	±7.4	355	±7.1	30	--	203	±6.7	94	±9.6
NATIONAL	3465	3358	1615	±3.9	2627*	±3.4	245	±8.2	1634	±3.2	927	±4.1

* NPW only enrolled in every second household. Estimated number of eligible NPW is 1313.

**Estimated prevalence and design effect are from most recently available data or, if data not available, 50% prevalence was assumed to maximize sample size

***The required number of children, adolescent girls and women was converted to the number of households to select. The number of households selected per stratum was based on stratum specific household sizes, household compositions and respond rates reported by the MICS 2018.

8.9. ETHICAL APPROVAL

ВЫПИСКА ИЗ ПРОТОКОЛА № 4

заседания этического комитета при НПО «Профилактическая медицина»
от 09 июня 2021 года.

Председатель – Байызбекова Д.А., д.м.н., профессор.
Секретарь – Мергенова И.О.

В заседание принимали участие 8 членов ЭК.

Повестка дня:
Вопрос №3: обсуждение этической экспертизы пакетов документов на проведение научно-исследовательской работы «Национальное комплексное исследование по содержанию микронутриентов и антропометрическим показателям в Кыргызской Республике (НКИСМАП 2021)» (этическая экспертиза представлена – Мергеновой И.О.)

Пакет документов на этическую экспертизу для проведения научно-исследовательской работы **«Национальное комплексное исследование по содержанию микронутриентов и антропометрическим показателям в Кыргызской Республике (НКИСМАП 2021)»** экспертом был получен 20.05.2021 г.

Заявитель: Детский Фонд ООН в Кыргызской Республике (ЮНИСЕФ).
Данное исследование будет проводиться ЮНИСЕФ совместно с партнерами по развитию (Всемирная продовольственная программа ООН (ВПП ООН), Продовольственная и сельскохозяйственная организация ООН (ФАО) Кыргызстан, ВОЗ, MercyCorps (Мерсико), Проект USAID «Advancing Nutrition» поддерживают Министерство здравоохранения и социального развития Кыргызской Республики в проведении комплексного исследования состояния питания детей, девочек подростков и женщин репродуктивного возраста.
Финансирующие агентства: ЮНИСЕФ Кыргызстан, ЮСАИД, ВПП, ФАО, Mercy Corps (Мерсико), Проект USAID «Advancing Nutrition» в Кыргызской Республике.
Исполнительные агентства: Министерство здравоохранения и социального развития Кыргызской Республики, Детский Фонд ООН (ЮНИСЕФ) Кыргызстан, Всемирная продовольственная программа ООН (ВПП ООН) Кыргызстан, Всемирная Организация Здравоохранения (ВОЗ) Кыргызстан, Продовольственная и сельскохозяйственная организация ООН (ФАО) Кыргызстан Mercy Corps (Мерсико), Проект USAID «Advancing Nutrition» в Кыргызской Республике.
Местные партнеры: Национальный центр охраны материнства и детства при МЗ и СР КР
Техническая поддержка/экспертиза: Компания GroundWork, Швейцария

Период исследования начиная с запуска декабрь 2020- 2022гг.

На этическую экспертизу представлен следующий пакет документов:
1. Сопроводительное письмо – 1 стр.
2. Протокол исследования «Национальное комплексное исследование по содержанию микронутриентов и антропометрическим показателям в Кыргызской Республике (НКИСМАП 2021)», получен 04.06.2021 г. -44 стр.
3. Приложение 11: Информация для участников и форма согласия- Информированый лист (остается у участника) опрос -2 стр.
4. Информационный лист (для участника опроса)-3 стр.
5. НИСМАП-ФОРМА НАПРАВЛЕНИЯ УЧАСТНИКА- 2 стр.

6. Биологическая форма –женщина/девочка –подросток -2 стр.
7. Биологическая форма- ребенок-6-59 месяцев -2стр.
8. Биологическая форма- ребенок 5-9 лет-2стр.
9. НКИСМАП 2021 КР- вопросник для женщины и девочки-подростка (10-49 лет) -11стр.
10. НКИСМАП КР -вопросник для ребенка- (в возрасте 6-59 месяцев) - 14стр
11. НКИСМАП КР -вопросник для ребенка- (5-9 лет) - 9стр.
12. НКИСМАП КР- вопросник для домохозяйств -22стр.
13. Резюме и копии дипломов членов исследовательской команды:

Главный исследователь - Бектурганов Улук-Бек Бектурсунович, заместитель министра здравоохранения и социального развития Кыргызской Республики;

Координатор исследования - Бермет Сыдыгалиева ЮНИСЕФ - координатор по вопросам здравоохранения и питания;

Соисследователи:

- Николай Петри, консультант – GroundWork;
- Рита Вегмюллер, консультант – GroundWork;
- Джеймс Вирт, консультант – GroundWork;
- Сабина Рустамова Алиева, консультант – GroundWork;
- Брэдли Вудрафф, консультант – GroundWork;
- Фабиан Ронер, консультант – GroundWork;
- Айнура Акматова, заведующая отделом общественного здравоохранения Управления организации медицинской помощи и общественного здравоохранения МЗ и СР КР;
- Бактыгуль Исмаилова, главный специалист отдела общественного здравоохранения, Управление организации медицинской помощи и общественного здравоохранения, МЗ и СР КР;
- Хилке Дэвид, заместитель Странового директора ВПП;
- Ума Кандалаева, Страновой директор, Mercy Corps (Мерсико;
- Уманкулова Жамал, Erfolg консалт, исследовательская компания, аналитик;
- Назгуль Абазбекова, Страновой директор, USAID /Проект «Advancing Nutrition»;
- Тиленбаева Нуршаим, Национальный сотрудник по вопросам охраны материнства и детства, ВОЗ;
- Кейго Обара, Специалист по продовольственной безопасности, ФАО.

