Ministry of Health
Republic of Tajikistan

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Micronutrient Status Survey in Tajikistan, 2009

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September 2010

Abbreviations

AAH	Action Against Hunger
ACC/SCN	Administrative Committee on Coordination/Subcommittee on Nutrition
AKHS	Aga Khan Health Services
BMI	Body mass index
CED	Chronic energy deficiency
CRP	C-reactive protein
DQA	Data quality audit
DRD	Direct Rule District (former Rayons of Republican Subordination)
ECCD	Early Childhood Care and Development
ELISA	Enzyme-linked immunosorbent assay
GAM	Global acute malnutrition (low weight-for-height)
GBAO	Gorno-Badakhshan Autonomous Oblast
GCM	Global chronic malnutrition (low height-for-age)
Hb	Haemoglobin
ICF	Informed consent form
IDA	Iron deficiency anaemia
IDD	Iodine deficiency disorders
IMCI	Integrated Management of Childhood Illnesses
INRAN	National Institute for Research on Food and Nutrition
MICS	Multi Indicator Cluster Survey
MNSS	Micronutrient Status Survey
MoH	Ministry of Health
NCHS	National Centre for Health Statistics
QA	Quality assurance
QC	Quality control
PPM	parts per million
RFP	Request for proposals
SCIH	Swiss Centre for International Health
SD	Standard deviation
SHL	Survey household list
SPMU	Systems Performance and Monitoring Unit
SPSS	Statistical Package of Social Sciences
sTfR	Serum transferrin free receptor
STI	Swiss Tropical Institute
TLSS	Tajikistan Living Standard Survey
TMB	Tetramethylbenzidine
ToR	Terms of reference
UI	Urinary iodine
UIE	Urinary iodine excretion
UNICEF	United Nations Children's Fund
USI	Universal salt iodization
WFP	World Food Program
WHO	World Health Organization
WRA	Women of reproductive age (15-49 yrs)

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Foreword

Good nutrition is key to helping children stay healthy, productive, and able to learn. Thus, good nutrition benefits families, communities, and the country as a whole.

Over the last years Tajikistan has made significant progress in nutrition related areas. The most remarkable achievement is the decrease in the proportion of anaemic women – a good indicator of the nutrition status of mothers – from 41.2 per cent in 2003 to 24.2 per cent in 2009. Another notable achievement is the reduction in stunting among children from 36 per cent in 2005 to 28.9 per cent in 2009. In addition, the number of households consuming adequately iodized salt has increased from 28 per cent in 2003 to 61.9 per cent in 2009.

Despite considerable progress made in these areas, undernutrition and micronutrient deficiencies remain significant public health problems in Tajikistan. This report shows that one in three, or almost 300,000 under-five children in the county are still stunted, a consequence of chronic nutritional deprivation that begins in the period before birth if the mother is undernourished. More than eight per cent of Tajik children under five are underweight and only 23 per cent of children under six months are exclusively breastfed. More than half of the country's children have low iodine levels and almost one third of them have iron-deficiency anaemia.

Undernutrition is the largest independent cause of child mortality. It steals children's strength and makes illness more dangerous. An undernourished child struggles to withstand an attack of pneumonia, diarrhoea or other illness – and illness often prevails. Undernutrition is caused by poor feeding and care, aggravated by illness. The children who survive may become locked in a cycle of recurring illness and faltering growth – diminishing their physical health, irreversibly damaging their development and cognitive abilities, and impairing their capacities as adults.

Undernutrition among mothers affects a woman's chances of surviving pregnancy as well as her child's health. Women who were stunted as girls, whose nutritional status was poor when they conceived or who didn't gain enough weight during pregnancy may deliver babies with low birthweight. These infants in turn may never recoup from their early disadvantage. Today in Tajikistan more than 50 per cent of women suffer from iodine deficiency and one in four women is anaemic.

UNICEF believes that good nutrition is critical in ensuring that every child has the best start in life. UNICEF in Tajikistan has been working on nutrition programmes aimed at fulfilling every child's right to adequate nutrition. UNICEF is committed to scaling up and sustaining coverage of its current high-impact nutrition interventions in the areas of mother and infant and young child feeding and micronutrients. With partners, UNICEF is ready to enhance integrated interventions to combine vitamin A and other micronutrient supplementation with child survival interventions.

UNICEF calls on the Government of Tajikistan and other international and national partners to take urgent actions to address nutritional challenges of women and children in Tajikistan.

Hongwei Gao
UNICEF Representative
Tajikistan

Summary

Background

The 2009 Micronutrient Status Survey (MNSS) in Tajikistan aims to assess the nutrition and micronutrient status of women and children, determine risk factors for deficiencies, and compare the findings with the previous MNSS from 2003. The presented MNSS is a nationally representative survey intended to obtain valid and reliable data on levels of haemoglobin (Hb), iron status and iodine deficiency, as well as the nutritional status of children 6-59 months of age and women of reproductive age (WRA) (15-49 years).

Methods

The survey covered the whole of Tajikistan in order to collect nationally representative data, whereby separating the country into five strata (Khatlon, Direct Rule District (DRD), Sughd, Gorno-Badakhshan Autonomous Oblast (GBAO) and Dushanbe), and relied on a cross-sectional cluster sample design for each of the five strata. For each strata it was aimed to collect the information for 432 children 6-59 months of age, and 432 non-pregnant WRA respectively, corresponding to a total number of 4'320 subjects (2'160 children 6-59 months of age and 2'160 WRA). In the first stage, 36 clusters (villages or mahallas in urban areas) were selected with a probability proportional to the population size of the primary sampling unit. At a second stage, a random sample of 12 individuals (12 children 6-59 months of age, and 12 WRA) was taken in each village or mahalla. Data collection took place in October 2009. Once a household was selected, the field survey team started the field and laboratory data collection by interviewing consenting women on the different modules included in the survey questionnaire. All study participants underwent anthropometric assessment, weight and height measurements and Hb measurement through the HemoCue test. For the micronutrient assessment, capillary blood and urine were collected from each study participant. Samples were further analyzed using ELISA testing in the laboratory facilities in Dushanbe. Data entry was performed using EpiInfo (version 3.5.1). Double data entry was done for the whole dataset and errors were corrected using the original questionnaire. All statistical analyses except for the anthropometrics of children were completed using STATA. Comparison of anthropometric measurements with the WHO standard growth curve and calculation of z-scores were conducted with the program ENA.

Results

The sample was composed of 2'141 WRA and 2'146 children 6-59 months of age, for a total of 4'287 individuals. Only a small number of individuals refused to participate in the survey and/or did not agree to provide biological samples (< 1%). With the exception of Dushanbe, most of the individuals were living in rural areas. The overall educational level of the household heads gave the following picture: 11.8% attended primary (grades 1-4) or basic school (grades 5-9); 37.8% attended secondary school; 23.2% a secondary special or technical school; and 27.2% had a higher education. Remittances were the main cash source of income (29.3%), followed by official salary (25.5%), and farming/livestock (22.6%). More than four out of five households were growing food crops for their own consumption, with the exception of Dushanbe where growing food was very low (7.9%). The overall percentage of growing food was 65.8%. The most common products grown were vegetable and fruit varieties, including vitamin C-rich products (oranges, apricots, carrots, pumpkins). Animal breeding for meat and milk production was practiced by 60.8% of all households. The interviewed households reported coping with problems related to food security since the beginning of 2009, and the respective strategies included: borrowing food or relying on help from friends or relatives, decreasing the amount of food consumption, increasing the production of food products for their own consumption, decreasing the purchase of non-food products, selling more animals, decreasing expenditures for health and drugs, withdrawing or postponing admission to school, seeking alternative employment, and increasing the number of household members who have left the village in search of work.

Women nutrition

Body mass index (BMI):

- 6.7% was the overall frequency of women with a low BMI (BMI < 18.5 kg/m2). The highest prevalence was found in the GBAO region (9.4%) and the lowest in DRD (5.1%). Severe thinness (BMI < 16 kg/m2) was less than 1% in all regions.
- More than one fourth (28.2%) of women were overweight or obese (BMI > 25 kg/m2). 19.4% were overweight (BMI > 25 to < 30 kg/m2) and 8.8% obese (BMI > 30 kg/m2). In addition, among obese women, 8.4% were within obesity Classes I and II (BMI > 30 to < 40 kg/m2), and 0.4% were in obesity Class III (BMI ≥ 40 kg/m2).
- Women from Dushanbe were more likely to be overweight than women from other regions (42.2%).
- The frequency of being overweight was significantly higher among women living in urban areas (36.8%) when compared to women living in rural areas (24.4%).
- In recent years, the frequency of high BMI has gradually increased: in 2003 the frequency of obese women was 7.1% compared to 8.8% in 2009.

Iodine:

- Iodine deficiency, defined as urinary iodine (UI) < 100 µg/L, was present in more than half of the women (58.6%), with a higher frequencies in Khatlon (84.8%) and DRD (74.3%) than in GBAO (55.2%), Dushanbe (45.9%) and Sughd (19.8%). Severe cases of iodine deficiency (UI <20 µg/L), were more common in Khatlon (5.2%), and were below 1% in the other regions.
- Women from urban areas had a higher mean level of UI (117.2 µg/L) than women from rural areas (106.9 µg/L). Particularly, moderate-to-severe UI deficiency was more frequent in rural areas (12.7%) than in urban areas (5.3%).

- In comparison to 2003, the prevalence of iodine deficiency remained at the same level (56.8% in 2003 and 58.6% in 2009). However, a noticeable decrease the number of cases of moderate and severe iodine deficiency was observed in all regions. The decrease of the frequency of moderate-to-severe iodine deficiency was most obvious in Sughd, from 27.8% to 0.9%.
- Nevertheless with 58.6% of women presenting with a UI of < 100 µg/L, iodine deficiency still represents a serious public health problem for the nation.

Anaemia:

- The overall frequency of anaemia among WRA was 24.2%. Among them 0.4% had severe anaemia. Across the regions no significant difference was observed.
- Compared to 2003, the proportion of non-anaemic women increased substantially from 58.8% to 75.8% in 2009.
- The frequency of anaemic women was highest in GBAO (29.8%) and lowest in Sughd (19%).
- Iron deficiency anaemia (IDA), defined as an elevated (> 3.3 mg/L) level of serum transferrin free receptor (sTfR) was observed in 4.8% of the women, with a higher prevalence in GBAO (7.5%) and DRD (7.0%) than in Khatlon (4.7%), Dushanbe (3.7%) and Sughd (3.6%).

Child nutrition

- Low height-for-age (stunting), low weight-for-height (wasting), low weight-for-age (underweight)
- Low height-for-age, or low height for age, was found in one out of five children 6-59 months of age (28.9%). In this category, almost one out of ten (9.0%) were severely low height-for-age. The region with the highest frequency was Khatlon (36.9%), followed by Sughd (27.9%). The lowest prevalence was found in Dushanbe (21.8%).
- The national frequency of global acute malnutrition (low weight-for-height) was 4.5%. The frequency of children with severe low weight-for-height was 1.4%. The highest proportion of children with severe 'low weight-for-height was found in DRD (7.2%) followed by Khatlon (4.9%). Sughd was the region with the lowest rate of children with severe low weight-for-height (2.3%). DRD had also the highest prevalence of children with severe low weight-for-height (2.8%).
- Underweight, or low weight-for-age, was prevalent in 8.4% of children 6-59 months of age. Children living in Khatlon again had the highest frequency of underweight (10.5%). The lowest frequency of underweight was found in Sughd (5.9%).
- Children from rural areas were more often low height-for-age than children from urban areas.
- Boys were more likely severely underweight-for-height than girls (boys: 2.0% girls: 0.7%), with the biggest differences observed in DRD (boys: 4.5%, girls: 1.0%).
- The prevalence for underweight in children 6-59 months of age has drastically decreased compared to the 2005 MICS survey (the most recent data which allows comparison — the MNSS 2003 did not assess this).

Iodine:

- More than half of the children (52.9%) had low values of UI (< 100 µg/L) with the highest frequencies in Khatlon (73.2%) and DRD (73.3%), and the lowest frequencies in Sughd (18.9%). Severe cases of iodine deficiency were most prevalent in Khatlon (1.2%), while for the rest of the country the prevalence remained under 1%.

- The mean UI level was considerably higher in children from urban areas (123.8 µg/L) than in children from rural areas (112.3 µg/L). Children from rural areas were more often found to have moderate-to-severe iodine deficiency (55.1%) than children from urban areas (45.5%).
- There has been a remarkable decrease in the prevalence of severe and moderate forms of iodine deficiency in children since 2003, with a drop in frequency from 40% to 9.5% in 2009. The most important improvement could be observed in Sughd oblast, which may be attributed to efforts in salt iodization.
- However, the presence of 52.9% of children with UI < 100 µg/L indicates that iodine deficiency is still a serious public health problem for Tajikistan.

Anaemia:

- Almost one third (28.8%) of children 6-59 months of age had Hb values < 11 g/dL. Children living in GABO were more likely to be anaemic (39,8%) than children living in the other regions. Severe cases of anaemia (Hb < 7 g/dL) were below 1% in all regions.
- Gender-related differences were observed for Hb concentration: girls (11.7 g/dL) had a higher Hb concentration than boys (11.5 g/dL). The most significant differences were observed in GBAO (boys: 11.0 g/dL, girls: 11.5 g/dL; P = 0.002) and in Sughd (boys: 11.5 g/dL, girls: 11.7 g/dL; P = 0.055). Severe anaemia was more frequent in boys (14.3%) than in girls (10.2%), with the biggest differences in GBAO (moderate and severe anaemia in boys: 21.7% and 24.9%, respectively; moderate and severe anaemia in girls: 17.6% and 16.2%, respectively).
- Anaemia was more frequent among children under two years of age, among whom 45.5% had Hb below 11 g/dL.
- According to sTfR results, 8.6% of the analyzed children presented with iron deficiency, with the highest prevalence in DRD and GBAO (15.6% and 15.2%, respectively), and the lowest prevalence in Dushanbe and Khatlon (5.3% and 5.8%, respectively).
- High sTfR levels were more frequent in rural areas (14.5%) than in urban areas (9.1%).
- Compared to 2003, a decrease in the frequency of anaemia and iron deficiency among children was observed. Khatlon was the region where the situation improved the most, and the national prevalence of anaemic children dropped from 62.3% in 2003 to 28.8% in 2009.

Breastfeeding

- Almost all infants in Tajikistan under two years of age were breastfed (97.5%), at least partially. Reported breastfeeding in GBAO was almost 100% (99.4%).
- More than a half of mothers (57.1%) breastfed their baby within the first 30 minutes from delivery, followed by one third (30.3%) within the first six hours.
- The majority of exclusive breastfeeding during the first four months was most common in Dushanbe (31.2%), and until six months in Sughd (58.1%).

Complementary feeding

- Complementary feeding to infants started at six months of age or older in the majority of cases (44.3%). Almost half of mothers started with complementary food when her child was between four and six months (48.5%), and 11.9% of the mothers within the first three months.

Vitamin D in infants (6-59 months)

- The overall mean concentration of vitamin D in infants 6-24 months of age was 56.1 nmol/L of serum 25-OHD concentration and varied between 61.6 nmol/L (GBAO) and 64.7 nmol/L (Sughd).
- 60.3% of infants had sufficient vitamin D concentration. Moderate vitamin D insufficiency (25-49 nmol/L), was observed in 26.1% of infants. Severe vitamin D deficiency (< 25 nmol/L) was observed in 13.6% of the sampled infants, with the highest rates in GBAO (insufficiency: 43.5%; deficiency: 23.2%).
- The mean vitamin D level was higher in children from rural areas (55.4 nmol/L) as compared to children from urban areas (47.4 nmol/L).
- Gender differences in vitamin D levels were markedly high in Sughd (boys: 71.5 nmol/L, girls: 57.4 nmol/L).

Iodization of household salt

- Household salt samples were adequately iodized in 61,9% of the cases (> 15 parts per million (ppm)). An insufficient iodine concentration (< 15 ppm) was found in 20,8% of the salt samples, and 17,4% had no iodine at all. Across the regions, important differences were observed: the lowest frequency of adequately iodized salt was found in DRD (27%) and the highest was found in Sughd (93.8%).
- In 2003 the rate of adequately iodized household salt was 28%. Although substantial improvements in the iodization of household salt were observed, the 90% threshold of adequately iodized salt recommended by WHO in order to eliminate iodine deficiency disorders is yet not reached.

Conclusions

In 2009, with the exception of iodine deficiency and overweight (BMI > 25 kg/m2), all nutritional status indicators for women have improved since 2003. Similarly, for children 6-59 months of age, all nutritional status indicators have showed a positive evolution. Though this is an encouraging trend, the prevalence of nutritional disorders remains high and indicates a serious public health problem in Tajikistan. In line with interventions supported in recent years by MoH Tajikistan, UNICEF and other agencies, continued efforts are needed through adopted, cost-effective and equitable interventions targeting women and children.

1. Introduction

The purpose of the 2009 Micronutrient and Nutrition Survey (MNSS) in Tajikistan was to conduct a nationally representative survey to obtain valid and reliable data on levels of haemoglobin (Hb), iron status and iodine deficiency, as well as the nutritional status of children 6-59 months of age and of women of reproductive age (WRA). The report presented here was closely adapted to a study protocol of the MNSS in Tajikistan that was conducted by UNICEF and the Tajik Ministry of Health (MoH) with support from the Italian Institute for Research on Food and Nutrition (INRAN) in 2003. The present survey was conducted to provide a basis for results comparison with the previous survey from 2003, and to allow policy and decision makers to review efforts in improving the nutritional status of high risk groups in recent years. Consequently, the present survey relies on the same methodology (sampling) and data collection tools as in 2003.

Tajikistan is the poorest of the five central Asian republics. Since the dissolution of the Soviet-Union in 1991, Tajikistan has experienced economic collapse and civil conflict. Tajikistan has one of the lowest per capita incomes of the former 15 Soviet Republics, and almost half of the labor force is working abroad supporting their families via remittances (CIA World Factbook, accessed 13 April 2010). According to the 2007 Tajikistan Living Standard Survey (TLSS 2007), 53.5% of the Tajik population is “poor” and 17.1% “very poor”. Two thirds of the population has less than US$ 2.15 per day to live, in spite of a growing economy in recent years. Several years of drought in the region resulted in significantly reduced yields of basic food crops and near exhaustion of normal coping strategies. This situation directly affects the nutritional status of vulnerable population groups. According to the results from the MICS 2005 (State Committee on Statistics of the Republic of Tajikistan, 2007), the infant mortality rate was estimated at 65 per thousand live births, while the under-five mortality rate is 79 per thousand.

The various surveys which fully or partially documented nutritional deficiencies in the Tajik population (UNICEF MNSS, 2003, MICS 2005, TLSS 2008) have revealed persistently high rates of acute and chronic malnutrition, giving cause for concern. According to the results of MICS 2005, the prevalence of underweight in Tajikistan was moderate in 17% of children and severe in 4% of children under five years of age. Nearly 27% of the children in this age group had a low height-for-age and 9% had a severely low height-for-age. Seven percent of those surveyed could be classified as children with low weight-for-height.