Заключение о компетентности команды исследователей – Команда исследователей предоставила документы, подтверждающие достаточный уровень навыков для выполнения исследовательской работы.

Заключение по протоколу: анализ протокола «Национальное комплексное исследование по содержанию микронутриентов и антропометрическим показателям в Кыргызской Республике (НКИСМАП 2021)» содержит описание процедур соблюдение этики в социальных и медицинских исследованиях, конфиденциальность и добровольное согласие будут соблюдены и задокументированы для каждого, протокол содержит описание процедур соблюдения этики в отдельном разделе 5 «ЭТИЧЕСКИЕ АСПЕКТЫ И ПРОЦЕДУРЫ ПОЛУЧЕНИЯ СОГЛАСИЯ» участника. Конфиденциальность информации, полученной от респондентов, будет соблюдаться с особой тщательностью на всех этапах сбора, обработки и анализа данных. Идентификационные записи, как в электронном, так и в бумажном формате, будут постоянно храниться под замком и ключом (или паролем), а доступ буден предоставлен только определенным сотрудникам исследования. Конкретная идентифицирующая информация будет удалена из всех электронных баз данных, используемых группой управления исследованием для анализа данных и для представления баз данных национальным заинтересованным сторонам.

Заключение по инструментам: инструменты для проведения исследования представлены к протоколу исследования. Имеется Формы письменного согласия участника на участие в исследовании. Представленные формы анкет соответствуют требованиям конфиденциальности и не создают рисков для стигматизации.

Рекомендации: в процессе устного опроса детей, а также дети не достигшие несовершеннолетия, взять письменное согласие у родителей и опрос проводить в присутствии родителей детей, ЗАКОН КЫРГЫЗСКОЙ РЕСПУБЛИКИ «Об охране и защите прав несовершеннолетних» (В редакции Закона КР от 17 июля 2004 года № 90). Статья 26. Законные представители несовершеннолетнего).

Соглашение по мониторингу: заявитель в обязательном порядке должен предоставить заключительный информационно-аналитический отчет по завершению исследовательской работы, так же будут приветствоваться предоставление копий публикаций.

Заключение: Протокол проведения исследования «Национальное комплексное исследование по содержанию микронутриентов и антропометрическим показателям в Кыргызской Республике (НКИСМАП 2021)» соответствует международным этическим нормам проведения исследований, и может быть оценено этическим комитетом как *«одобрено»*.

Председатель ЭК,
д.м.н., профессор — **Байызбекова Д.А.**

Секретарь ЭК — **Мергенова И.О.**

8.10. INFORMATION SHEET AND CONSENT FORM

INFORMATION SHEET (FOR THE PARTICIPANT TO KEEP)

Title of Study:	National Integrated Micronutrient and Anthropometric Survey in the Kyrgyz Republic (NIMAS)
Principal Investigators:	Bermet Sydygalieva (UNICEF The Kyrgyz Republic)
Certified Protocol Number	ВЫПИСКА ИЗ ПРОТОКОЛА, No. 4

General Information

The National Integrated Micronutrient and Anthropometric Survey in the Kyrgyz Republic 2021 is conducted to understand the severity of various nutritional deficiencies, such as anemia, iron deficiency, vitamin A deficiency, and under- and overweight in children, adolescent girls and women. The survey is being conducted by UNICEF, World Food Programme, Mercy Corps, and GroundWork (a Swiss-based organization). The survey is supported by Ministry of Public Health of the Kyrgyz Republic.

We will ask questions about your household, and if there are selected children, adolescent girls or women living in the household, we will ask individual questions to better understand their person and their food habits.

We would very much appreciate your participation in this survey. This information will help the Government to plan health services. The questionnaire for you usually takes about 30 minutes to complete. Whatever information you provide will be kept strictly confidential and will not be shown to other persons.

Following the completion of the household and individual questionnaires, we will measure height and weight and request to draw a small amount of blood from all young children 6 to 59 months of age, school age children aged 5-9 years, adolescent girls 10-18 years of age and women 19-49 years of age in a dedicated place near your household. This small blood sample will be used to test each individual's anemia status, and these results will be provided to you directly. In addition, a small portion of blood will be collected to test for deficiencies in iron, folate, vitamin D, and vitamin A status; urine will be collected from adolescent girls and women to measure iodine concentration.

Further, we will take a salt sample to measure the iodine concentration in the salt and from some households a flour sample to measure iron concentration.

Benefits/Risk of the study

For children 6-59 months of age and school age children, 4 mL of blood will be collected. For adolescent girls and women, 6 mL of blood will be collected. Blood will be collected from the arm vein using a needle by trained technicians. The blood draw should take less than 5 minutes, and the anemia results will be provided in less than 5 minutes following the taking of blood, and should you be diagnosed with severe anemia, we will provide you with a referral to a nearby health facility for further testing and treatment. This survey poses no serious risks to you or other participating family members.

Other than the information about your hemoglobin levels and referral in case of diagnosis of severe anemia, we cannot promise that the survey will help you directly. But the information collected will help the Government to evaluate and improve its nutrition and health services.

Confidentiality

All information which is collected about you and your household during the course of the interview will be kept strictly confidential, and any information about you and the household address will not be included in the final report so that you cannot be recognized.