Malnutrition and micronutrient deficiencies are highly prevalent among children, and the latter represents one of the main causes for poor infant and under-five mortality in Tajikistan (MNSS 2003). Other

findings revealed a high prevalence of anaemia (38%) in under-five children (Table 1). Iron deficiency, as a major determinant of Hb, and iodine deficiency often lead to severe health problems. Low UI excretion was also observed in 64% of the children.

According to the survey, the situation for WRA was similar, which is reflected in poor birth outcome and high maternal mortality rates. According to the 2003 MNSS, a low body mass index (BMI < 18.5 kg/m2) was observed in 9% of WRA. Other findings of the 2003 MNSS revealed high anaemia prevalence in 41% of all examined women. Low UI excretion was observed in 57% of women.

These conditions may be indirectly caused by household poverty, improperly balanced diets, and weak public management and promotion of nutrition including poor public education, inadequate food fortification and a lack of micronutrient supplementation programmes. Moreover, a food price crisis in 2007 resulted in a poor-quality diet for a high number of people in Tajikistan, further threatening public health.

Malnutrition is being addressed within the public health sector in Tajikistan. The related health issues, however, persist and need to be tackled as a public health priority. Although breastfeeding is practiced among families, exclusive breastfeeding is not sufficiently widespread. Effective childcare practices are crucial for the healthy development of children. Children can achieve optimal physical and mental health when their development is followed at home, in rural and urban communities and at school. Focusing on the welfare of infants and children under eight years of age, the Early Childhood Care and Development (ECCD) Programme supported by UNICEF provides support for the development of family care and practices which promote the survival, growth, protection, psycho-social and cognitive development of children. However, little is known about how this programme functions in Tajikistan.

Table 1: Prevalence of selected nutritional disorders in Tajikistan

Indicator	Population distribution	Prevalence	Source
Hb (anaemia)	Non-pregnant WRA (15-49 yrs)	40.1% mild-to-severe	MNSS 2003
	Children 6-59 m	37.7% mild-to-severe	MNSS 2003
Iodine deficiency	Non-pregnant WRA (15-49 yrs)	56.8% mild-to-severe	MNSS 2003
	Children 6-59 m	63.9% mild-to-severe	MNSS 2003
Exclusive breastfeeding rate	Infants 0-24 m	25.5%	UNICEF MICS 2005
Acute malnutrition	Children 0-59 m	17.5% moderate-to-severe	State Committee on Statistics of the Republic of Tajikistan. 2007
Low height-for-age (–2 z-scores height-for-age)	Children 0-59 m	26.9%	UNICEF MICS 2005
Low weight-for-height (–2 z-scores weight-for- height)	Children 0-59 m	7.2%	UNICEF MICS 2005

The national health information system in Tajikistan administered by MoH does not reflect many of the key international indicators for monitoring the micronutrient nutritional status of women and children. Therefore in 2003 UNICEF, in cooperation with the Asian Development Bank, assisted MoH Tajikistan

in conducting a national survey for the evaluation of the most important indicators of micronutrient deficiencies. This large-scale survey covered indicators to assess the prevalence of micronutrient deficiency disorders and risk factors in relation to regional disparities and the high-risk age group of children 6-59 months of age. Based on the survey results, with the technical support of UNICEF and WHO, MoH Tajikistan developed a nutrition plan of action. Nationally representative surveys like MICS (2005), TLSS (2006) and National Nutrition Survey [Action Against Hunger (AAH); MoH Tajikistan, 2006)] covered essential nutrition indicators but did not cover indicators on the prevalence of haemoglobin (anaemia), iodine deficiency and vitamin D deficiency. To monitor time trends of these indicators and, more generally, of the micronutrient status of children and women, the present national nutrition survey was initiated and implemented in 2009.

2. Objectives

The aim and objectives of the 2009 national MNSS in Tajikistan are as follows:

The aim is:

- To assess the nutritional and micronutrient status of women and children, determine risk factors for deficiencies, and determine possible strategies for improvement.

The objectives of study are:

- To identify levels of Hb, iron status and iodine deficiency in WRA and in children under five years of age (6-59 months).
- To assess the vitamin D level of children 6-24 months of age.
- To evaluate feeding patterns among infants and young children (6-24 months).
- To conduct anthropometric measurements among children 6-59 months of age and of non-pregnant WRA.
- To assess time trends in the nutritional status of women and children in Tajikistan by comparing 2009 with 2003 results of the MNSS studies.
- To assess the level of knowledge and practice of mothers regarding ECCD.
- To suggest health policy options resulting from the survey.

3. Methodology

3.1 Study area, study design and sampling

Tajikistan is divided into four oblasts, or regions; Sughd in the northwest, Khatlon in the southwest, Rayon of Republican Subordination (or Direct Rule District, DRD) in the centre and west and Gorno-Badakhshan Autonomous Oblast (GBAO) in the east. The capital, Dushanbe, in the DRD oblast, is a separately administrated area and was considered in this survey as its own strata, with a separate sampling unit to provide representative data for Dushanbe only. Oblasts are divided into rayons (districts). Rayons are further subdivided into mahallas (committees) in urban areas, and jamoats (villages) in rural areas. Tajikistan's population is concentrated in the geographic lowlands, and 90% of its inhabitants live in valleys; often in densely concentrated urban centres.

The survey was conducted in October 2009 and covered the whole of Tajikistan in order to collect nationally representative data to allow for comparison with the 2003 MNSS. The same sampling methodology and data collection tools were used in 2009 to remain consistent with the methodology used in 2003. The MNSS was conducted with a representative sample of WRA and in children 6-59 months of age in each of the administrative areas (Khatlon, DRD, Sughd, GBAO and Dushanbe), and at the national level for urban and rural areas.

The survey was implemented using a cross-sectional cluster sample design using population estimates as of 1 January 2009. A cluster design was used because the idea of taking a simple random sample of individuals across Tajikistan is unsuitable. Therefore a two-stage cluster sampling design was used:

1. First stage: primary sampling units, i.e. clusters (usually villages or mahallas in urban areas) were selected with a probability proportional to the population size of the primary sampling unit.
2. Second stage: random sample of a fixed number (as revealed in the first stage) of individuals (children 6-59 months of age and WRA) in each village.

The sample for each oblast looked as follows:

1. First stage: 36 clusters with the probability of selection within the oblast being proportional to size (see Appendix 2: Selected Cluster List per Oblast).
2. Second stage: In every selected cluster (village, community) only households with at least one child 6-59 months of age or a non-pregnant WRA were randomly included in this study, for a total of 12 children and 12 women within each cluster.

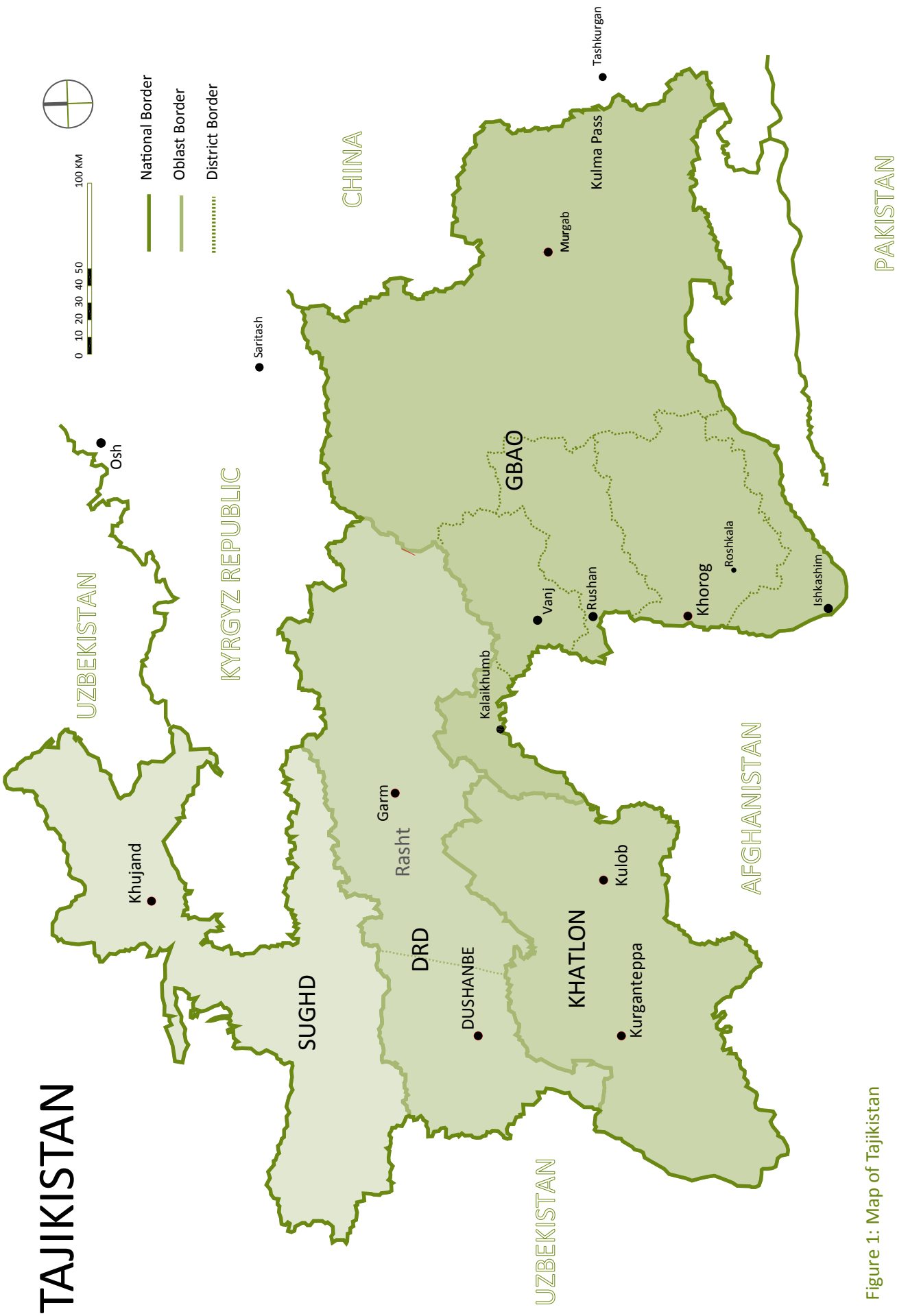


Figure 1: Map of Tajikistan

Based on the list of households, the survey team listed all household members of a selected household and checked for the following eligibility criteria, which were:

1. At least one child 6-59 months of age
2. At least one non-pregnant WRA (15-49 years)
3. Willingness to participate in this survey

The survey team continued to visit households until the quotas of 12 children and 12 women per cluster were reached. If eligibility criteria were not fulfilled the team had to move to the next household.

If eligibility criteria were fulfilled, the survey team started and included in every eligible household all children 6-59 months of age and all non-pregnant WRA. During data collection, the study participants received detailed information about the purpose of the study and the extent of their involvement (questionnaire, blood sample). Written informed consent was requested (informed consent form (ICF), Appendix 4). It was pointed out that participation is voluntary and that individuals may withdraw from the trial at any time.

Once a household was selected, the field survey team began field and laboratory data collection by interviewing consenting women on the different modules included in the survey questionnaire. All study participants underwent anthropometric assessment, and weight and height measurements. For the micronutrient assessment, capillary blood and urine were collected from each study participant. The survey components and procedures are described below in detail.

3.2 Sample size

The sample size was designed to allow reliable estimation of micronutrient and nutritional indicators based on a representative probability sample on the level of:

- Tajikistan as a whole
- The five main administrative regions (oblasts) of the country (Dushanbe, DRD, Sughd, Khatlon, and GBAO)

Further, the sample was designed to allow an urban–rural comparison for the whole of Tajikistan, taking into account that Dushanbe is only urban. The population of Tajikistan for 2009 was estimated and used as the basis for the sample size calculation is listed in Table 2, Appendix 1.

In deciding an appropriate sample size for a survey, a balance must be achieved between precision and cost. Appendix 3 shows the calculation of clusters necessary for different estimations of the proportion of the population, and the respective confidence interval. For the 2009 survey it was decided that 20 clusters with 25 individuals per strata assured representativity for each strata and was the best compromise between precision and cost. In comparison to the 2003 survey, the following modifications were implemented in 2009:

Reduction of the number of the children 6-59 months of age and non-pregnant WRA per cluster from 25 to 12. Based on the 2003 experience, it is assumed that 12 children and women can be investigated within a working day. A cluster of 12 then corresponds to the workload of one day. This assured that data collection for one cluster can be completed within one day.

Due to the lower number of individuals per cluster, it is assumed that the design effect will become smaller. In consequence, the design effect used for estimating the number of clusters for the 2009 survey was reduced from 2.0; similar to the 1.75 reduction used in 2003 (Bennett et al. 1991).

Both of these modifications had a small statistical impact on the comparability (confidence interval and error of margin) for the comparison of MNSS 2003 and MNSS 2009, as decreasing the number of individuals per cluster increases the precision being counterbalanced by reducing the design effect.

Table 3: Necessary sample size for MNSS 2009

Population strata	Estimated population size as per 1.1.2009	Estimated number of households (based on census 2000)	Proportion (e.g. micronutrient deficiency)	Expected precision of proportion	Sample	Adjusted sample (+10% sample loss)	number of clusters
Dushanbe	695'246	139'239	50%	6.50%	398	432	36
DRD	1'645'999	204'390	50%	6.50%	398	432	36
Sughd	2'171'194	365'136	50%	6.50%	398	432	36
Khatlon	2'642'283	307'322	50%	6.50%	398	432	36
GBAO	219'077	30'933	50%	6.50%	398	432	36
Tajikistan	**7'373'799**	**1'047'020**				**2'160**	

The following sample size was therefore proposed:

- 432 children 6-59 months of age per oblast
- 432 non-pregnant WRA (15-49 years) per oblast

Consequently, a total of 4'320 subjects (2'160 children and 2'160 women) were targeted.

In view of the inclusion of urban and rural households with a probability proportion to the population size (or number of households) in each strata, the clusters were distributed to urban and rural domains in proportion to the size of urban and rural populations in each respective oblast.

3.3 Field Data Collection

The field data collection was carried out in October 2009 (after the Ramadan period) by 12 teams of three MoH Tajikistan staff each (medical doctors and laboratory technicians). All teams were composed of one staff with specific training in interview techniques, one supervisor specifically trained in anthropometric assessments of children and adults, and one laboratory technician with experienced skills on capillary blood collection and maintenance of cold chain procedures.

A one week training course of MoH Tajikistan staff for standardization of the data collection was organized by MoH Tajikistan and UNICEF in early October 2009 prior to the survey. The field staff were recommended by MoH Tajikistan, but a test was done for each candidate to make sure that quality criteria were met for field data collection. The first days of training focused on sampling methodology (how to fill in the questionnaire, interview techniques, anthropometric assessment and blood sample collection procedures). In order to identify problems in the survey methodology and design, a pilot study was conducted over the next two days. The pilot survey aimed at testing the daily work load, validating the survey questionnaire, assessing the duration of the interviews and testing capillary blood collection and storage modalities in the central laboratory in Dushanbe.

Table 4 provides an overview of the different nutritional parameters assessed in relation to the respective population groups. Further details are described in the chapters below.

Table 4: Overview on topics and sub-studies within MNSS 2009

Nutritional parameters	Individuals / topic
Hb, iron status and iodine deficiency	Children (6-59 months) of age and WRA
Vitamin D	Children under 2 years of age (6-24 months).
Feeding patterns	Children under 2 years of age (0 to 24 months)
Iodine level in salt	Each household participating in the study
Anthropometric measurements	Children 6-59 months of age and WRA
Knowledge and practice regarding care and development in children	Mothers (of children < 24 months of age)

3.3.1 Questionnaire

A questionnaire was designed with assistance from WHO and WFP to provide relevant indicators of the health and nutritional status of children 6-59 months of age and WRA as outlined in the survey objectives. The questionnaire (Appendix 5) had to be as similar as possible to the one used in MNSS 2003 for the best comparison of data. The questionnaire was translated into Tajik and then translated back into English in order to check for misinterpretations.

The questionnaire for micronutrient assessment consisted of seven modules:

- Modules 1-4: Household characteristics (type of dwelling, number of rooms), identification of participant, socio-economic characteristics of the household, food security coping strategies.
- Module 5: Child health issues: morbidity of diarrhea, nutritional habits during illness, child anthropometric assessment and blood testing.
- Module 6: Infant (6-24 months of age) feeding relevant questions: duration of exclusive breastfeeding, complementary feeding, care and development.
- Module 7: Women's health issues: nutritional habits, anthropometric measurement among non-pregnant WRA, laboratory examinations.

3.3.2 Anthropometric assessment

For these assessments, every child was weighed and measured. For the measurements, a UNICEF standardized electronic scale was used for both children and mothers. For infants (6-24 months), the height was measured supine. Children (2-5 years) and women were measured in an upright position. Anthropometric measurement procedures were standardized on the basis of guidelines published by the UN (United Nations, 1989) and WHO (WHO, 1995). Measurers were adequately trained, and quality control was assured by the NGO Zerkalo as well as the supervisor in charge of respective teams.

Three nutritional status indicators were used for monitoring progress of the nutritional status of children:

- Weight-for-age (low weight-for-age indicates being underweight for a specific age);
- Height-for-age or height-for-age (low height-for-age is an indicator of chronic malnutrition or past undernutrition);
- Weight-for-height or weight-for-height (low weight-for-height or low weight-for-height is an index for children suffering from current or acute undernutrition).

Growth

Height-for-age was identified by comparing measurements of children›s heights to the National Centre for Health Statistic (NCHS) growth-reference population. Low height-for-age is an indicator of the

child's past and cumulative nutrition situation, and hence is considered chronic. The cut-off point for low height-for-age is determined by -2 z-scores, severe low height-for-age by −3 z scores. Low weight-for-height is referred to as «acute malnutrition» because it is believed that episodes of low weight-for-height have a short duration. In contrast, low height-for-age is regarded as "chronic malnutrition."

For women, the assessment of nutritional status was done by calculating the body mass index (BMI=kg/m2). BMI is a simple index for weight-for-height that is commonly used to classify underweight, overweight and obesity in adults.

A BMI below 18.5 kg/m2, expressed as thinness, was suggested as the cut-off point for diagnosis of chronic energy deficiency (CED) (James et al. 1988). However, some ambiguity remains about the significance of mildly low BMI, initially referred as grade-I CED, but which only reflects relatively low weight-for-height (Gartner et al. 2001).

The CED determination for the population level is categorized according to a WHO expert committee (WHO, 1995) as follows:

- Low prevalence (warning signs detected, monitoring required): 5-9% of the population with BMI < 18.5.
- Medium prevalence (poor situation): 10-9% of population with BMI < 18.5.
- High prevalence (serious situation): 20-39% of population having BMI < 18.5.
- Very high prevalence (critical situation): ≥ 40% of population having BMI < 18.5.
- Low BMI classified in CED grades: CED grade I or mild thinness, BMI 17 – < 18.5; CED grade II or moderate thinness, BMI 16 – > 17; CED grade III or severe thinness, BMI < 16.

3.3.3 Salt collection

The iodine content of salt used in the households of Tajikistan was evaluated by testing the content of potassium iodate or potassium iodide. A drop of each of two indicator solutions (UNICEF Stock No. 05-860-01 and UNICEF Stock No. 05-860-02 respectively) was applied to one spoonful of salt, flattened on a dish. The color that immediately developed from the reaction was interpreted with the colored scale on the back of the packet of test solution.

3.3.4 Human specimen collection

Blood and urine samples were collected from consenting individuals (ICF, Appendix 4).

Among all children (6-59 months) and WRA (15-49 years) participating in this study, capillary blood was collected to determine:

1. Hb
2. Serum ferritin
3. Serum transferrin free receptor (sTfR)
4. C-reactive protein (CRP)
5. Vitamin D (only among children 6-24 months)

The medical staff within the teams was extensively trained to obtain good capillary samples.

Among all participants, a five-ml urine pot was collected for UI excretion measurement.

3.3.5 Ethical considerations

During the survey, high value was given to the respect of ethical considerations related to study design and implementation. The study protocol was reviewed by the institutional review boards of Swiss TPH and was submitted for clearance to UNICEF Tajikistan and national and regional authorities.

Jointly with UNICEF, and as mentioned before, national and regional authorities were informed about the aim and objectives of the study. MoH Tajikistan provided written approval of the survey, including approval of the survey's ethical aspects.

During data collection, study participants were given detailed information about the aim and objectives of the study, and the extent of their involvement (questionnaire, blood and urine sample). Written informed consent was obtained from all study participants and/or parents/legal guardians of children below the age of five years. (see ICF, Appendix 4). It was pointed out that participation is voluntary and that individuals may withdraw from the trial at any time.

3.4 Laboratory analysis

The measurement of Hb, ferritin, sTfR and CRP levels among the study groups (children 6-59 months, WRA), as well as vitamin D in children 6-24 months of age, was a crucial component of the survey in Tajikistan.

The approach, methodology and results of MNSS 2003 guided the MNSS 2009 survey, so that similar or comparable methods for the analysis of blood were used. However, for MNSS 2009, a decision was made to conduct all laboratory analysis in Dushanbe so that conducting the survey also contributes to strengthening local expertise in laboratory investigations.

Table 5: Overview of laboratory methods for MNSS 2009

Analysis	Method	Place of analysis
Haemoglobin	HemoCue	Field testing
Vitamin D	ELISA	Laboratory of Institute for Prevention Medicine Dushanbe
Ferritin	ELISA	
Serum transferrin free receptor	ELISA	
C-reactive protein	ELISA	
Urine iodine	Sandell-Kolthoff reaction (modified)	Centre for Endocrinology Dushanbe
Salt iodization	Rapid test Kit UNICEF	Field testing

3.4.1 Haemoglobin

As in MNSS 2003, Hb measurement among children 6-59 months of age and WRA was planned to rely on the field Hb analyzer (Hemocue™). The subjects were asked to sit and relax; the middle fingers of their hands were massaged gently and each pricked with a sterile lancet. The first drop of blood was removed, and the second one was collected by capillarity in a cuvette containing dry Drabkin's reagent for Hb analysis. Laboratory technicians collected an additional approximately 600 mL blood. The blood was placed in an amber tube (Microtainer™) for light-sensitive analysis with a serum separator gel. The tube was labelled with the identification code of the subject and stored in a cold box at 4°C. The samples were quickly transferred in the cold boxes to nearest district or oblast hospital. There, the samples were centrifuged for serum separation within two to three hours but no later than eight hours

after blood sampling. Immediately after centrifugation, the samples were placed in a -20°C freezer and transported in frozen condition to a central laboratory (Laboratory of Preventive Medicine Dushanbe) until further analysis. As pointed out in the result section (Section 4) the number and percentage of missing samples was low.

The cut-off points used to define the different classes of Hb are shown in Appendix 6 (WHO, CDC, 2008).

At elevations above 1'000 m, Hb concentrations increase as an adaptive response to the lower partial pressure of oxygen and reduced oxygen saturation of blood. The compensatory increase in red cell production ensures that sufficient oxygen is supplied to tissues. The cut-off points quoted in Appendix 6 are only valid at sea-level or at an altitude below 1'000 m. In order to correctly estimate Hb values in survey sites at higher altitudes in Tajikistan, the Hb cut-offs for determining anaemia were adjusted to the respective altitudes (Sullivan et al. 2008).

Hb values measured in the field were recorded uncorrected. Later, the altitude of each cluster was recorded, and correction values were subtracted according to the observed individual values. The altitude for each cluster was obtained by using the Google Earth Program, and detailed Tajikistan maps were provided by the Swiss Development Cooperation in Dushanbe.

3.4.2 Serum ferritin, serum transferrin free receptor and C-reactive protein

Serum ferritin and serum transferrin free receptor (sTfR) were measured among all WRA and children 6-59 months of age. Laboratory analyses were conducted in Dushanbe during October and November 2009. These analyses provided important information about the iron status of each individual.

Serum ferritin, sTfR and CRP were measured using the simple, commercially available enzyme-linked immunosorbent assay (ELISA) procedure. All ELISA tests were performed at the central laboratory in Dushanbe; the kits were purchased from the BioVendor Company.

Serum ferritin: The principle of the ELISA test follows a typical one-step capture or 'sandwich'-type assay. The assay makes use of two highly specific monoclonal antibodies. A monoclonal antibody specific for ferritin is immobilized onto the microwell plate, and another monoclonal antibody specific for a different region of ferritin is conjugated to horseradish peroxidase (HRP). Ferritin from the sample (and standards) are allowed to bind simultaneously to the plate and to the HRP conjugate. The washing and decanting steps remove any unbound HRP conjugate. After the washing step, the enzyme substrate is added. The enzymatic reaction is terminated by the addition of stopping solution. The absorbance is measured on a microtiter plate reader. The intensity of the color formed by the enzymatic reaction is directly proportional to the concentration of ferritin in the sample. A set of standards is used to plot a standard curve from which the amount of ferritin in patient samples and controls can be directly read.

sTfR ELISA: In BioVendor's Human sTfR ELISA standards, quality controls and samples are incubated in microplate wells pre-coated with monoclonal anti-human sTfR antibody. After 60 minutes incubation and washing, monoclonal anti-human sTfR antibody, conjugated with HRP, is added to the wells and incubated for another 60 minutes with captured sTfR. Following another washing step, the remaining HRP conjugate is allowed to react with the substrate solution with tetramethylbenzidine (TMB). The reaction is stopped by the addition of acidic solution, and absorbance of the resulting yellow product is measured. The absorbance is proportional to the concentration of sTfR. A standard curve is constructed by plotting absorbance values against concentrations of standards, and concentrations of unknown samples are determined using this standard curve.

CRP: Human sera for testing are diluted to 1:4'000 and allowed to react with antibodies coated on specially treated micro-wells. After appropriate incubation, the wells are washed to remove unreacted serum proteins, and an enzyme-labelled rabbit anti-human CRP (conjugate) is then added to react with and tag the antigen-antibody complexes. Following another incubation period, the wells are again

washed to remove unreacted conjugate. A urea peroxide substrate with TMB forms as chromogen is added to start color development. Development of a blue color indicates a positive reaction while negative reactions appear colorless or with a trace of blue. The reaction is interrupted with a stop solution that turns the blue positive reactions to yellow. Negative reactions remain colorless or with a hint of yellow. Color intensity (absorbance) is read at a wavelength of 450 nm on a spectrophotometer or ELISA reader. Semi-quantification of absorbance can be accomplished by the use of a standard curve generated by measuring two-fold dilutions of the standard provided.

3.4.3 Vitamin D

Vitamin D was measured among children 6-24 months of age. The assay for obtaining vitamin D values utilizes of a competitive ELISA technique with a selected monoclonal antibody recognizing 25-hydroxy (25-OH) vitamin D. For a reliable determination of 25-OH vitamin D, it is necessary to release it from the 25-OH vitamin D-DBP-complex. Standards, controls and patient samples which are assayed for 25-OH vitamin D are incubated with the releasing reagent. The pre-incubated solutions are then transferred to the microplate coated with 25-OH vitamin D, and an anti-25-OH vitamin D antibody is added. During an overnight incubation step, 25-OH vitamin D in the sample and a fixed amount of 25-OH vitamin D bound to the microtiter well compete for the binding of the antibody. Then a peroxidase-conjugated antibody is added into each microplate well. A complex of 25-OH vitamin D - anti-25-OH vitamin D antibody – peroxidase conjugate is formed. TMB is used as a peroxidase substrate. Finally, an acidic stop solution is added to terminate the reaction, whereby the color changes from blue to yellow. The intensity of the yellow color is inversely proportional to the concentration of 25-OH vitamin D. A dose response curve of the absorbance unit (optical density, OD at 450 nm) vs. concentration is generated using the values obtained from the standard. 25-OH vitamin D in the samples is determined from this curve.

3.4.4 Urinary iodine excretion

Urinary iodine (UI) excretion levels were measured in all subjects surveyed. For measurement of iodine excretion, urine was collected during the interview. The samples were kept in a cold box at 4 °C and quickly frozen at -20°C until analysis. Urine samples were digested with ammonium persulfate on a heating block. Then, after the addition of arsenious acid solution, ceric ammonium sulphate solution was added and the absorbance of yellow complex was read in a spectrophotometer at 317 µM. The concentration was calculated by extrapolating from a standard curve. The procedure was simplified by the use of a kit and by reading the results on a microplate reader. The determination was performed in the central laboratory in Dushanbe.

3.5 Data entry and analysis

Data entry was performed in November and December 2009 in EpiInfo (version 3.5.1, Centers for Disease Control and Prevention (CDC), Atlanta). In order to eliminate a proportion of the errors in the data, the data entry mask was fitted with consistency checks. Double data entry was done for the whole dataset and errors were corrected using the original questionnaire.

All statistical analyses except for the anthropometrics of children were done in STATA (versions 9.2 and 10.1 Stata Intercooled, Stata Corp., College Station, Texas). Comparison of anthropometric measurements with the WHO standard growth curve and calculation of z-scores were conducted with the program ENA (available from: www.nutrisurvey.de/ena/ena.html, accessed 18th November 2009). The z-scores were then imported back into STATA for further analysis. Calculation of national averages and all tests of statistical significance were done using the prefix commands of the –svy– family of STATA.

Analysis of variance (ANOVA) using a post-hoc comparison of means (Scheffe's test) was performed for continuous variables, i.e. Hb, ferritin, sTfR and vitamin D.

The cluster sampling used in the study was taken into account using the –svyset– command and defining the 180 primary sampling units (usually villages or mahallas). Regional and urban-versus-rural residences were defined as strata. There were a total of nine strata, because one region (Dushanbe) had no urban population. Weighting factors were obtained by dividing the total population size of each stratum by the sample size for the same stratum and normalising the factors (Table 6).

Table 6: Sample size, population and weighting factors for MNSS 2009

	Population size		Total	Sample size children		Weighting factors	
	Urban	Rural		Urban	Rural	Urban	Rural
Dushanbe	695'246	0	695'246	430	0	0.44	
DRD	209'294	1'436'705	1'645'999	72	358	0.79	1.09
Sughd	550'873	1'620'321	2'171'194	108	324	1.39	1.36
Khatlon	456'612	2'185'671	2'642'283	60	371	2.07	1.60
GBAO	29'259	189'818	219'077	60	367	0.13	0.14
Tajikistan	**1'941'284**	**5'432'515**	**7'373'799**		**2150**		

Data sets were checked for outliers. The following values were considered as outliers and excluded from further data analysis: BMI above 60 kg/m2 and z-scores more than six standard deviations from the reference growth curve. These values are either impossible (negative concentrations), or clerical errors and were excluded for the above-mentioned reasons from the data set.

The optical densities measured in the ELISA assets were used to calculate concentrations of ferritin, CRP, sTfR and vitamin D using standardization curves with the specifications suggested by the corresponding manuals. Small deviations in the calculated concentrations are possible and therefore small negative values were corrected to zero concentration, but larger negative values were considered outliers and were excluded (see above).

4. Results

4.1 Study population

From a planned sample size of 4'320 individuals outlined according the study methodology, a total of 4'287 individuals were finally included in the survey. Thirty-three individuals, corresponding to < 1% of the initially planned sample, had to be excluded for various reasons such as incomplete or lost questionnaires.

The sample was composed by 2'141 WRA and 2'146 children 6-59 months of age. Table 7 shows the total number of individuals included in the survey and the percentage of individuals with laboratory examinations performed and anthropometric measurements taken. A negligible number of participants refused to provide biological samples.

Table 7: Number of individuals included in the survey and percentage of individuals with laboratory examinations and anthropometric measurement

	Number of persons included	% with Hb measurement	% with sTfR measurement	% with ferritin measurement	% with UI measurement	% with anthropometric measurement
Women of reproductive age (WRA) (15-49 years)						
Dushanbe	432	99%	100%	84%	99%	99%
Khatlon	432	99%	89%	79%	98%	100%
Sughd	432	100%	97%	87%	100%	100%
RRS	432	100%	100%	84%	100%	100%
GBAO	430	98%	99%	82%	100%	98%
total	**2,158**	**99%**	**97%**	**83%**	**99%**	**99%**

	Number of persons included	% with Hb measurement	% with sTfR measurement	% with ferritin measurement	% with UI measurement	% with anthropometric measurement
Children 6-59 months						
Dushanbe	426	99%	101%	86%	100%	100%
Khatlon	430	100%	92%	81%	98%	100%
Sughd	432	100%	100%	90%	99%	100%
RRS	431	100%	100%	82%	100%	100%
GBAO	427	99%	101%	75%	100%	100%
total	**2,146**	**100%**	**99%**	**83%**	**100%**	**100%**

4.2 Demographic characteristics of households and individuals

In total, 1'417 households were included in the survey. Two households where data were not available were excluded. Table 81 in (Appendix 8) displays the number of households in urban and rural areas. Dushanbe was the only region with an entirely urban population; the other regions were composed of populations living mainly in rural areas and their respective weight in the strata (regions) did not vary much; from 77% of households in Sughd to 86% in Khatlon.

Nearly four out of 10 households (38.4%) were composed of one single family (i.e. one couple with at least one child 6-59 months of age) according to the eligible criteria. More than every fourth household (28.8%) had two families; and every third household (32.9%) between three and more families. Households with only one family were most frequent in Dushanbe (62.8%) whereas households with three and more families were most found in Khatlon (45.5%), Sughd (48.5%) and DRD (49.6%).

At the national level, an average of 9.0 household members were living in the same household. The highest average number of household members living in the same household was observed in DRD (11.0%) and the lowest in Dushanbe (7.0%). The majority of households (84.7%) were headed by a man. The highest portion of women-headed households was found in Dushanbe (21.0%), and the lowest one in GBAO (9.8%).

The overall educational level of household heads gave the following picture: 11.8% attended primary (grade 1-4) or basic school (grade 5-9) - these groups include 2.0% of the households without any education; 37.8% attended secondary school; 23.2% attended a secondary special or technical school; and 27.2% had a higher education (university). In all regions, with the exception of Dushanbe, the majority of those interviewed attended secondary school. Almost every second household head in Dushanbe (46.8%) had a higher education level. Khatlon had the highest percentage of household heads with no formal education (4.6%), and Sughd the lowest percentage (0.8%). The highest percentage of female household heads was reported from Dushanbe (21.0%), followed by DRD (16.1%), Sughd (15.1%), Khatlon (12.8%), and GBAO (9.9%).

Remittances were the main cash source of income (29.3%), followed by official salary (25.5%), farming/livestock (22.6%) and private business (17.9%). Pension/social aid (2.7%) and no cash income (1.8%) were mentioned from very few households. The three main cash income sources in Dushanbe were salary, private business and remittances. Farming represented, in addition to remittances, an important cash income source for all four regions, with exception of Dushanbe (0.3%). Farming provided the highest cash income in Khatlon with 45%, followed by DRD (31.8%). Official salary as a source of income was high in GBAO (33.3%) compared to other regions. A small part of the households (2.7%) reported being dependent on social aid or pension, most often in Dushanbe and GBAO (4.6% and 4.3%,

respectively). No cash income was reported from 1.8% of all households surveyed, with the highest rates in Khatlon and Sughd (3.7% and 3.1%, respectively), and the lowest rate in GBAO (0.3%).

More than four out of five households were growing food crops to complement their own consumption, with the exception of Dushanbe where home-grown food was very low (7.9%). The overall percentage of households growing food was therefore 65.8%. The most common products were a variety of vegetables and fruits, including vitamin C-rich products (oranges, apricots, carrots, pumpkins), reaching 58.9% at the national level. Yellow or orange colored vegetables (pumpkins, carrots) or fruits (plums, apricots, etc.) were grown by half of the households (51.5%), and most frequently in GBAO (80.9%). Tubers (potatoes and other roots) were grown by almost half of the interviewed households (44.6%), and were most commonly grown in GBAO (79.7%). Cereals (wheat, rice) were produced by one third of households (35.1%), predominantly in Khatlon (63.4%). Pulses (beans, peas, lentils, nuts) were grown by every fifth household (21.7%), and most often in Khatlon and DRD (37.7% and 36.4%, respectively).

Animal breeding for meat and milk production was practiced by 60.8% of all households. This type of subsistence farming is very widespread (between 69.2 and 81.8%) in all regions, except Dushanbe (4.9%). Most popular was cattle breeding (53.3% at national level; between 55.0% and 74.6% for all regions excluding Dushanbe). Poultry and sheep farming was practiced by every third household (32.3% and 30.8%, respectively). Chicken farming was most common in Khatlon and GBAO (48.3% and 48.8%, respectively). Goats were raised by nearly every third household (28.2%), and most frequently in GBAO (68.8%). Only a few households had horses (3.2%), mainly in DRD (9.1%).