Only the personnel doing the interview and the principal researchers will have access to identifiable information and by providing your signature/thumbprint, you allow the research team to do so.

Compensation

Your participation in this interview is important and we do appreciate the time made available. As mentioned earlier, should you/your child be diagnosed with severe anemia or severe malnutrition, we will let you know and fill in a referral form for you to seek treatment. Further, your household will be compensated with 250 g of salt.

Withdrawal from Study

Participation in this survey is voluntary, and if we should come to any question you do not want to answer, just let me know and I will go on to the next question; or you can stop the interview at any time, without any consequences to you or your household. However, we hope that you will participate in this survey since your views are important. There will not be any negative effects on you, if you decide that you no longer want to continue with the interview.

If you are younger than 18 years, your legal parent will have to give signed consent for your participation. This information sheet will be for you/your caretaker to keep. If you have any question, do not hesitate to contact the principal researchers.

Contact for additional Information

If you have any questions about the study, you are welcome to call Mrs. Bermet Sydygalieva, from UNICEF Uzbekistan, who oversees this study, on +996 777919104 and she will be happy to answer your questions.

NIMAS - WRITTEN INFORMED CONSENT FORM

Complete this form for one person only;

do NOT put information from 2 or more people on the same form!!

VOLUNTEER AGREEMENT

a. Participation of individual below 18 years of age

"I have read or have had someone read all information on the information sheet, have asked questions, received answers regarding participation in this study, and am willing to give consent for my child/ward to participate in this study. I have not waived any of my rights by signing this consent form. Prior to signing this consent form, I was given a copy of the information sheet for my personal records."

____
Name of mother or legal caregiver (if respondent is a minor)

____ ____________________
Signature or mark of mother or legal caregiver *Date*

b. Adult woman's own participation

"I have read or have had someone read all information on the information sheet, have asked questions, received answers regarding participation in this study, and am willing to give consent to participate in this study. I have not waived any of my rights by signing this consent form. Prior to signing this consent form, I was given a copy of the information sheet for my personal records."

____
Name of participant

____ ____________________
Signature or mark participant *Date*

CLUSTER ID:	☐☐☐☐	**RESPONDENT Label:**	W☐☐☐☐
HH Label:	H☐☐☐☐	**RESPONDENT Label:**	S☐☐☐☐
		RESPONDENT Label:	P☐☐☐☐

If selected individual or caretaker of a minor (heretofore "volunteer") cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

____

Name of witness

______________________________ ______________

Signature of witness *Date*

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

______________________________ Interviewer ID ☐☐

Name of Interviewer who obtained Consent

______________________________ ______________

Signature of Interviewer who obtained Consent *Date*

8.11. AUTHORIZATION LETTER FROM MINISTRY OF HEALTH

КЫРГЫЗ РЕСПУБЛИКАСЫНЫН САЛАМАТТЫК САКТОО ЖАНА СОЦИАЛДЫК ӨНҮКТҮРҮҮ МИНИСТРЛИГИ

720040, Кыргыз Республикасы
Бишкек ш., Москва көчөсү, 148
Тел., факс: (0312) 66 07 17, тел.: 62 18 65
E-mail: mz@med.kg
р/с 4402011101027449 БИК 440001
Каттоо № СФ КР 01-0009315
Биринчи май районундук МСКБ 004
КРФМ Биринчи май райондук АБ
КРФМ Борбордук казыналыгы
ОКПО 00013014 ИНН 00610199210162

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ И СОЦИАЛЬНОГО РАЗВИТИЯ КЫРГЫЗСКОЙ РЕСПУБЛИКИ

720040, Кыргызская Республика
г. Бишкек, ул. Московская, 148
Тел., факс: (0312) 66 07 17, тел.: 62 18 65
E-mail: mz@med.kg
р/с 4402011101027449 БИК 440001
Регистрационный № СФ КР 01-0009315
УГНС Первомайского района 004
Первомайское районное ТУМФКР
Центральное казначейство МФКР
ОКПО 00013014 ИНН 00610199210162

18.08.2021 № 06-1/5-9600
__________ № __________ катка

Полномочным представителям Президента Кыргызской Республики в областях
Мэрия г. Бишкек, Мэрия г. Ош

В настоящее время в Кыргызской Республике реализуются Государственная программа по охране здоровья населения и развитию системы здравоохранения на 2019-2030 годы «Здоровый человек – процветающая страна» (постановление Правительства Кыргызской Республики от 20 декабря 2018 года № 600) и Государственная программа по продовольственной безопасности и питанию на 2019-2023 гг. (постановление Правительства Кыргызской Республики от 27 июня 2019 года № 320), в которых улучшение питания детей первых пяти лет жизни, девочек подросткового возраста и женщин детородного возраста признано приоритетным направлением.

В целях реализации вышеуказанных постановлений Министерство здравоохранения и социального развития Кыргызской Республики проводит национальное комплексное исследование состояния питания определенных подгрупп населения совместно с партнерами по развитию (ЮНИСЕФ, ВПП, ФАО, ВОЗ, Мерсико, «Мыкты Азыктануу»/ЮСАИД).

Цели и задачи исследования включают оценку состояния питания и микронутриентного статуса среди детей, девочек -подростков, небеременных женщин репродуктивного возраста и беременных женщин, оценку практики кормления детей грудного и раннего возраста, оценку относительной важности выборочных вероятных причин анемии, оценку потребления обогащенных продуктов питания и оценку эффективности национальных программ обогащения продуктов питания.

Полевые работы по исследованию запланированы в период с 13 сентября по 22 ноября 2021 года и будут охвачены население 269 сел и 13 городов. В связи с чем, просим оказать содействие в проведении настоящего исследования.

Заместитель министра **У. Бектурганов**

Исмаилова Б.А. 624439

010846 *

8.12. TEAMS, TEAM MEMBERS, AND SUPERVISORS

Stratum	Supervisors	Team Number	Team leader	Interviewers	Anthropometrist	Phlebotomist
Batken oblast			Babakulova Maatkaziev	B. Suyuyunova, M. Millaeva, Nooruz Madimarov, Meerim Ashirali, Ismatulaeva, D. Joosheva, Kanzada, R. Topchilova, N.Eralieva, M. Ormonova, Z. Anarbayeva,A. Saykalova, M. Polotova, Subakulova, Baymuratova, M. Baratova, B. Kamchieva, Daleyva, Toychieva.	O. K. Ismanovna	D. Chalbaeva
Jalal-Abad oblast				A.Tolgunbaeva, A. Seyitova, M. Toktorova, G. Khyrmamatova, Z. Shamshidinova, F. Abdrakhmanova, B. Bazarkulova, G. Aserbekova, K. Shamuratova, T. Usupbekova, K. Moldalieva, Z. Israilshanova, Z. Ryskulova, G. Atembekova, A. Chotonova, M. Kuzieva, N. Ubraimaliyeva, Z. Matieva, C. Yndiyeva, C. Karmysheva, G. Namanova, B. Temirova, N. Borubaeva, G. Abdymomunova.	I. G. Aleksandrovich	G.S Seydakmatova
Issyk-Kul oblast				A. Dyushebayeva, B. Mambetov, M. Dumanaeva, V, Sydykova, G. Gurinova. B. Omurakanova, T. Tyulegenov, Z. Sansyzbayeva, A. Kerimova, A. Kurmanalieva, Z. Gorbunova, D. Sultanaliyeva, A. Mamytova, M. Abdullayeva, M. Adilbekova, C. Baizakova	G.S. Sydygalieva	Z. Cholponbaeva
Naryn oblast				G. Zhumvayeva, G. Akmatova, Z. Duishebayeva, B. Mambetkulova, S. Tokoy Kyzy, G. Nazarmmambetova,	A.I. Idrisova	N. Toktaliyeva

				N. Mambetalieva, R. Abrazakova, S. Moldobaeva, A. Moldogazieva, Z. Koboeva, G. Gulyashova, M. Myrzakanova, S. Zhusupbekova, V. Kadieva, K. Kockonbaeva, N. Akylbek, Z. Iskakova, Z. Kasymova, A. A. Turganbaeva, N. Beishkeeva, G. Kalyeva.		
Osh oblast				K. Sadykova, U. Buranova, R. Abdullayeva, Z. Dukenbaeva, B. Rakhimbayeva, A. Mahabat, E. Umarova, T. Mukashova, A. Syrdalieva, G. Kamalova, M. Abdullaeyva, M. Nazhimova, N. Toyaly, R. Zhakypova, M. Razzakova, T. Koibagarocv, A. Samiev, B. Kaznagiyeva, U. Aftandilova, T. Otonova, N. Matraimova, M. Urazaliyeva, S. Saparova.	V.B. Torobaev	I.A. Mamademinova
Talas oblast				G. Duishenalieva, A. Bolotbekova, G. Abdrakhmanova, E. Askarbekova, R. Satymkulova, N. Kutmanova, G. Omusheva, J. Imanova, S. Alymkulova, Z. Batyrbekova, T. Kozhobekova, Z. Beisobayeva, A. Shabdanova, A. Abdrakhmanova, D. Estebesova, D. Chormonova, A. Akisheva, Z, Tazamieva.	M.T. Akmatova	A. Shabdanbekova
Chui oblast				B. Omuralieva, N. Toktogulova, E. Iskakova, K. Doolokeeva, N. Kalpayeva, N. Bazarbek, S. Aliyeva, M. Zhusupova, A. Ikanova, A. Sharsheeva, A. Attokurova, Z. Kubatbekova, S. Tezekbayeva, A. Anepova, Z. Dzhakshybayeva, T. Bozterieva, R. Adylbekova, N. Sarybayeva, G. Alymbekova,	A.T. Matkeeva	A. Rysbekova

				M. Dzhumabayeva, B. Satybaldieva, K. Tynalieva, N. Gavrilova, R. Baysalbayeva, K. Radjabov.		
Bishkek city				Z. Kazieva, A. Almanbetva, Z. Abylbayeva, A. Satarova, A. Taichieva, M. Tilenbaeva, C. Imankanova, N. Zhientaeva, N. Zhikentayeva, A. Musurova, Kaikieva, N. Kurzhunbaeva, N. Kurmankulova, N. Beksultanova, C. Abdykerimova, G. Niyazova, S. Malbaeva, Mamasaitova, N. Kamenikova, F. Batyr, R. Tookeeva, A. Osmonkulova, K. Zhunusalieva, Aidarova, Kenzhebayeva, Zhuraeva, Toktogulova, B. Asel, Kurmanbekova, M. Taabaldiyeva, A. Derkenbayeva, Rakhmatildaeva, M. Aitkulova, G. Monkoeva, Makambayeva, Mirdzhalilova.	E.K. Zhumalieva	N. Beishebayeva Maatkazievna
Osh city				C. Abdraimova, Z. Kazakbaeva, A. Monokbayeva, N. Tugolova, B. Shankaeva, D. Arapova, M. Kirgizbaeva, S. Tursunova, Z. Matmusaeva, K. Baimaeva, S. Zulpieva, S. Gulamova, S. Masaitova, T. Madumarova, U. Nurperi, K. Tokoeva, K. Makhmudova, N. Tugolova, N. Ganieva.	M. Ibragimova	B. Akmatova