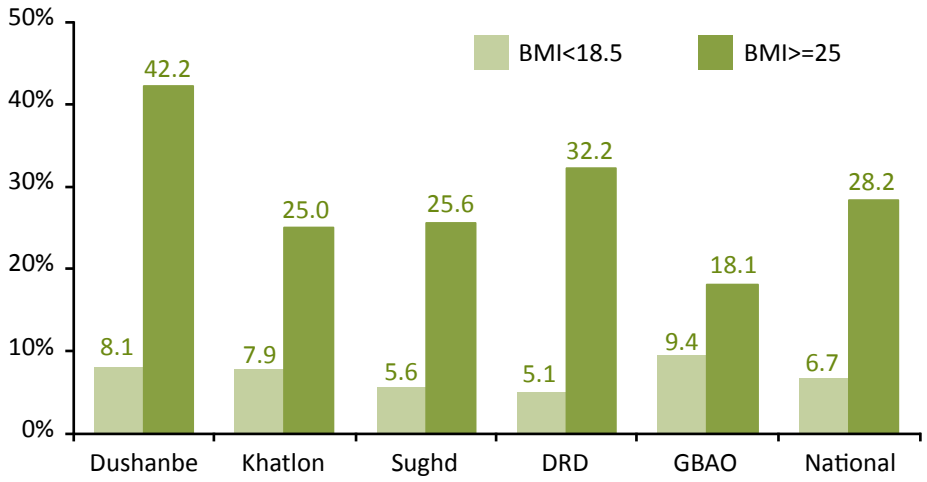
Interviewed households reported their coping strategies for problems related to food security since the beginning of 2009. Coping strategies included: borrowing food or relying on help from friends or relatives, decreasing the amount of food consumption, increasing production of food products for their own consumption, decreasing the purchase of non-food products, selling more animals, decreasing expenditures for health and drugs, withdrawing or postponing admission to school, seeking alternative employment, and increasing the number of household members who are out of the village in search for work. Most often reported were seeking alternative employment and migration (37.8% and 37.3%, respectively). Seeking alternative work was highest in Khatlon (54.5%), and reported migration was highest in Khatlon and Sughd (46.3% and 44.6%, respectively). Over 40% of households reported decreasing buying some non-food products (DRD: 72.3%). Every fifth household reported borrowing food or relying on help from relatives or friends (national level: 22.0%; DRD: 35.1%). One out of five households reported decreasing expenditures for health care and drugs (national level: 20.3%; Sughd: 31.9%). The amount of food consumption was reported to be decreased by every fifth household (national level: 21.3%; DRD: 39.7%). Food production for own consumption was reported to be increased by every fifth household (national level: 19.7%; DRD: 45.9%). Every tenth household reported selling more animals than usual (national level: 9.45; DRD: 20.7%). A small proportion of households reported withdrawing or postponing admission to school (national level: 3.3%; Dushanbe, Khatlon and DRD: 5.2%, 5.5% and 5.8%, respectively).

4.3 Women's nutritional status

4.3.1 BMI

A low BMI (< 18.5 kg/m2) at the national level was observed among 6.7% of the examined women (Figure 2, detailed information in Appendix 7.1, Table 10). The highest prevalence of underweight women was observed in GBAO and Dushanbe (9.4% and 8.1%, respectively), and in Khatlon (7.9%). Examined women from Sughd and DRD less often showed a low BMI (5.6% and 5.1%, respectively). The frequency of severe thinness (< 16 kg/m2) was 0.3% at the national level and below 1% for all five administrative areas.

Figure 2: Distribution of BMI among women 15-49 years of age by region.

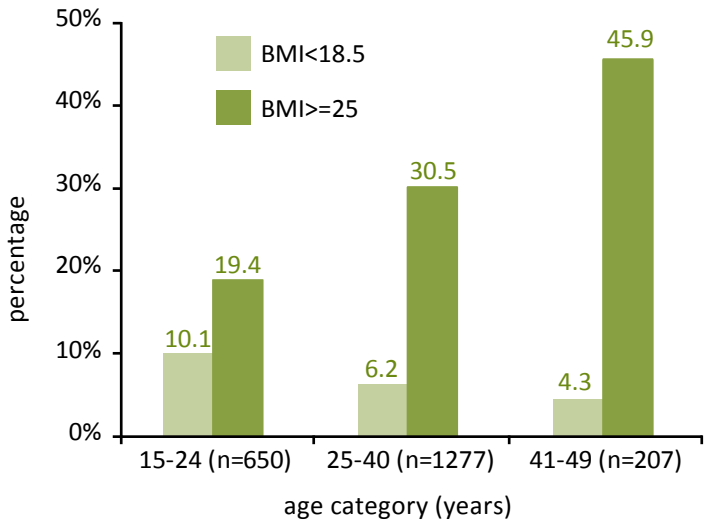


Almost one third of the examined women (28.2%) were overweight or obese (BMI > 25 kg/m^2). The highest prevalence of overweight was found in Dushanbe (42%) and lowest in GBAO (18%). The prevalence of obesity (BMI > 30 kg/m^2) at the national level was 8.8%, concentrated mainly in Dushanbe (17.0%). The frequency of obese women in other regions was below 10% (DRD 9%; Khatlon 8%; Sughd 8%; GBAO 4%). Obesity Class ll (BMI 35–39.99 kg/m^2) was 1.7% at the national level, however Dushanbe showed the highest prevalence (5.9 %) compared to the other regions (between 0.5% and 1.6%). Obesity Class lll (BMI > 40 kg/m^2) was very rare at the national level (0.4%).

Stratified by rural and urban areas, the rate of women having a BMI < 18.5 kg/m2 was not statistically significant (6.6% for rural areas, 8.5% for urban areas). However, the frequency of women with a BMI ≥ 25 kg/m2 was significantly higher in urban areas (36.8%) when compared to rural areas (24.4%) (Pearson $\chi^2 = 43.264$, $P < 0.001$) (*see Appendix 7.1, Table 11, Table 12*).

A statistically significant difference ($\chi 2 = 65.4$, $P > 0.001$) was observed between age groups and BMI Classes. As the age of mothers increased, the prevalence of overweight and obesity was also found to increase (*Figure 3; also see Appendix 7.1, Table 13*).

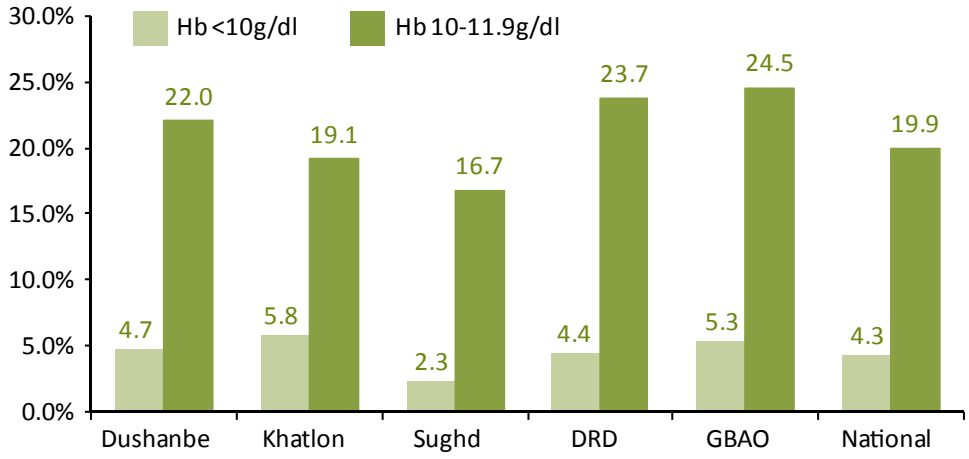
Figure 3: BMI Classes distribution for women by age (15–49 years)



4.3.2 Anaemia

The mean of Hb concentration from 2'138 examined women at the national level was 12.8 g/dL (SD +/-1.9 g/dL) (Appendix 7.2, Table 14). A significant difference between regions was observed (Bartlett›s test for equal variances: $\chi 2 = 65.01$; degrees of freedom [df] = 4; $P < 0.001$). Women from Sughd oblast showed a significantly higher mean Hb concentration than women from other oblasts (Sughd: 13.1 +/- 1.4 g/dL; Scheffe's test $P < 0.05$). The survey indicated an overall prevalence of anaemia (Hb < 12 g/dL) of 24.2% (see Appendix 7.2, Table 15 and Table 16,).

Figure 4: Frequency of anaemia among women 15-49 years of age by region



The highest prevalence of anaemic women were found in GBAO and DRD (29.8% and 28.1%, respectively). Sughd showed the lowest prevalence (19%). Regional variations were not statistically significant (Pearson $\chi 2 = 19.92$, df=12, $P = 0.143$). Considering the group of anaemic study participants (24.2%), 19.9% of anaemic cases were classified as mild anaemia (Hb 10–11.9 g/dL), and 3.9% as moderate anaemia (Hb 7–9.9 g/dL). Severe cases of anaemia were present in 0.4% of the population without significant differences among regions.

No rural/urban differences were observed for mean Hb levels (12.8 g/dL for urban, 12.7 g/dL for rural) and frequencies of anaemic women (24.9% and 27.2%, respectively) (Appendix 7.2, Table 17 and Table 18).

The prevalence of moderate anaemia was higher in older age groups (41-49 years), whereas 79.1% of the younger women (15-24 years) had normal Hb values. The differences were statistically significant, (Pearson $\chi 2 = 14.78$, df = 6, $P = 0.02$) (Appendix 7.2, Table 19)

4.3.3 Iron deficiency

Almost every sixth examined women (17.5%) had an acute infection (CRP > 5 mg/L). The highest prevalence was observed in DRD (16.6%), and the lowest prevalence in Sughd (10.3%). Taking into account the fact that ferritin values become elevated in response to infection, serum ferritin values were considered only for individuals with normal CRP (< 5 mg/L).

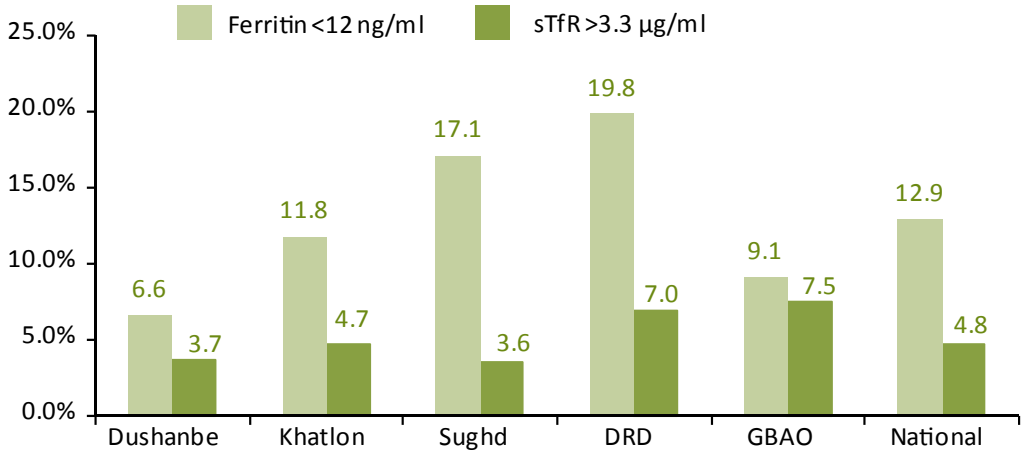
The national mean ferritin concentration was 122.0 mg/L (SD = 104.5 mg/L). The highest ferritin values were observed in Dushanbe and the lowest values in DRD (154.5 mg/L and 106.2 mg/L, respectively) (Appendix 7.3, Table 20). Out of 1'791 women, 9.3% showed low serum ferritin values (cut-off < 12 µg/L) (Appendix 7.3, Table 21). DRD was the region with the highest prevalence of women with low serum ferritin concentrations (14.3%), and Dushanbe and GBAO had the lowest prevalence (both 1.6%) .

Ferritin concentrations and the prevalence of low ferritin values did not differ significantly between urban (8.0%) and rural (6.4%) areas (Appendix 7.3, Table 22 and Table 23).

Taking sTfR concentrations (cut-off > 3.3 µg/ml) into consideration in the interpretation of iron deficiency anaemia (IDA), urban/rural differences were more apparent. The national mean sTfR concentration was 1.2 µg/mL (+/- SD 1.4 µg/mL) and varied considerably between the regions (Appendix 7.3, Table 24). Women living in GBAO had the highest mean concentration of sTfR (1.6 µg/mL), followed by women from DRD (1.5 mg/L). The lowest mean sTfR concentration was observed in Dushanbe (0.9 µg/mL).

The overall prevalence of elevated sTfR was 4.8%, and the variation between regions showed a different picture than for ferritin (Figure 5 below; Appendix 7.3, Table 25 and Table 26).

Figure 5: Frequency of low ferritin and high sTfR among women (15-49 years) by strata



The highest prevalence of IDA (defined by sTfR > 3.3 µg/mL) was found in GBAO (7.5%), and the lowest prevalence was found in Sughd (3.6%).

High sTfR levels were quite similar in rural and urban areas (8.5% and 8.0%, respectively) (Appendix 7.3, Table 27 and Table 28).

Older women had a higher prevalence of IDA than younger women. Iron deficiency (elevated sTfR) was present in 15.5% of all anaemic women (Hb < 12 g/dL). The highest prevalence of women with IDA was observed in GBAO (20% of women showing elevated sTfR). IDA was present in 42.4% of women with moderate-to-severe anaemia (Hb < 9.9 g/dL).

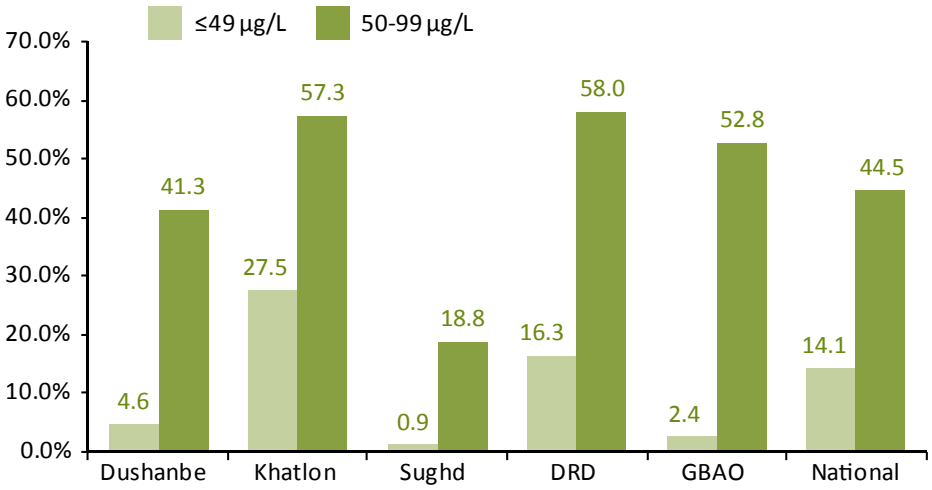
4.3.4 Iodine

A total of 2'140 urine samples were collected from women and analyzed for iodine excretion. The national median UI excretion was 107.8 µg/L, which was just at the expected level of 100 µg/L. A threshold of 100 µg/L is considered as the minimum iodine concentration in urine and is therefore an indicator for adequate iodine intake. The observed mean indicates that iodine status in WRA is at the threshold level (see Appendix 7.4, Table 29). Sughd and Dushanbe were above the expected normal range (178.5 µg/L and 103.8 µg/L, respectively). The lowest mean concentration was found in Khatlon (61.8 µg/L).

Mild iodine deficiency (values 50-99 µg/L) was observed in almost half of examined women (44.5%), with the highest prevalence in Khatlon (57.3%) and lowest in Sughd (18.8%). Moderate iodine deficiency (20–49 µg/L) was observed in one out of 8 women (12.1%). The highest prevalence of moderate

iodine deficiency was observed in Khatlon (22%), and the lowest in Sughd (0.7%). A similar distribution was found for severe iodine deficiency (< 20 µg/L) (Figure 6; Appendix 7.4, Table 30 and Table 31).

Figure 6: Urinary iodine distribution among women (15-49 years) by region



Severe cases of iodine deficiency (< 20 µg/L) were most frequent in Khatlon (5.2%). In the other regions the prevalence remained under 1%. UI values exceeded 300 µg/L in a very small number of samples (0.2% at the national level).

Women living in urban areas showed a considerably higher mean UI concentration (117.2 µg/L) when compared to women living in rural areas (106.9 µg/L) (ttest, $P < 0.001$). Particularly the category of moderate-to-severe iodine deficiency was more frequent among women living in rural areas (12.7%) compared to women living in urban areas (5.3%) (Pearson $\chi 2 = 36.5$, $P < 0.001$) (Appendix 7.4, Table 32 and Table 33).

At the national level, 61.9% of the tested salt was adequately iodized. Iodization of edible salt was highest in Sughd with more than 90% of household salt showing an adequate iodine level (> 15 ppm).

4.3.5 Consumption of food categories and association with nutritional indicators

The women were asked by the interviewers what kind of food they consumed since the previous day (i.e. within a recall period of 24 hours) (Appendix 7.5, Table 34). The most commonly consumed foods were 'wheat, bread, rice, pasta, biscuits', 'potatoes or other roots or tubers,' and 'other vegetables and fruits'. More than 90% of the respondents indicated having consumed all three of these food categories. Consumption of food groups 'fats and oils,' and 'yellow or orange colored vegetables or fruits' was also very high (88.4% and 82.9%, respectively). Two thirds (66.2%) reported having consumed 'milk or milk products', and six out of 10 women (59.0%) reported having consumed pulses ('beans, peas, lentils, nuts'). Eggs were eaten by four out of 10 women (41.8%), and 'meat, liver, kidney, chicken, or fish' by every fourth woman (27.3%).

The most common drinks were black or green tea (99.7%) and 'plain water' (90.1%). More than two thirds of the respondents reported having consumed 'sugary water or fruit juices' (67.9%). The intake of vitamins, mineral supplements and/or medicine was reported by few respondents (5.8%).

Linking consumption of different nutritional categories (recall period: 24 hrs) with nutritional indicators (Appendix 7.5, Table 35), no significant association was observed for BMI and anaemia. For categories of UI concentrations, women who were eating 'yellow or orange colored vegetables or fruits' seemed to be less often affected by moderate-to-severe iodine deficiency (Pearson $\chi 2 = 23.598$, $P = 0.005$).

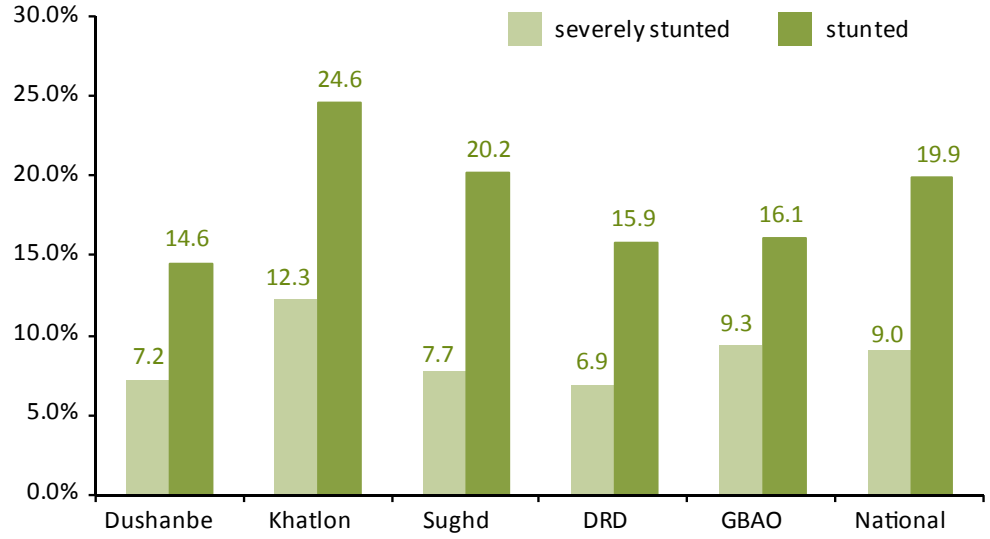
4.4 Children's nutritional status

4.4.1 Anthropometric assessment

The results from the present survey revealed a low height-for-age rate among 20% of the children (low height-for-age, –2 z-scores). Children living in Khatlon were significantly more often low height-for-age (design based F P = 0.001). The percentage of low height-for-age children in Khatlon was 24.6%, followed by Sughd (20.2%), GBAO (16%), DRD (15.9%) and Dushanbe (14.6%).

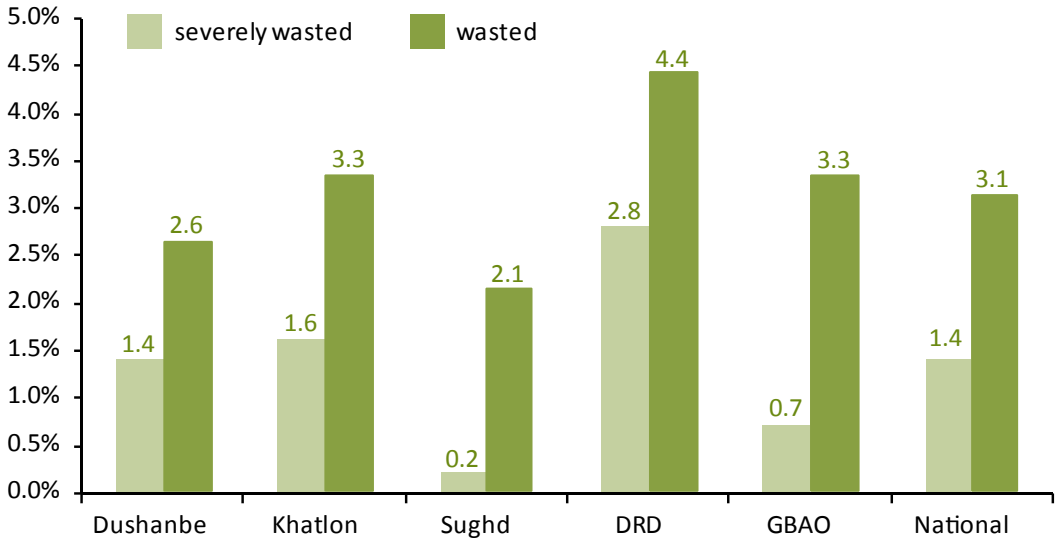
The overall prevalence of severe low height-for-age (–3 z-scores) was less than 10%. In Khatlon, this condition reached 12.3%, (highest rate) and in DRD it reached 6.9% (lowest rate) (Appendix 7.6, Table 36).

Figure 7: Frequency of low height-for-age children (6–59 months) by strata



According to the definition of low weight-for-height (–2 z-scores), 3.1% of the children were observed to present the condition of acute malnutrition. DRD showed the highest rate (4.4%) and Sughd the lowest (2.1%). The rate of severe low weight-for-height (–3 z-scores) followed a similar distribution (DRD: 2.8%, Sughd 0.2%) (Appendix 7.6, Table 37).

Figure 8: Frequency of children (6-59 months) with low weight-for-height.



Children in rural areas were more likely to have low height-for-age than children in urban areas ($\chi 2$ = 7.599, P = 0.022) (Appendix 7.6, Table 38). There were, on the other hand, no rural/urban differences observed for low weight-for-height and underweight (Appendix 7.6, Table 39 and Table 40).

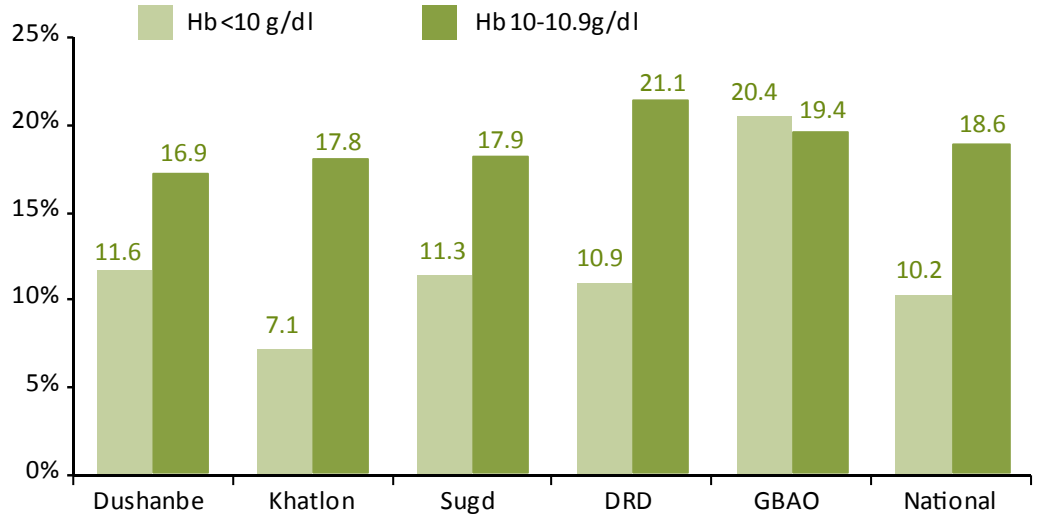
No significant gender-related differences for height-for-age and underweight were observed at the national and regional levels (Appendix 7.6, Table 41 and Table 42 - for height-for-age and underweight). An exception was Sughd where boys were more likely to be underweight and severely underweight (6.3% and 2.5%, respectively) than girls (2.7% underweight, 0% severely underweight) (P = 0.01).

Regarding low weight-for-height (wasting) at the national level, boys were more likely to have severe low weight-for-height than girls (2.0% and 0.7%, respectively; Pearson $\chi 2$ = 7.775, P = 0.021). The gender-related difference of the category severe low weight-for-height was observed to be particularly high in the region of DRD (boys: 4.5%, girls: 1.0%; P = 0.011) (Appendix 7.6, Table 43).

4.4.2 Anaemia and iron deficiency

Hb and iron status were assessed by measuring Hb, serum ferritin, CRP and sTfR, following the same procedures as for women. Laboratory-analyzed blood samples were obtained from 2'136 children 6-59 months of age. The mean Hb concentration was 11.6 +/-1.3 g/dL (Appendix 7.7, Table 44). The overall national prevalence of anaemia (Hb < 11 g/dL) was 28.8%, and was highest in GBAO (39.8%) and lowest in Khatlon (24.9%). Mild anaemia varied little between regions (16.9% to 21.1%). Children in GBAO showed a significantly higher prevalence of moderate anaemia (Hb 7-9.9 g/dL) compared to all other regions. Severe anaemia was below 1% for all regions (Figure 8; Appendix 7.7, Table 45 and Table 46).

Figure 9: Frequency of severe and moderate anaemia in children (6-59 months) by strata



Mean Hb concentrations were similar in rural and urban areas (1.6 g/dL in each strata); 31.4% children were anaemic in rural areas and 30.2% of children in urban areas were anaemic (Appendix 7.7, Table 47 and Table 48).

Stratified by gender, the mean Hb concentration was higher in girls (11.7 g/dL) than in boys (11.5 g/dL) (ttest P = 0.001). Significant differences were observed in GBAO (boys: 11.0 g/dL, girls: 11.5 g/dL; P = 0.002) and in Sughd (boys: 11.5 g/dL, girls: 11.7 g/dL; P = 0.055). Looking at frequencies, severe anaemia was more common in boys (14.3%) than in girls (10.2%) ($\chi 2$ = 8.959, P = 0.011). Notably in GBAO, the frequency of boys with moderate and severe anaemia (21.7% and 24.9%, respectively) was considerably higher than the frequency of girls showing moderate and severe anaemia (17.6% and 16.2%, respectively) (Appendix 7.7, Tables 49–52).

Figure 10: Frequency of anaemia in children stratified by age group

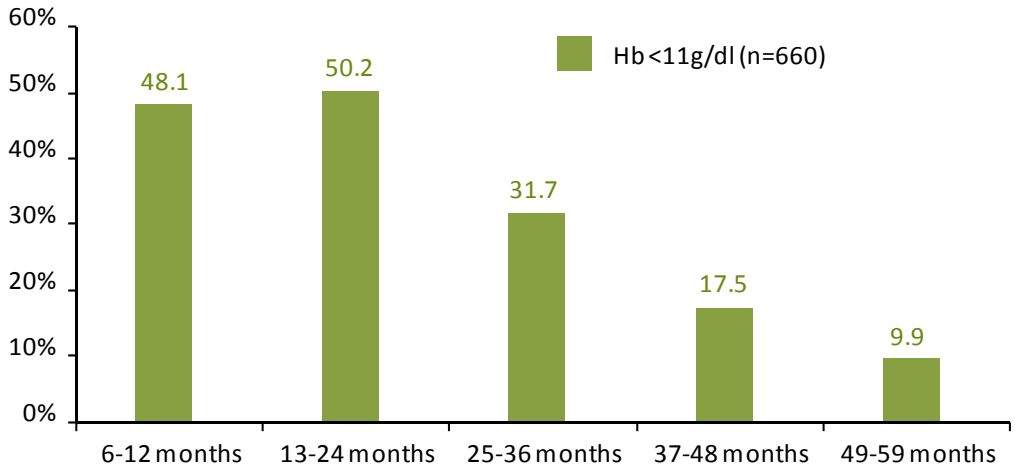


Figure 10 shows the prevalence of anaemia among children by age groups (for further information see Appendix 7.7, Table 53). Anaemia was more frequent in younger children; 48.1% of all children 6-12 months of age and 50.2% of all children 13-24 months had a Hb level below 11 g/dL. In older age groups the prevalence of anaemia decreased to 31.7% (25–36 months) and to 9.9% (49–59 months).

The presence of an acute infection (CRP > 5 mg/L) was found in 13.9% of all examined children. The highest prevalence of acute infection was found in DRD (18.3%), and the lowest rate in Sughd (11.2%).

Ferritin values were considered only for individuals with normal CRP. Out of 1'805 children with normal CRP values, 9.7% showed low serum ferritin concentrations (cut-off < 12 mg/L) (Appendix 7.8, Table 54). The highest prevalence of low ferritin concentrations was found in DRD (13.5%), and the lowest rate in Dushanbe (2.4%).

The mean ferritin concentration was insignificantly higher in urban areas (110.7 mg/L) than in rural areas (92.1 mg/L). The percentage of children showing low ferritin values was inconsiderably higher in urban areas (10.4%) than in rural areas (8.1%) (Appendix 7.8, Table 55 and Table 56).

No remarkable gender-related difference of low ferritin concentrations was observed at the national level. Dushanbe was the only region where the prevalence of low ferritin concentrations was higher in boys (4.7%) when compared to girls (1.0%) ($\chi 2 = 4.992$, $P = 0.027$) (Appendix 7.8, Table 57).

Considering the mean sTfR concentration for the interpretation of iron deficiency anaemia (IDA), a mean concentration of 1.6 µg/mL (+/-1.4 µg/mL) was observed at the national level. Children living in GBAO showed a significantly higher mean concentration of sTfR relative to children in other oblasts (Appendix 7.8, Table 58). According to sTfR results, 8.6% of analyzed children were iron deficient, with the highest prevalence in DRD and GBAO (15.6% and 15.2%, respectively), and the lowest prevalences in Dushanbe and Khatlon (5.3% and 5.8%, respectively) (Appendix 7.8, Table 59).

The mean sTfR concentration was higher in rural areas (1.7 µg/mL) than in urban areas (1.4 µg/mL) (ttest $P < 0.001$). In rural areas a higher prevalence of elevated sTfR concentrations were found when compared to urban areas (rural: 14.5%, urban: 9.1%; $\chi 2 = 12.854$, $P < 0.001$) (Appendix 7.8, Table 60 and Table 61).

Stratified by gender, the overall mean sTfR concentration was higher among boys (1.7 µg/mL) when compared to girls (1.5 µg/mL) (ttest $P = 0.031$). However, the only remarkable difference was observed in Dushanbe (boys: 1.3 µg/mL, girls: 1.1 µg/mL; ttest $P = 0.043$). In this region, the frequency of sTfR concentrations of ≥ 3.3 µg/mL was higher in boys (7.7%) than girls (3.1%) (Appendix 7.8, Table 62 and Table 63).

Younger children (6-24 months) showed more frequently an elevated sTfR (19.3%) than older children (3-5 years) (9.3%). These results showed a similar pattern to age-related Hb distribution (Appendix 7, Table 53).

Iron deficiency (elevated sTfR) was present in one third (30.9%) of children with severe and moderate anaemia, and in 5.4% of children with normal Hb values. For both indicators, DRD (Hb: 46.8%; elevated sTfR: 10.3%) and GBAO (Hb: 33.8%; elevated sTfR: 8.4%) showed the highest prevalence rates.

The highest frequencies of iron deficiency were observed in DRD and GBAO. In DRD 46.8% (and in GBAO 33.8%) of the children with severe and moderate anaemia showed elevated sTfR values, and among children with Hb > 11 g/dL, 10.3% (8.4% in GBAO) had elevated sTfR.

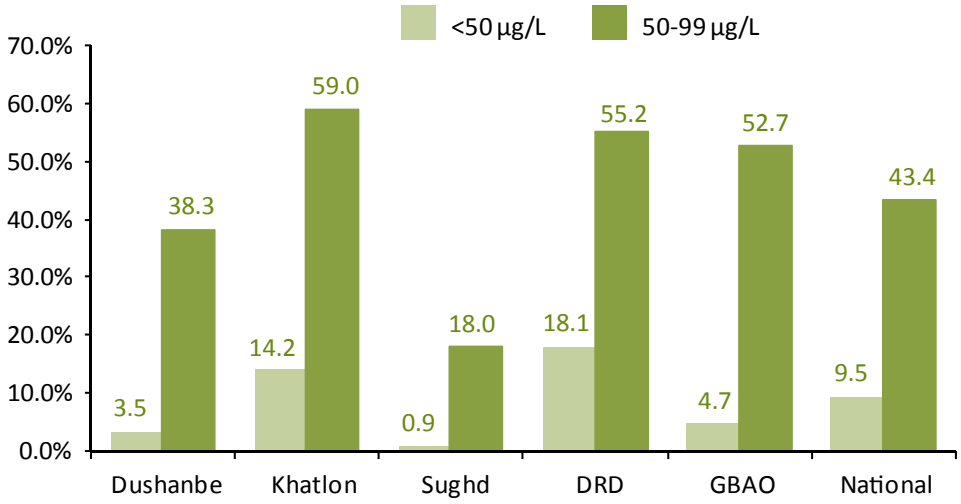
Almost 50% of the children reported having been dewormed within the last six months. The highest percentage of deworming was reported in GBAO (62.1%), with the lowest in Khatlon (45%).

4.4.3 Iodine

Table 64 in Appendix 7.9 displays UI concentrations among children 6-59 months of age per region. Results from 2'137 laboratory analyzed urine samples were obtained. The national median concentration (116.5 µg/L, SD = 63.9 µg/L) was slightly above the threshold value of 100 µg/L. Dushanbe and Sughd showed a median concentration above the cut-off point of 100 µg/L (107.7 µg/L and 176.8 µg/L, respectively).

Iodine deficiency (UI < 100 µg/L) was observed in more than half of the children studied (52.9%), indicating an insufficient iodine status in children. DRD and Khatlon showed the highest rate of children with iodine deficiency (73.3% and 73.2%). In Sughd the lowest prevalence was found (19%) (Appendix 7.9, Table 65).

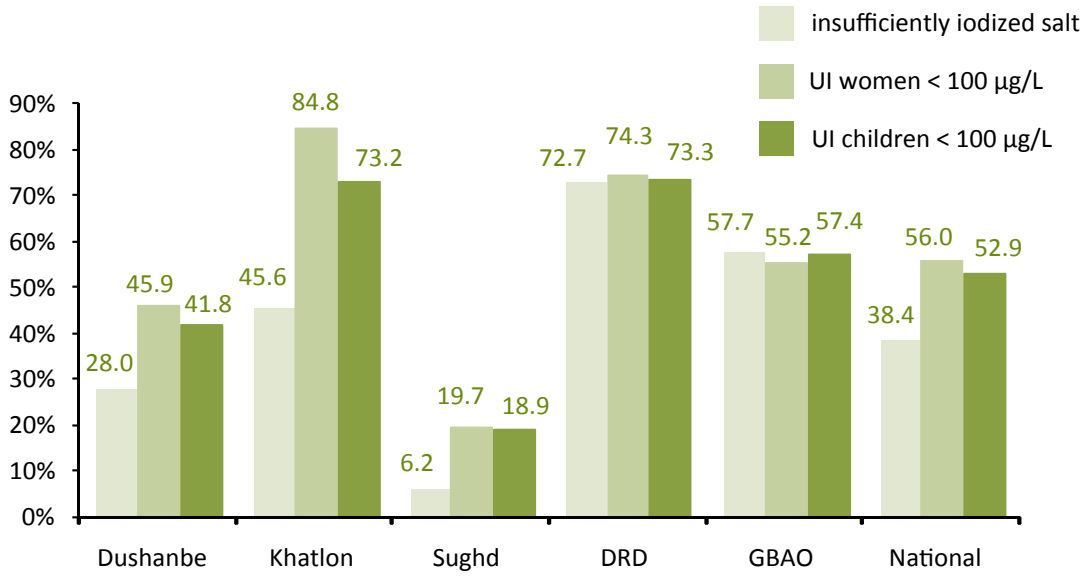
Figure 11: Frequency of urinary iodine concentrations in children (6-59 months) by strata



At the national level, severe cases of iodine deficiency was 0.6%, and these cases were concentrated in the DRD and Khatlon oblasts. This finding showed a similar distribution to iodine concentrations in tested household salt in those oblasts.

The mean UI concentration was observed to be noticeably higher in urban areas (123.8 µg/L) when compared to rural areas (112.3 µg/L). The frequency of children with mild and moderate-to-severe iodine deficiency was significantly higher in children from rural areas (55.1%) than in children from urban areas (45.5%) (Pearson $\chi 2 = 22.959$, $P < 0.001$) (Appendix 7.9, Tables 66 and 67).

Figure 12: Frequency of insufficiently iodized salt (< 15 ppm) and of urinary iodine < 100 µg/L



Looking at gender, mean UI concentration and frequencies of mild and moderate-to-severe iodine deficiency did not differ significantly between boys and girls in any of the regions (Appendix 7.9, Tables 68–70).

The level of iodized salt in households and the reported prevalence of goitre in children living in these households was not statistically associated (logistic regression; P = 0.24).