8.13. SURVEY QUESTIONNAIRES

NIMAS HOUSEHOLD QUESTIONNAIRE

Kyrgyz:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_household_questionnaire-kyr.pdf

Russian:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_household_questionnaire-ru.pdf

English:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_household_questionnaire.pdf

NIMAS CHILDREN 6-59 MONTHS QUESTIONNAIRE

Kyrgyz:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_preschool_children_questionnaire-kyr.pdf

Russian:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_preschool_children_questionnaire-en.pdf

English:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_preschool_children_questionnaire.pdf

NIMAS CHILDREN 5-9 YEARS QUESTIONNAIRE

Kyrgyz:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_school_age_children_questionnaire-kyr.pdf

Russian:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_school_age_children_questionnaire-ru.pdf

English:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_school_age_children_questionnaire.pdf

NIMAS WOMEN/ ADOLESCENT GIRLS QUESTIONNAIRE

Kyrgyz:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_women_questionnaire-kyr.pdf

Russian:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_women_questionnaire-ru.pdf

English:
https://groundworkhealth.org/wp-content/uploads/2022/10/nimas_women_questionnaire.pdf

NIMAS CHILDREN 6-59 MONTHS BIOLOGICAL FORM

Russian:
https://groundworkhealth.org/wp-content/uploads/2022/10/10.6_RU_NIMAS_PSC-biological-form-210918.pdf

English:
https://groundworkhealth.org/wp-content/uploads/2022/10/10.6_EN_NIMAS_PSC-biological-form-210918.pdf

NIMAS CHILDREN 5-9 YEARS BIOLOGICAL FORM

Russian:
https://groundworkhealth.org/wp-content/uploads/2022/10/10.7_RU_NIMAS_SAC-biological-form-210918.pdf

English:
https://groundworkhealth.org/wp-content/uploads/2022/10/10.7_EN_NIMAS_SAC-biological-form-210918.pdf

NIMAS WOMEN/ ADOLESCENT GIRLS BIOLOGICAL FORM

Russian:
https://groundworkhealth.org/wp-content/uploads/2022/10/10.5_RU_NIMAS_Woman-Adolescent-girl-biological-form-210918.pdf

English:
https://groundworkhealth.org/wp-content/uploads/2022/10/10.5_EN_NIMAS_Woman-Adolescent-girl-biological-form-210908.pdf

8.14. REFERRAL FORM

unicef

NIMAS REFERRAL FORM

The Ministry of Health of the Kyrgyz Republic and UNICEF are conducting a national micronutrient and anthropometry survey to better understand the various nutritional conditions, such as overweight and obesity, anemia, vitamin and mineral deficiencies in women, adolescent girls and children. As part of this, the hemoglobin concentration and anthropometric measurements are done in women 19-49 years old, pregnant women, adolescent girls 10-18 years old, school age children 5-9 years old and children 6-59 months.

Any individual found the severely anemic (<70 g/L for pregnant women and children 6-59 months of age; <80 g/L for school age children, adolescent girls and non-pregnant women) or any child (<-3 weight-for-height Z-scores) and pregnant women (MUAC< 23 cm) suffering from severe acute malnutrition are hereby referred to a health facility.

This referral is to inform the health facility about the results and possible treatment from on-site diagnostics:

Person is:

☐ Child 6-59m	☐ Child 5-9	☐ Adolescent girl 10-18y	☐ Non-pregnant woman 19-49y	☐ Pregnant girl/woman (any age)

Person's name: ______________________	**Person has severe anemia:** **Hemoglobin =** ______________g/L	☐ NO	☐ YES
Date: ______________________	**CHILDREN 6-59 months *ONLY*** **Weight-for-height Z-score <-3SD:**	☐ NO	☐ YES
Age: ______________________ Residence: ______________________	**CHILDREN 5-9 years or Adolescent girls:** **BMI-for-age Z-score <-3SD:**	☐ NO	☐ YES
Name of health post: ______________	**Pregnant women *ONLY*** **MUAC < 23 cm:**	☐ NO	☐ YES
	Name of referring nurse: ______________________ Phone of referring nurse: ______________________ Signature of referring nurse: ______________________		

8.15.ANTHROPOMETRY – NIMAS: ENA PLAUSIBILITY CHECK REPORT

Plausibility check for: NIMAS_Anthro ENA for PSC_v4.as

СтанYespт/рекоменYesции, исSехьзованные для расчета z-оценки: СтанYespты ВОЗ 2006/Standard/ Reference used for z-score calculation: WHO standards 2006

1. Overall data quality:

Criteria	Flags*	Unit	Excel.	Good	Accept	Problematic	Score
Flagged data (% of out of range subjects)	Incl	%	0-2.5 0	>2.5-5.0 5	>5.0-7.5 10	>7.5 20	0 (1.7 %)
Overall Sex ratio (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<=0.001 10	0 (p=0.899)
Age ratio(6-29 vs 30-59) (Significant chi square)	Incl	p	>0.1 0	>0.05 2	>0.001 4	<=0.001 10	0 (p=0.890)
Dig pref score - weight	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	0 (3)
Dig pref score - height	Incl	#	0-7 0	8-12 2	13-20 4	> 20 10	2 (9)
Standard Dev WHZ -	Excl	SD	<1.1 and	<1.15 and	<1.20 and	>=1.20 or	
-	Excl	SD	>0.9 0	>0.85 5	>0.80 10	<=0.80 20	0 (0.93)
Skewness WHZ	Excl	#	<±0.2 0	<±0.4 1	<±0.6 3	>=±0.6 5	0 (0.08)
Kurtosis WHZ	Excl	#	<±0.2 0	<±0.4 1	<±0.6 3	>=±0.6 5	0 (0.05)
Poisson dist WHZ-2	Excl	p	>0.05 0	>0.01 1	>0.001 3	<=0.001 5	0 (p=0.487)
OVERALL SCORE WHZ =			0-9	10-14	15-24	>25	2%

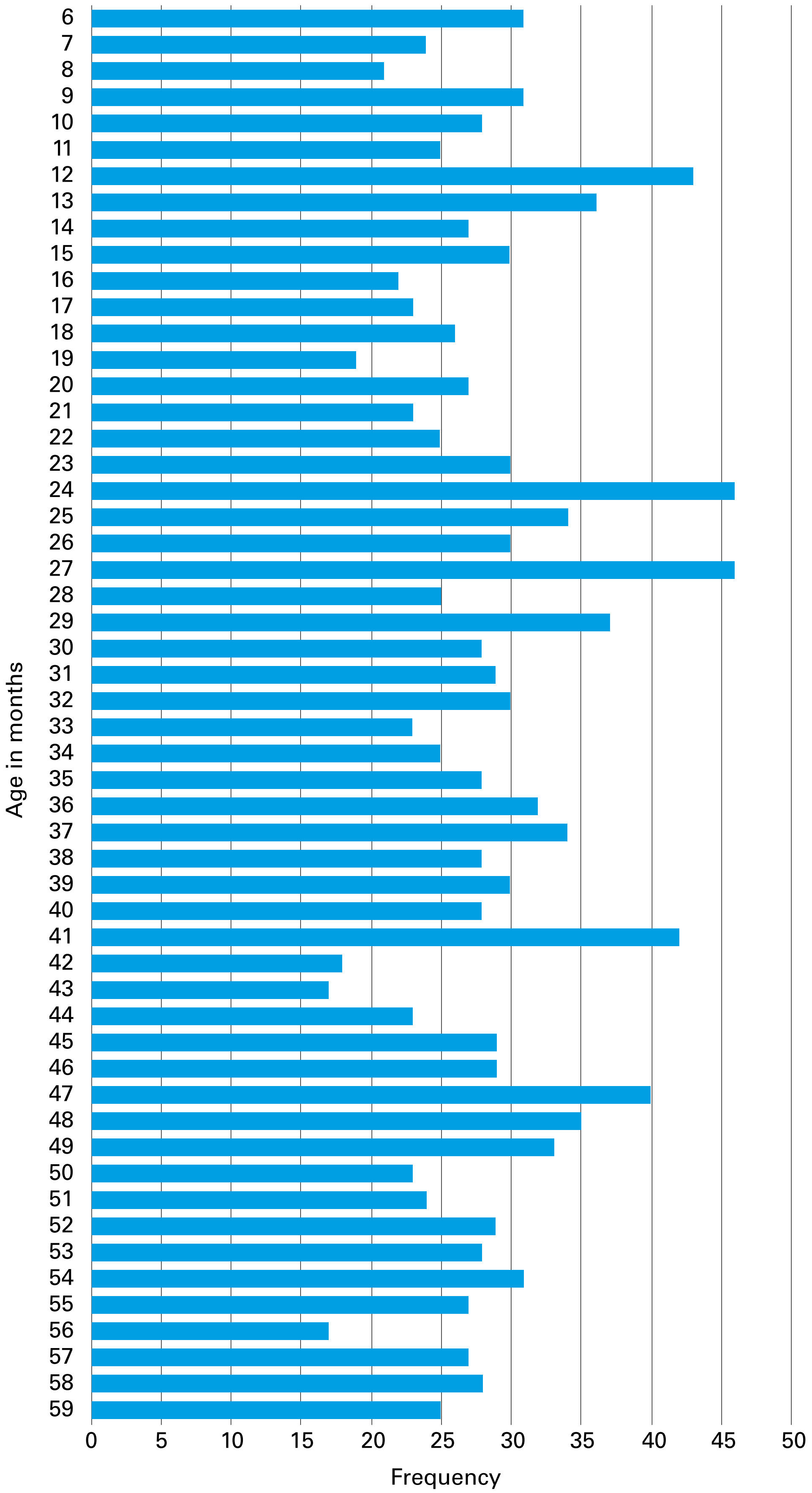
The overall score of this survey is 2 %, which is excellent.

2. Duplicate entries: There were no duplicate entries detected.

There were no duplicate entries detected.

3. Age distribution:

Age distribution for children 6-59 months of age, the Kyrgyz Republic 2021



Age ratio of 6-29 months to 30-59 months: 0.84 (The value should be around 0.85).:

p-value = 0.890 (as expected)

4. Statistical evaluation of sex and age ratios (using Chi squared statistic):

Age cat.	mo.	boys	girls	total	ratio boys/girls
6 to 17	12	176/179.5 (1.0)	165/180.7 (0.9)	341/360.2 (0.9)	1.07
18 to 29	12	176/173.3 (1.0)	192/174.4 (1.1)	368/347.6 (1.1)	0.92
30 to 41	12	166/169.7 (1.0)	191/170.8 (1.1)	357/340.4 (1.0)	0.87
42 to 53	12	188/167.0 (1.1)	140/168.0 (0.8)	328/335.0 (1.0)	1.34
54 to 59	6	66/82.6 (0.8)	89/83.1 (1.1)	155/165.7 (0.9)	0.74
6 to 59	54	772/774.5 (1.0)	777/774.5 (1.0)		0.99