4.4.4 Vitamin D

Blood samples from infants 6–24 months of age were also analyzed for vitamin D. From a total of 791 infants examined, results from laboratory analyses were obtained from 625 individuals. The difference of 166 specimens can be explained by an insufficient amount of blood from these infants for laboratory analyses. Vitamin D status was grouped into four categories: deficient (< 25 nmol/L of serum 25-OH vitamin D concentration), moderately insufficient (25-49 nmol/L), adequate (50-74 nmol/L), and optimal (> 75 nmol/L); according to Pearce and Cheetham (2010). The overall mean vitamin D concentration was 56.1 nmol/L (SD = 28.8 nmol/L) (Appendix 7.10, Table 71). Infants from Sughd showed the highest mean vitamin D concentration (64.7 nmol/L), and infants from GBAO the lowest mean concentration (41.6 nmol/L). Differences of mean vitamin D concentrations were not statistically significant between regions.

About 60% of all investigated infants had sufficient (adequate and optimal) vitamin D concentrations, with the highest frequency in Sughd (74.2%) and the lowest frequency in GBAO (33.4%). GBAO and DRD were the two regions with the highest rates of infants showing vitamin D insufficiency (43.5% and 38.5%, respectively) and vitamin D deficiency (23.2% and 21.1%, respectively) (Appendix 7.10, Table 72).

Children from rural areas showed a higher mean vitamin D concentration (55.4 nmol/L) compared to children from urban areas (47.4 nmol/L) (ttest P < 0.001) (Appendix 7.10, Table 73).

Results from gender-related analyses showed that boys from the region of Sughd had a higher mean concentration of vitamin D than girls (71.5 nmol/L and 57.4 nmol/L, respectively; ttest P = 0.001) (Appendix 7.10, Table 74).

4.4.5 Infant feeding pattern

Nearly nine out of 10 interviewed mothers reported that the health worker asked or gave advice on breastfeeding and asked about infant feeding patterns.

Almost all of the infants 6-24 months of age were breastfed (97.5%) for at least the first four months. Reported breastfeeding for children 6-24 months of age in GBAO was almost 100% (99.4%). The question for exclusive breastfeeding was: 'For how long did you exclusively breastfeed your child?' The information (number of months) provided by the mother stands for the last month when the infant was breastfed before stopping (Figure 13). Exclusive breastfeeding at least during the first three months was done by 84.6% of the interviewed mothers, and breastfeeding during the first five months by 64.8% of the mothers. A large proportion of mothers seemed to stop breastfeeding between months five and six. Only 23% of the mothers reported breastfeeding their infant during the first six months, and only 1.6% of the mothers during the first 12 months.

Figure 13: Reported exclusive breastfeeding in number of months

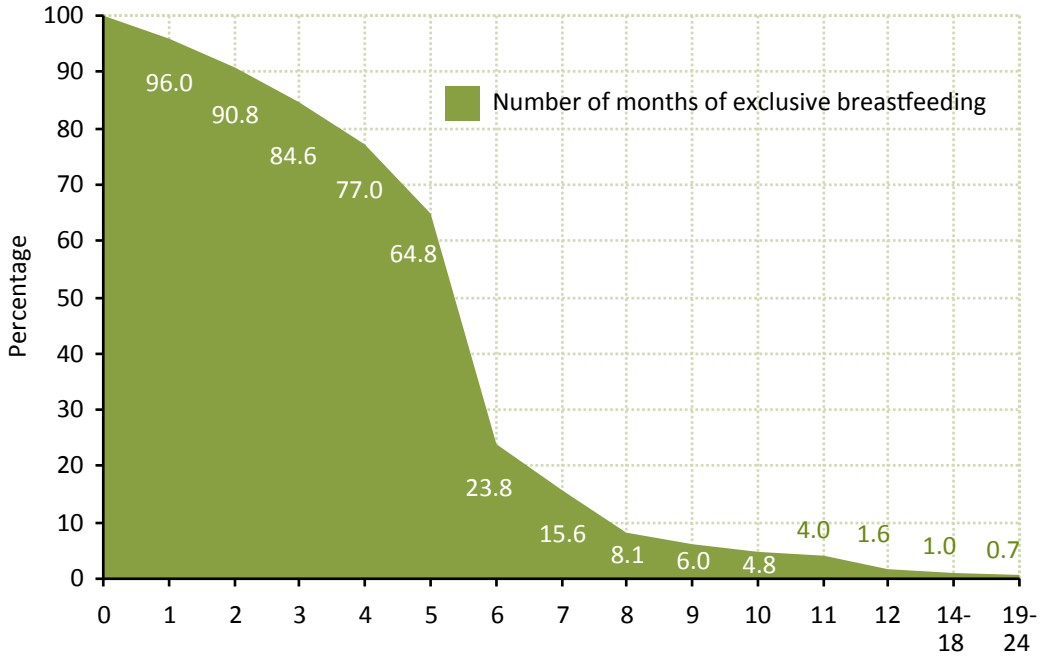
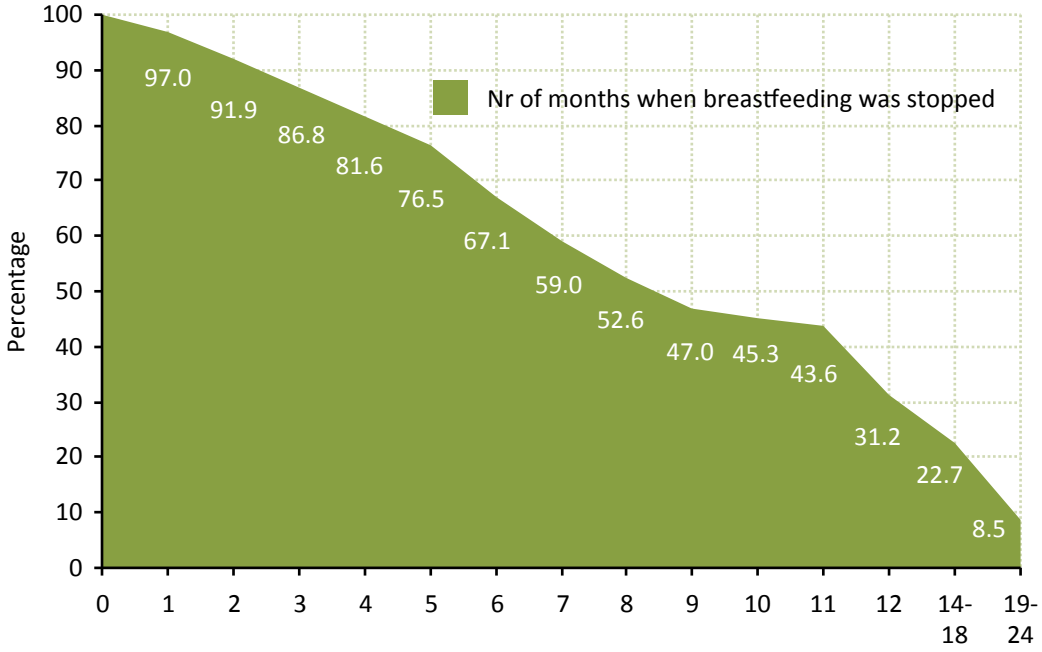


Figure 14 displays results from the question to mothers 'When did you stop breastfeeding?'. Most of the interviewees (70.2%) did not remember when they stopped breastfeeding entirely. Reported stopping of breastfeeding was gradual for those who remembered: 18.4% of the mothers did not breastfeed their child anymore by month four; 32.9% by month six; and 68.8% by month 12.

More than a half of the mothers (57.1%) breastfed their baby within the first 30 minutes from delivery, followed by a third (30.3%) within the first six hours. More than two thirds of the mothers (72.3%) in Sughd breastfed their infant within the first 30 minutes after delivery, but in Khatlon this practice was observed only among every second mother (52.1%).

Figure 14: Number of months when breastfeeding was stopped at all



The mother was also asked if the child has received any other drinks in addition to the breast milk within the last 24 hours. The administration of additional drinks was very common. Plain water was mostly given (90.9%: Sughd: 98.4%; GBAO: 77.1%). Black or green tea was given to four out of five children (81.5%). Regarding regions, the administering of black or green tea varied between 87.5% (DRD), 75.5% (Dushanbe) and 75.2% (GBAO). Almost every second interviewee reported giving animal milk to her child (48.8%); most frequently in GBAO (68.8%) and least frequently in Sughd (28.5%). The question 'Did you dilute the animal milk?' was not responded to by half of the women interviewed. Of those who remembered, almost every second interviewee reported diluting the animal milk (44.0%). The highest reported differences for diluting animal milk were observed between Khatlon (65.9%) and Sughd (30.2%). Administering fruit juices and herbal tea was less common. Fruit juices were reported to be given to a child by one third of mothers on average (34.4%; Sughd: 54.3%; Khatlon: 20%). Herbal tea was given to every fifth child on average (18.0%) and varied between 26.3% (DRS) and 10.2% (GBAO). Four out of five mothers on average (80.0%) added sugar to drinks (between 70.6% in Dushanbe and 83.9% in Sughd).

Complementary feeding was first introduced mainly to infants at six months of age and older (44.3%). Almost half of mothers started with complementary food when her child was between four and six months (48.5%), and 11.9% of the mothers within the first three months. In the region of GBAO the highest proportions of mothers who first introduced complementary food after six months was observed (60.5%), whereas Sughd showed the lowest proportion of mothers starting with complementary food after six months (25.5%). The highest proportion of mothers starting with complementary food during the first three months was observed in Dushanbe (24.5%), and the lowest proportion in GBAO (11.5%).

4.4.6 Nutrition given to children and association with nutritional indicators

Food categories that were most often given to children were 'wheat, bread, rice, pasta, biscuit (96.7%), 'potatoes or other roots or tubers' (92.8%), and 'other vegetables and fruits' (87.4%). Less often consumed (i.e. only four out of ten children were offered) were pulses ('beans, peas, lentils, nuts') (42.6%) and eggs (36.9%). Looking at drinking habits, a large percentage of children were reported to be given black or green tea (94.0%) and 'sugary water or fruit juices' (77.9%) (Appendix 7.11, Table 75).

Comparing food categories with nutritional indicators, children from households growing and receiving pulses ('beans, peas, lentils, nuts') seemed less frequently to have mild and moderate-to-severe anaemia than other children ($\chi 2 = 16.652$, $P = 0.002$ for growing pulses; $\chi 2 = 34.552$, $P = 0.001$ for eating pulses). Children who were eating 'meat, liver, kidney, chicken, fish' and 'eggs' less often had anaemia ($\chi 2 = 20.608$, $P = 0.012$ for eating meat etc and fish; $\chi 2 = 12.526$, $P = 0.014$ for eating eggs) (Appendix 7.11, Tables 76 and 77).

4.4.7 Child health

The reported incidence of diarrhea for a recall period of four weeks was 37.2% at the national level and did not vary considerably between regions (Appendix 10, Table 97). The most commonly reported drinks given in case of diarrhea were water (95.3%), tea (91.9%), and soup (90.2%). Three out of four interviewees gave antibiotics (78.8%). Another observation was that an oral rehydration solution (ORS) was given in three out of four cases of diarrhea (72.6%) (Appendix 10, Table 98). More than half of the mothers reported that their child drinks much more when she or he has diarrhea (Appendix 10, Table 99).

Regarding general health problems, the reported rate of vision problems at night was 1.8% at the national level, with the highest rate in Dushanbe (5.4%). Goitre was reported at 1%, though it should be noted that goitre is a long-term sign of iodine deficiency and therefore visible only after several years, and mainly in older children. The high rate of reported goitre from children in Dushanbe (6.2%) might be explained by the urban cluster of Dushanbe and thus better access to health care, in particular specialized service delivery. Every seventh child (14.7%) received iron syrup within the past six months and 85.1% of all children were administered a vitamin A capsule within the past six months. Half of the children were reported to have been dewormed within the past six months (46.4%) (Appendix 10, Table 100).

4.4.8 Care and Development

The Care and Development evaluation was planned in parallel with the nutrition survey, and the findings of the two are complementary. The following sub-chapter summarizes the findings from the Care and Development section.

Nearly all (96.6%) of the interviewed caregivers reported having received a visit from a health worker or volunteer for the assessment of child health and development within the last six months. Full coverage was reached in GBAO, whereas the lowest coverage was reached in Dushanbe (88.7%).

Less than the half of the interviewed mothers (45.7%) visited a health worker within the last six months for a child's illness. The lowest rate of mothers visiting a health worker was reported from GBAO (22.1%). The highest rate of visit to a health worker was in the DRD region (67.9%).

Only 15.2% of the interviewed population visited a health worker for their infant exclusively for preventive purposes. Preventive visits were most common in GBAO (20.8%) and least common in DRD (4.5%).

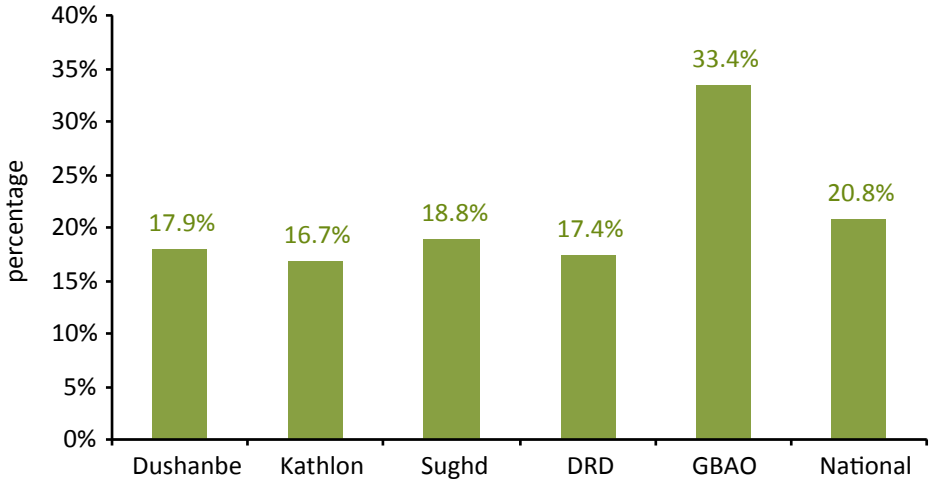
About 40% of caregivers (40.6%) received advice on Care and Development during a visit to the health worker. Seeking advice on Care and Development was most common in Sughd with 48.9% of the interviewed responding that they were asked questions on child development by the health worker. Three out of four (72%) of interviewees reported that they were questioned about their infant's milestones (i.e. ability to walk, to talk, and to understand).

Only 63.6% of mothers received advice on child care, discipline, and sleeping habits. Receiving advice on how to help the child in learning more was reported from 69.6% of interviewed mothers. In Sughd, 69.2% of the caretakers were asked about child care, discipline and sleeping habits, whereas in GBAO only 54.1% of the mothers were asked.

4.5 Knowledge, attitude and practice

Intake of iron-folate supplements: One fifth of interviewed women (20.8%) reported having received iron-folate tablets in the prior six months. The intake of iron supplements was most frequent in GBAO (33,4%), and least frequent in Khatlon (16.7%).

Figure 15: Frequency of women indicating to have received iron-folate tablets by strata

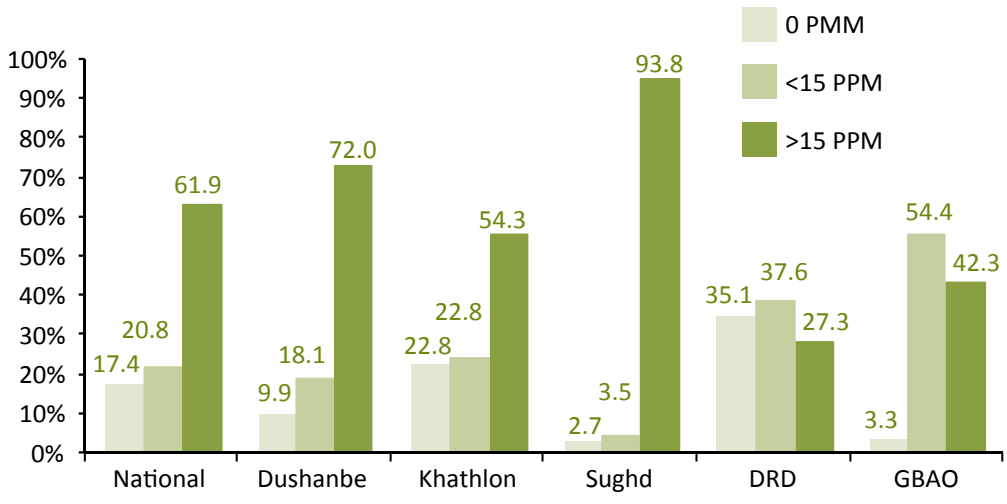


Iodine level of salt samples from households: The majority of the study participants (85%) reported using iodized salt. Another 10% admitted to not knowing about iodization of edible salt. The remaining 5% of interviewed households reported using salt that is not iodized.

Almost 80% of households reported the use of iodized salt as a benefit to prevent goitre, help the normal development of the fetus during pregnancy, and prevent children from developing mental disorders. The storage of salt was appropriate in general; over 80% of the interviewees stored their salt in closed containers. The highest rate of reported poor storage was found in DRD (24.4%).

Edible salt from 1'409 surveyed households was tested on iodine concentration using test kit solutions provided by UNICEF. 82.7% of the salt samples were iodized, but 20.8% of the tested salt samples were not sufficiently iodized (< 15 ppm). The rate of adequately iodized salt was 61.9% with large variations between the regions. More than 90% of households from Sughd used adequately iodized salt (93.8%). DRD on the other hand showed the lowest rate of adequately iodized salt (27.3%).

Figure 16: Frequency of household salt iodization levels by strata



5. Discussion

The overall objective of the 2009 MNSS in Tajikistan is to assess nutrition-related health indicators among a representative sample of the population (WRA and children 6-59 months of age) at the national and regional levels, and to compare the most recent results with findings from previous national nutrition surveys conducted in 2003 (UNICEF MNSS, conducted by INRAN and the MoH Tajikistan) and 2005 (UNICEF Multi Indicators Cluster Survey, MICS). The results are discussed indicator by indicator in the following paragraphs below.

5.1 Quality assurance and quality control procedures

Within this survey, quality measures ensuring an acceptable-to-good quality of field data collection, laboratory analysis and data management were considered. During the pre-survey the quality assurance (QA) was tested. A comprehensive training of the field team (interviewers, laboratory technicians and supervisors) was conducted covering interview techniques, sampling procedure, inclusion and exclusion criteria of target population, sources of errors, taking of measurements, standardizing questions in the questionnaire, levels of precision required in measurements, handling of equipment and the general courtesy of conducting a survey.

Further, the questionnaire was pre-tested in a pilot study carried out as described above. The pilot testing also included familiarizing the survey teams with village/cluster entries, administering the questionnaire, sampling procedure, correct taking of anthropometric measurements, and documentation. After the field exercise, views and experiences were exchanged to address the difficulties identified; appropriateness of the questions in the questionnaire was reviewed and necessary changes were undertaken. During the field data collection, QA and data control mechanisms relied on the following:

- An independent quality control (QC) team led by a nutritionist performed random unannounced visits of around 10% of the total sampled households that were visited by field workers in the previous two days. Doing so, each of the 12 field teams' performance was assessed at least once with a QA/QC checklist. This checklist was comprised of essential information from the questionnaire but also included questions about interview techniques, information about the communities, selecting the households and general courtesy of the field teams. The above described methodology had been tested by the WFP.

- The field teams were supervised by a national survey coordinator from MoH Tajikistan and an independent supervisor from the Swiss TPI to ensure that the data were collected properly. All survey teams were contacted on a daily basis in order to address all upcoming questions or issues immediately. The national survey coordinator also conducted onsite unannounced field visits.
- An independent external NGO (Zerkalo) monitored about 30% of households by calling selected households and survey teams by phone. Furthermore all questionnaires were screened for missing or inconsistent data. Field teams or the QC team were immediately informed about their findings.
- The data unit supported the QC team by continuous data cleaning after data entry. Using this procedure, any outliers or mistakes could be detected and replaced or repeated in households, depending on the magnitude of error. During this exercise however no major issues arose.

5.2 Limitations and bias

MNSS 2009 faced various limitations and biases:

- Information bias
  - "Interviewer bias" has to be considered.
  - Inaccurate translations of the questionnaire could have caused possible further information bias.
- Response bias has to be considered, especially due to the "official" appearance of the survey team.
- Language limitation: In Tajikistan, several languages are spoken in different areas. The questionnaire was translated into Tajik and back to English for QA. However translations were not done in other languages (Uzbek, Pamiri languages, Yaghnobi, Russian). Special emphasis was given that all interview staff was familiar with the regional language to which they were sent to conduct the survey.
- Time limitation: Optimal preparation, excellent communication and collaboration with the partner organization are of crucial importance for the stringent time frame.

The collection of biological samples, labelling, transport and storage went smoothly in general. During the sample analysis some batches had to be discarded following QC criteria. Regarding the laboratory analysis, the ELISA kits were not sufficient to carry out replicates, in particular for the analysis of ferritin. As the laboratory analysis was performed in Dushanbe, the purchase and delivery of new ELISA kits was not possible within a reasonable time frame.

5.3 Women's nutritional status

5.3.1 Body mass index (BMI)

Low BMI (< 18.5 kg/m2)

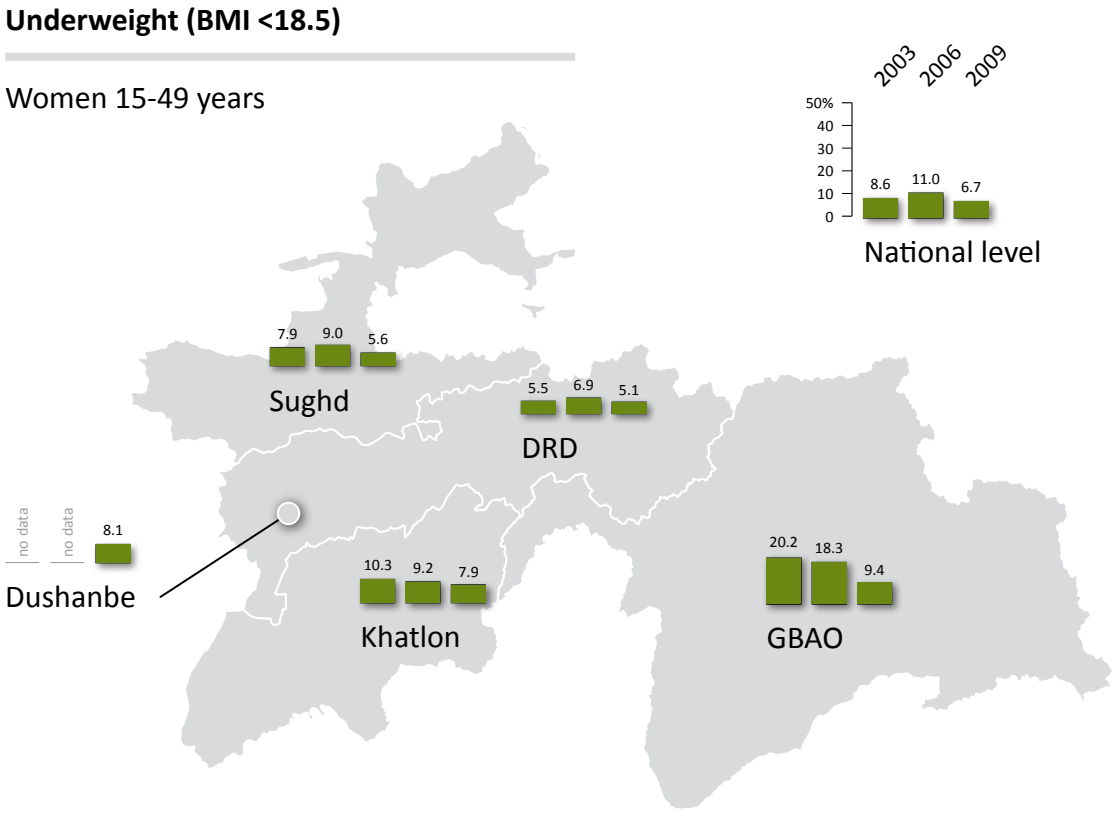
Maternal underweight places both the mother and her fetus at risk (King et al. 2003). There is substantial evidence relating to low birth weight and intrauterine growth retardation to maternal under nutrition (Fishman et al. 2003). Maternal malnutrition is associated with both maternal morbidity and mortality. Malnutrition is the main contributor to illness and diseases at the global level (Ezzati et al. 2002), and holds risk factors related to undernutrition, excess consumption of certain dietary components (total calories and fat) and low consumption of fruits and vegetables. Maternal underweight is a key risk factor for low birth weight. The latter one in turn is a risk factor for child low height-for-age and underweight and for some types of chronic diseases during adulthood (Barker, 1993).

During the MNSS 2009 the overall frequency of underweight (BMI < 18.5 kg/m2) among all examined women in Tajikistan was 6.7%. The majority of underweight women was within the class of mild and moderate underweight [6.4%; also called chronic energy deficiency (CED) Grades I and II]. The frequency of low BMI (CED Grades I-III) was highest in GBAO (9.4%) and lowest in DRD (5.1%). Severe

underweight (CED Grade III) was less than 1% for all regions. According to the categories described in the WHO technical report on the interpretation of low BMI (1995), the findings of the present survey indicate that the rate of underweight or CED in Tajikistan was low in 2009. Nevertheless, WHO recommends careful monitoring of this situation, as this prevalence is considered as a warning sign at the population level.

The results for MNSS 2009 showed that the current prevalence of underweight women (6.7% including all CED Grades) has subtly decreased compared to the 2003 survey (8.6%) (two-sample test of proportion, P = 0.019, z = 2.348). Looking at single regions, changes were remarkable for GBAO (2003: 20.2%; 2009: 9.4%) (Figure 17). On the other hand, the proportion of women with a normal BMI did not vary between 2003 (65.8%) and 2009 (65.1%). It is to be noted that in MNSS 2003, no separated data is available with regard to Dushanbe, as women and children from that strata were included in the DRD strata.

Figure 17: Prevalence of underweight (BMI < 18.5 kg/m2) in women of reproductive age (15-49 years)



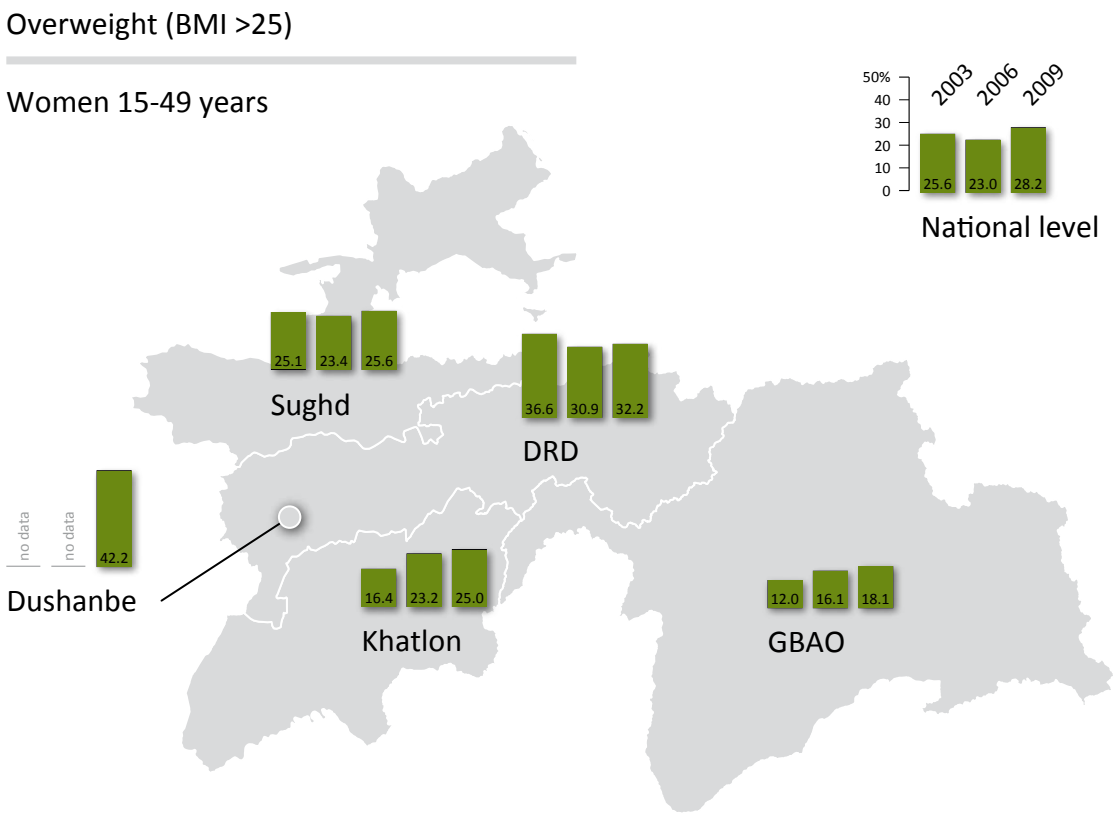
High BMI (overweight and obesity, BMI ≥ 25 kg/m2 Classes I-III)

Overweight and obesity among women in developed and developing countries is currently the subject of a common health problem. Obesity is the condition of excessive fat in the body, and has significant health consequences. It is the result of undesirable weight gain caused when more energy is consumed than expended. In the last three decades the rate of obesity has tripled in many European countries (WHO, 2006), making obesity one of he greatest public health challenges of the 21st Century. The most significant health consequences of overweight and obesity include non-insulin dependent (Type 2) diabetes, coronary heart disease, hypertension and stroke, gallbladder diseases, and certain types of cancer (endometrial, ovarian, breast, cervical, prostate). The condition is a major economic challenge due to the loss of productivity and income, and consumes up to 8% of overall health budgets (WHO, 2006).

The MNSS 2009 survey seemed to confirm a trend of increasing overweight and obesity among women in Tajikistan, particularly in urban areas (Dushanbe). The overall frequency of overweight and obesity (BMI ≥ 25 kg/m2) was 28.2%, whereas 8.4% of the examined women were obese (BMI 30–40 kg/m2), and 0.4% of the women had obesity Class III (BMI ≥40 kg/m2). The highest prevalence of overweight was found in Dushanbe and DRD (25.8% and 23.2%, respectively), and the lowest in GBAO (14%). The highest prevalence of obesity Classes I and II were observed in Dushanbe (15.5%) and DRD (8.8%). Women from urban areas had a BMI ≥ 25 kg/m2 considerably more frequently than women from rural areas. The questionnaire about eating habits (recall period: 24 hours) did not, however, allow drawing any conclusions of a potential linkage between BMI and consumption of particular food categories.

The results obtained from the MNSS 2003 showed an overall prevalence of overweight and obesity of 25.6% (overweight 18.5% and obesity 7.1%). Except for Dushanbe, which was not included as a stratum in the 2003 survey, DRD was the region with the highest rate of overweight and obesity (24.4% and 11.3%, respectively).

Figure 18: Prevalence of overweight (BMI > 25 kg/m2) in women of reproductive age (15-49 years)



To conclude, the prevalence of overweight and obesity seemed to gradually increase from 2003 to 2009. Furthermore a trend of increased overweight and obesity in older age groups was observed which might be a matter of concern from a public health perspective (health consequences as described above). These observations however need a more in-depth analysis of the two datasets.

5.4 Children's nutritional status

5.4.1 Low height-for-age, low weight-for-height, underweight

Undernutrition, as measured by underweight status, has been associated with a substantially increased risk of childhood mortality worldwide (WHO, 2004). Malnutrition is directly or indirectly responsible for about one third of deaths among children less than five years of age. More than two thirds of these deaths, often associated with inappropriate feeding practices, occur during the first year of life (UNICEF, 2007).

Low height-for-age, or Global Chronic Malnutrition (GCM), is a height-for-age index that reflects the child's past and cumulative nutrition situation and is hence considered as chronic. Once established, low height-for-age and its effects typically become permanent. Children of low height-for-age may never regain the height lost, and most children will never gain the corresponding body weight. It also leads to premature death later in life because vital organs might not fully develop during childhood. Low height-for-age is a phenomenon of early childhood and directly results from a poor diet and infection. Poor diet and infectious diseases interact to cause growth failure in children. Physiological damage, especially of the immune system, and specific clinical conditions like anaemia, lead to impaired development and death (ACC, SCN, 2000). Low height-for-age occurs in early childhood because nutritional needs are greater in relation to weight than at any other time. Nearly one third of children less than five years of age in the developing world are low height-for-age (UNICEF, 2007). Eliminating malnutrition would cut child mortality by more than 50% and reduce the burden of disease in developing countries by about 20% (FAO, WHO, 1992; Murray CJ, Lopez AD, 1997). Well nourished children perform better in school, grow into healthy adults and in turn give their children a better start in life.

Comparing the MNSS 2009 with MICS 2005, the proportion of children being low height-for-age slightly dropped from 27% to 19.9%. However, the proportion of children being severely low height-for-age was 9.0% for both surveys. Looking at the regional level, the situation did not improve in Khatlon: in 2005, 29% of the children in Khatlon were low height-for-age and 10% were severely low-height-for-age. In 2009, still 24.6% of the children showed low height-for-age and 12.3% had severe low height-for-age. In contrast, the situation seemed to be improved in GBAO (29.7% for low height-for-age, and 11.6% for severely low height-for-age in 2005. 16.1% low height-for-age and 9.3% severe low height-for-age).

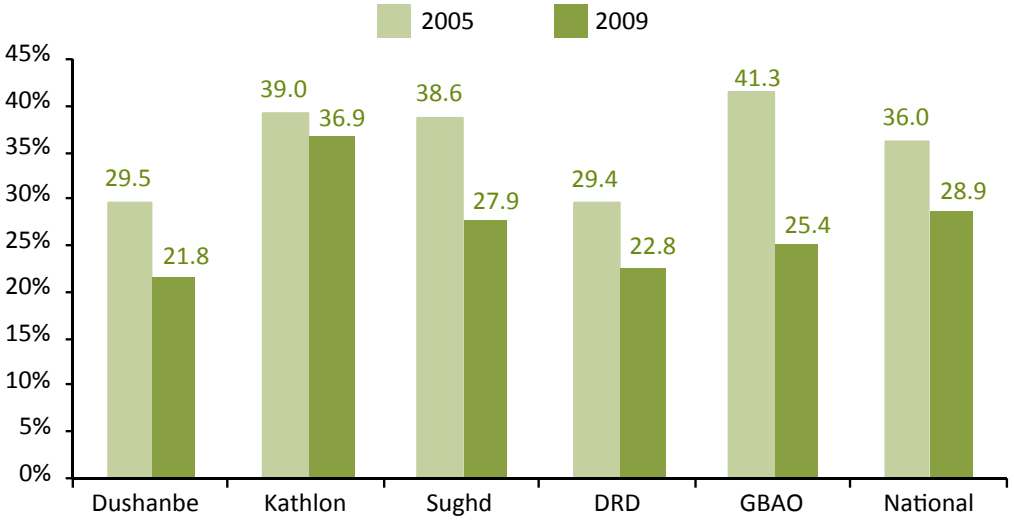
Children from rural areas seemed to be more likely low height-for-age when compared to children from urban areas.

Gender-related differences for underweight were found in Sughd: boys were more frequently underweight and severely underweight than girls. Boys also were more likely low weight-for-height when compared to girls, in particular in DRD.

Low weight-for-height, or Global Acute Malnutrition (GAM), is a predictor of mortality among children under five years of age (UNICEF, 2007). Low weight-for-height is usually the result of acute significant food shortage and/or disease. Children with weight-for-height below 2 z-scores from the median of the reference population are too thin for their height have a low weight-for-height or moderate malnutrition, while those with weight-for-height below 3 z-scores from the reference median population are severely low weight-for-height or have severe malnutrition (Save The Children, 2006).

For the assessment of the severity of a malnutrition crisis, the WHO classification system provides guidance using the following thresholds for rates of GAM: < 5% level of severity 'acceptable'; 5–9% level of severity 'poor'; 10–14% level of severity 'serious'; > 14% level of severity 'critical' (WHO, 2003).

Figure 19: Rate of low height-for-age among children (6-59 months) by strata



Comparing current low weight-for-height rates with MICS 2005, the prevalence of low weight-for-height slightly dropped nationwide (from 8.8% to 4.5%), with the exception of DRD, where severely low weight-for-height was 1.4% in 2005 and 2.8% in 2009.

Finally, the prevalence of low weight-for-height in Tajikistan nearly reached the cut-off of 5–9%. A proportion of 5–9% of low weight-for-height reflects a poor public health severity level according to WHO.