The data are expressed as observed number/expected number (ratio of obs/expect)

Overall sex ratio: p-value = 0.899 (boys and girls equally represented)

Overall age distribution: p-value = 0.424 (as expected)

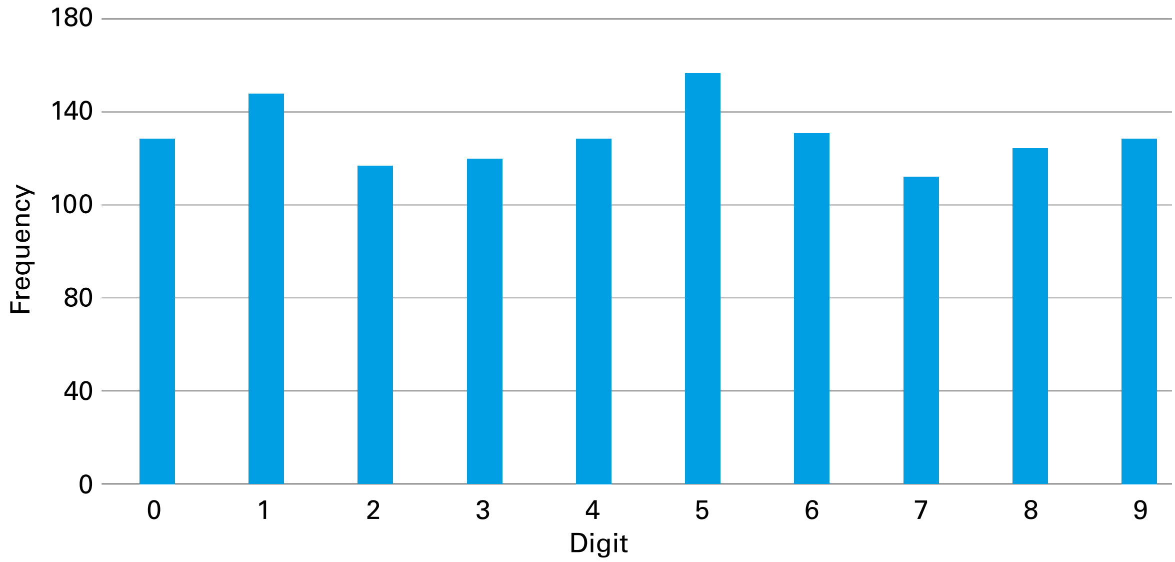
Overall age distribution for boys: p-value = 0.187 (as expected)

Overall age distribution for girls: p-value = 0.031 (significant difference)

Overall sex/age distribution: p-value = 0.002 (significant difference)

5. Digit preference Weight:

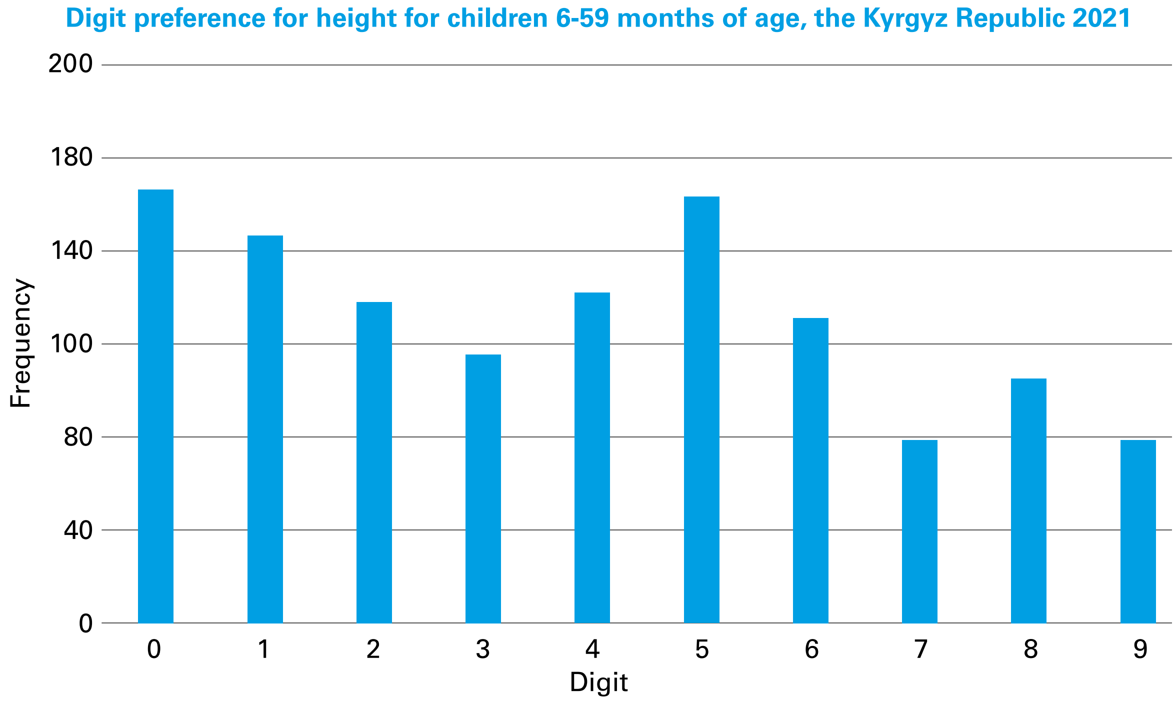
Digit preference for weight for children 6-59 months of age, the Kyrgyz Republic 2021



Digit preference score: 3 (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)

p-value for chi2: 0.410

6. Digit preference Height:



Digit preference score: 9 (0-7 excellent, 8-12 good, 13-20 acceptable and > 20 problematic)

p-value for chi2: 0.000 (significant difference)

Evaluation of Standard deviation, Normal distribution, Skewness and Kurtosis using the 3 exclusion (Flag) procedures

	no exclusion	exclusion from reference mean (WHO flags)	exclusion from observed mean (SMART flags)
WHZ			
Standard Deviation SD: (The SD should be between 0.8 and 1.2) Prevalence (< -2)	1.17	1.01	0.93
observed:	1.1%	1.0%	
calculated with current SD:	1.3%	0.6%	
calculated with a SD of 1:	0.5%	0.5%	
HAZ			
Standard Deviation SD: (The SD should be between 0.8 and 1.2) Prevalence (< -2)	1.46	1.28	1.04
observed:	7.5%	7.3%	6.8%
calculated with current SD:	13.8%	11.1%	7.8%
calculated with a SD of 1:	5.7%	5.8%	7.0%
WAZ			
Standard Deviation SD: (The SD should be between 0.8 and 1.2) Prevalence (< -2)	1.03	0.99	0.95
observed:	1.0%		
calculated with current SD:	1.7%		

calculated with a SD of 1:	1.5%		
Results for Shapiro-Wilk test for normally (Gaussian) distributed data:			
WHZ	p= 0.000	p= 0.000	p= 0.071
HAZ	p= 0.000	p= 0.000	p= 0.034
WAZ	p= 0.000	p= 0.000	p= 0.094
(If p < 0.05 then the data are not normally distributed. If p > 0.05 you can consider the data normally distributed)			
Skewness			
WHZ	2.24	-0.25	0.08
HAZ	1.36	0.87	0.15
WAZ	0.94	0.29	0.09
If the value is: • *below minus 0.4 there is a relative excess of wasted/stunted/underweight subjects in the sample* • *between minus 0.4 and minus 0.2, there may be a relative excess of wasted/stunted/underweight subjects in the sample.* • *between minus 0.2 and plus 0.2, the distribution can be considered as symmetrical.* • *between 0.2 and 0.4, there may be an excess of obese/tall/overweight subjects in the sample.* • *above 0.4, there is an excess of obese/tall/overweight subjects in the sample*			
Kurtosis			
WHZ	33.72	1.86	0.05
HAZ	12.65	2.71	-0.08
WAZ	7.03	0.61	-0.06
Kurtosis characterizes the relative size of the body versus the tails of the distribution. Positive kurtosis indicates relatively large tails and small body. Negative kurtosis indicates relatively large body and small tails. *If the absolute value is:* • *above 0.4 it indicates a problem. There might have been a problem with data collection or sampling.* • *between 0.2 and 0.4, the data may be affected with a problem.* • *less than an absolute value of 0.2 the distribution can be considered as normal.*			

8.16. DESIGN EFFECTS OF MAJOR OUTCOMES

Variable	Number in analysis	Design effect
Household		
Improved water source	3,060	6.96
Improved sanitation	3,058	2.29
Salt adequately fortified	2,863	1.45
Wheat flour fortified	704	1.66
Children 6-59 months of age		
Low birth weight	1,442	1.47
Had diarrhea in past 2 weeks	1,535	1.79
Had fever in past 2 weeks	1,544	1.82
Had LRI in past 2 weeks	1,546	1.93
Early initiation of breastfeeding	473	1.08
Currently breastfeeding	472	1.03
Minimum dietary diversity	489	1.45
Anemia	1,211	2.04
Iron deficiency	1,161	1.68
Vitamin A deficiency	1,161	1.75
Vitamin D deficiency	394	1.57
Children 5-9 years of age		
Low birth weight	1,508	1.33
Had diarrhea in past 2 weeks	1,729	1.55
Had fever in past 2 weeks	1,728	1.46
Had LRI in past 2 weeks	1,730	2.94
Minimum dietary diversity	1,730	1.71
Anemia	1,401	2.05
Iron deficiency	1,388	2.13
Vitamin A deficiency	1,388	2.15
Adolescent girls 10-18 years		
Took folic acid supplement in past 6 months	991	2.06
Took iron supplement in past 6 months	987	2.32
Took multi-vitamin supplement in past 6 months	990	1.57
Anemia	858	1.89
Iron deficiency	822	2.18
Vitamin A deficiency	822	1.56
Folate deficiency	824	1.87
Vitamin D deficiency	201	1.34
Non-pregnant women 15-49 years		
Took folic acid supplement in past 6 months	1,375	1.15
Took iron supplement in past 6 months	1,375	1.72
Took multi-vitamin supplement in past 6 months	1,371	1.85
Overweight or obesity	1,189	1.73
Anemia	1,203	1.66
Iron deficiency	1,149	1.99
Vitamin A deficiency	1,149	1.31

Folate deficiency	1,163	1.62
Vitamin D deficiency	315	1.34
Pregnant women		
Took folic acid supplement in past 6 months	171	1.38
Took iron supplement in past 6 months	171	1.21
Took multi-vitamin supplement in past 6 months	172	0.99
Undernutrition (i.e., MUAC<23 cm)	131	1.47
Anemia	140	1.22

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Wherever he lives.
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A future.
A fair chance.
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In more than 190 countries and territories.
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The furthest from help.
The most excluded.
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And never give up.

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