Figure 20: Rate of low weight-for-height (–2 z-scores) among children 6-59 months of age

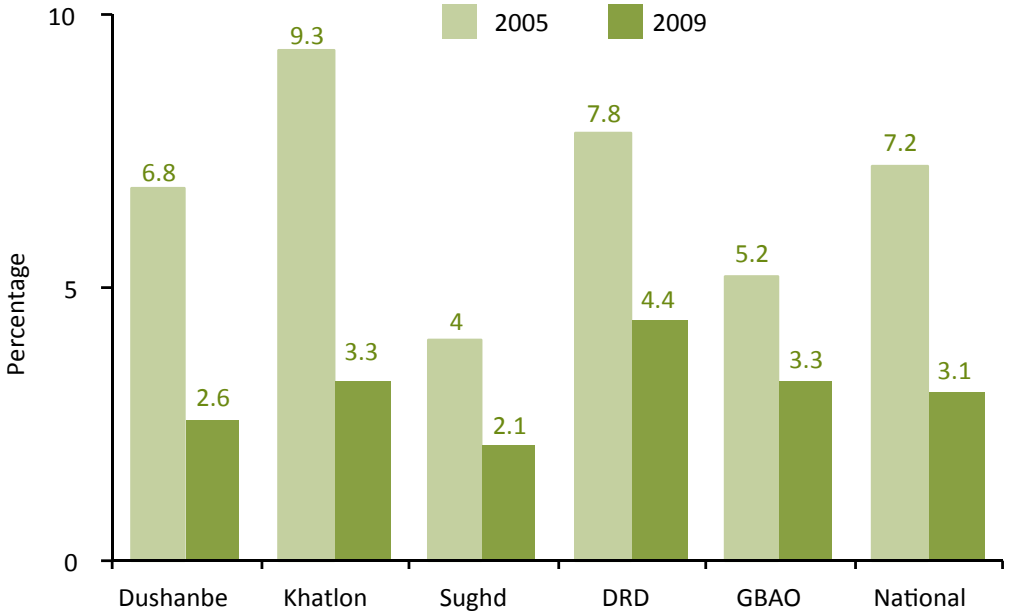
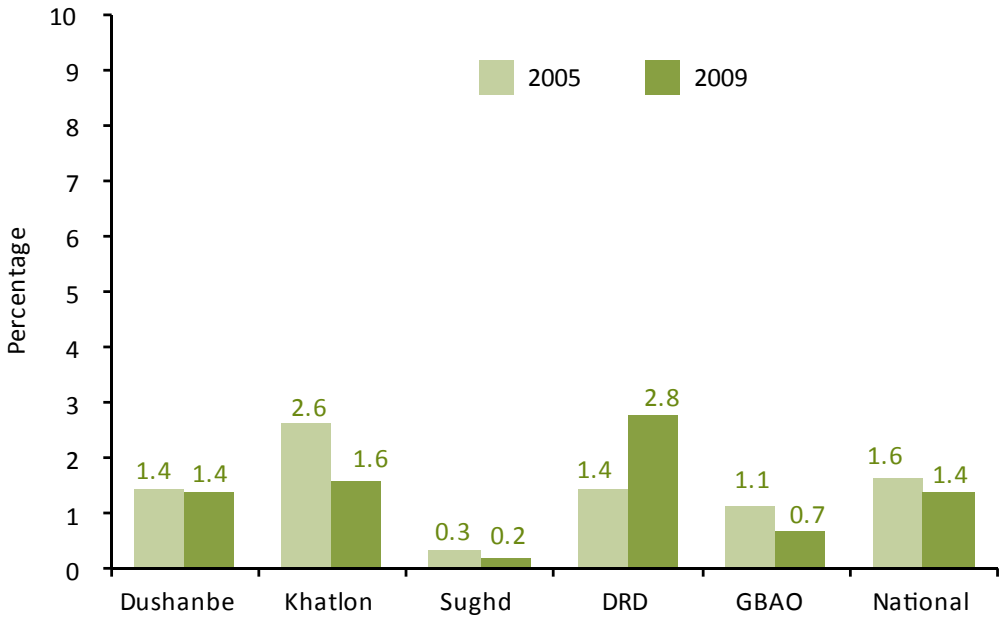


Figure 21: Rate of severely low weight-for-height (-3 z-scores) among children 6-59 months of age



Underweight was defined for children 0–4 years of age as low weight-for-age relative to the National Center for Health Statistics/World Health Organization (NCHS/WHO) reference median (WHO, 2004). Weight-for-age is a measure for both chronic and acute malnutrition. Child undernutrition (measured as poor anthropometric status) is internationally recognized as an important public health indicator for monitoring nutritional status and health in populations. Young children are most vulnerable to undernutrition and face the greatest risk of its adverse consequences (WHO, 2004).

The overall frequency of underweight (–2 z-scores) was 8.4% whereof severe underweight children (–3 z-scores) represented 2.2% of the category 'underweight children'. Children living in DRD were most often underweight (7.2%), and children living in Khatlon were most often severely underweight (3.5%). Children from Sughd were least often underweight (5.9%). The frequency of underweight children was considerably lower in 2009 (8.4%) compared to the MICS 2005 survey (21%). In the current survey, respondents were not requested to provide an identity card for age verification.

Children from rural areas were more likely to have a higher level of vitamin D than children from urban areas (rural: 55.4 nmol/L, urban: 47.4 nmol/L). Particularly high mean levels of vitamin D were observed in boys from the region of Sughd (71.5 nmol/L; girls: 57.4 nmol/L).

5.5 Anaemia

Anaemia is one of the most common and intractable nutritional problems worldwide today. The main causes of anaemia are dietary iron deficiency, infectious disease and deficiency of other key micronutrients (folate, vitamin B12 and vitamin A). Therefore the prevalence of anaemia is an important national health indicator. The concentration of Hb should always be measured (and preferably concomitantly) with other iron status indicators. Hb concentration can provide information on the severity of iron deficiency (WHO/CDC, 2004). The most severe consequence of iron depletion is iron deficiency anaemia (IDA), and it is still considered as the most common nutritional deficiency worldwide. It is important to distinguish between anaemia caused by iron deficiency and anaemia caused by chronic disease. For this reason the determination of biomarker indicators such as soluble transferrin-receptor concentrations, and ferritin in association with CRP (Clark SF, 2008) should be performed. Transferrin receptor in serum is derived from developing red blood cells and therefore reflects the intensity of

erythropoeisis and the demand for iron. The concentration of this chemical rises in IDA and is a marker of the severity of iron insufficiency. The serum transferrin receptor is less affected by inflammation than serum ferritin. Serum ferritin is a measure of the amount of iron in body stores if there is no concurrent infection. When the serum ferritin concentration is low then iron stores are depleted. In case of infection, the concentration of ferritin may increase even if iron stores are low; this means that it can be difficult to interpret the concentration of ferritin in situations where infectious diseases are common. In general the concentration of transferrin receptor does not rise in response to inflammation so that, when combined with the concentration of serum ferritin, it is possible to distinguish between iron deficiency and inflammation due to infection (WHO/CDC, 2004).

In the present survey, the iron status of women and children was assessed according WHO/CDC guidelines (WHO/CDC, 2004) using Hb, serum ferritin and serum transferrin receptor. In study samples where CRP values exceeded the level of 5 mg/L, ferritin values were not considered for the assessment of iron status.

The results from MNSS 2009 revealed an overall prevalence of anaemia (Hb <12 g/dL) of 24.2% in non-pregnant WRA. Among children the overall prevalence of anaemia (Hb <11 g/dL) was 28.8%. The proportion of mild anaemia in women was 19.9%, and 18.6% among children. Severe anaemia was observed in 0.5% or below in both groups. Considerable regional variations were observed, varying between 19% and 30% for women and 25.3% and 40.1% for children. GBAO was the region with highest prevalence of anaemic individuals (29.8% of women and 39.8% of children) and of severe and moderate anaemia (5.3% for women and 20.4% for children).

Compared with MNSS 2003, a remarkable decrease of the overall prevalence of anaemia was observed in MNSS 2009. In 2003 the overall prevalence of anaemia for women was found to be 42% and among children 37.8%, indicating that anaemia was a public health priority in Tajikistan because it exceeded the 40% threshold for WRA. In Khatlon from 2003 to 2009, the prevalence of anaemia decreased from 63% to 24.2% in women, and from 52% to 28.7% in children. In MNSS 2009, GBAO showed the highest prevalence of anaemia (29.8% for women and 39.8% for children).

Mean Hb concentrations did not differ between rural and urban areas. There were on the other hand observed gender-related differences: the mean Hb concentration was higher in girls when compared to boys (11.7 g/dL and 11.5 g/dL, respectively, with highest differences in GBAO and Sughd). Severe anaemia was more often observed in boys (14.3%) than in girls (10.2%), particularly in GBAO.

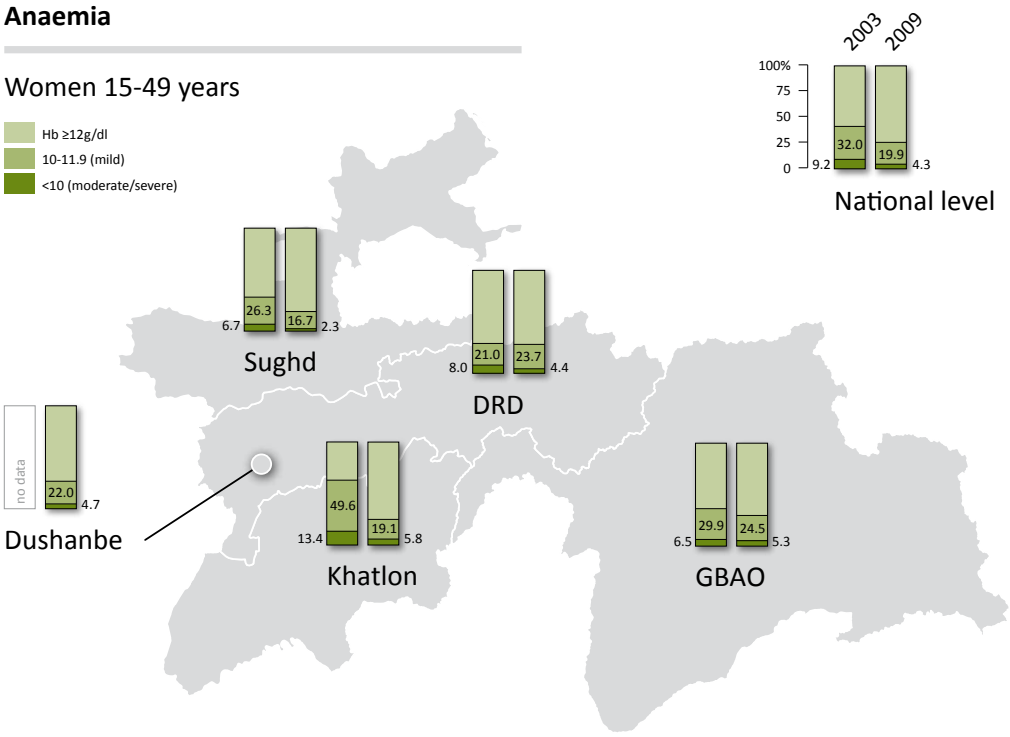
Age is also an important factor affecting the influence of anaemia. Children 6-24 months of age were considerably more often anaemic than older children. Children three years of age and older showed were about four times less often anaemic than infants (9.9% for children ≥ 3 years of age and 48.1% for children < 3 years of age). Women 40–49 years of age had slightly more frequently a moderate anaemia (5.3%) compared to women who were younger than this (4%).

Iron deficiency is a state in which there is insufficient iron to maintain the normal physiological function of tissues such as the blood, brain and muscles. Iron deficiency may exist in the absence of anaemia (WHO, UNICEF, UNU, 2001).

In the MNSS 2009, iron deficiency (defined by sTfR > 3.3 µg/mL) occurred in 15.5% of examined women with anaemia, but this value was 42.4% if only moderate and severe forms were considered. Iron deficiency in moderate and severely anaemic children (Hb < 9.9 g/dL) was 30.9%. Among the non-anaemic population, the frequency of iron deficiency (sTfR > 3.3 µg/mL) was 1.8% in women and 5.4% in children.

Comparing mean sTfR concentrations between rural and urban strata, a higher mean sTfR and higher frequencies of high values of sTfR were observed in rural areas.

Figure 22: Anaemia status of women of reproductive age (15–49 years)

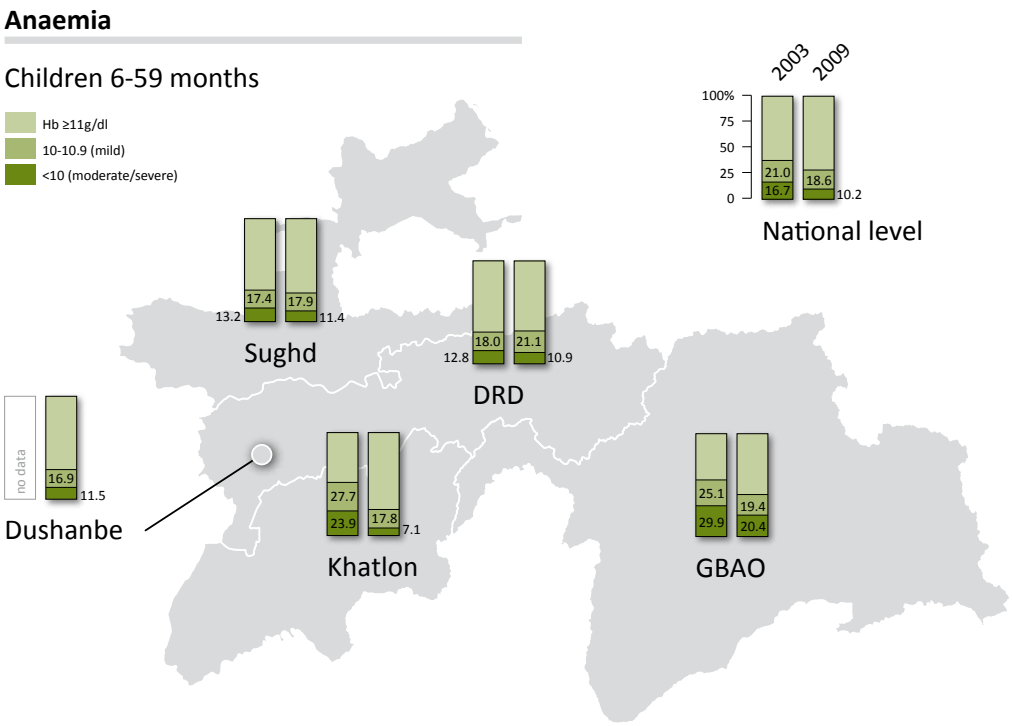


Age was an important factor influencing the prevalence of anaemia. Infants (6–24 months) most often had severe and moderate anaemia (56% in 2003 and 49.1% in 2009).

Moreover, the frequency of IDA (elevated sTfR) significantly decreased between 2003 and 2009: from 36% to 4.8% among women and from 39% to 8.6% among children.

IDA prevalence defined by low ferritin was not considered in this survey. The frequency of high CRP values was 17.5% for women and 13.9% for children with significant differences between regions. Furthermore, no correlation (unlike for sTfR, see above) was found between ferritin and Hb values.

Figure 23: Anaemia status of children 6–59 months of age



5.6 Iodine

Iodine deficiency disorders (IDD) refers to all consequences of iodine deficiency in a population that can be prevented by ensuring an adequate intake of iodine (WHO, 1996).

Iodine deficiency affects the function of the thyroid gland. A low level of thyroid hormones in the blood is the principal factor responsible for damage to the developing brain and other harmful effects known as IDD (WHO, UNICEF, ICCIDD, 2007). Iodine deficiency in mothers increases the risk of still-births and miscarriages (Dillon JC, Milliez J., 2000). Adequate development of the fetal brain during pregnancy and the early post-natal stage, as well as the mental development of the child, is dependant on an adequate diet. Certain dietary deficiencies during the first two years of life (e.g. iodine and iron) create problems that cannot be reversed by a later adequate diet. In developing countries, there is consistent evidence that the adequacy of diet has lasting implications for cognitive development. In particular, attention has been directed to protein-calorie malnutrition and more specifically the intake of iron, iodine and vitamin A (Benton D, 2010).

Since 1994 it has been proven that effective elimination of IDD is through universal salt iodization (USI). The most common strategy used to eliminate IDD is USI (WHO, UNICEF, ICCIDD, 2007). The indicator of iodized salt consumption is the proportion of households consuming adequately iodized salt. The iodine content of salt can be determined quantitatively by titration or qualitatively using rapid test kits (given in ppm), in which a minimum of 15 ppm is the cut-off level for adequate iodine content of salt. (WHO, UNICEF, 2004). The goal of USI is considered achieved when at least 90% of households consume iodized salt.

The most common indicator assessing the impact of USI programs is UI. Given that greater than 90% of ingested iodine is excreted in the urine, UI is an excellent indicator of current iodine intake from the diet (Zimmermann, 2008) (Appendix 7.10, Table 78).

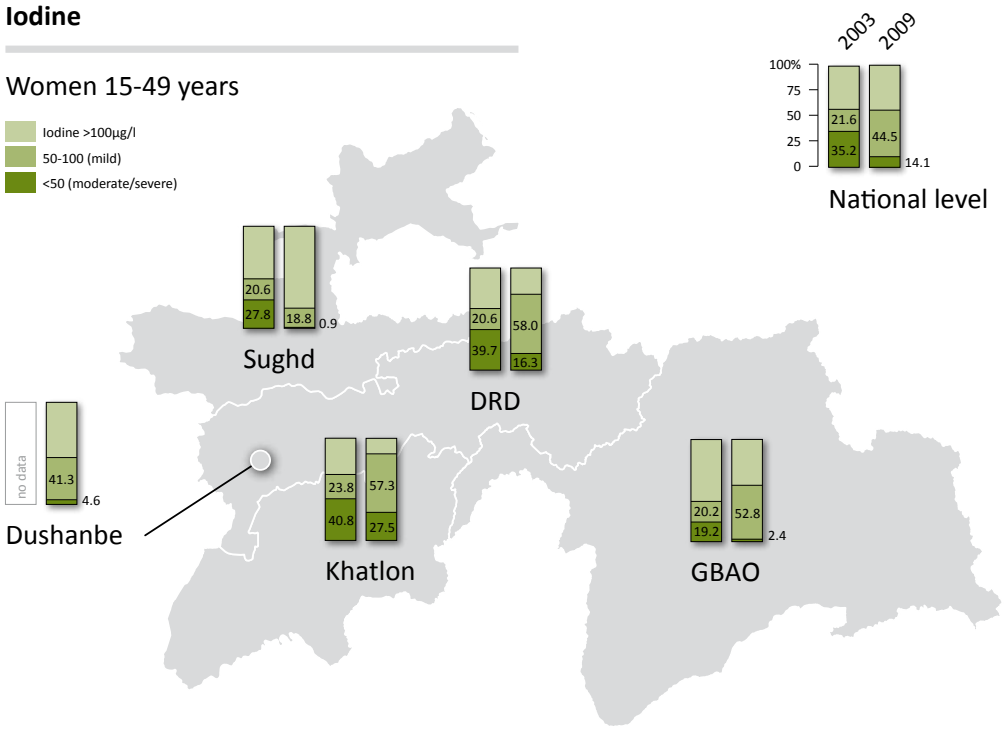
For children less than two years of age a median UI concentration of 100 µg/L can be used to define adequate iodine intake (WHO, UNICEF, ICCIDD, 2007).

The MNSS 2009 revealed an overall median UI concentration which was slightly above the threshold of 100 µg/L (107.8 µg/L for women, 116.5 µg/L for children). Dushanbe and Sughd were the only regions with adequate iodine nutrition (see Appendix 7.10, Table 78 for definitions). More than half of the women and children had an iodine deficiency (UI < 100 µg/L). Among iodine-deficient women, 2.0% were severely deficient, and 0.6% of children had a severe iodine deficiency. Excessive UI was observed for less then 2% in both groups.

The median UI levels in the 2003 MNSS were 93.6 µg/L in women and 73.1 µg/L in children. None of the regions reached a median UI level of 100 µg/L. However women living in Sughd and GBAO had adequate median values with 56.8% of women and 64% of children having a UI concentration below 100 µg/L. One out of five women (22.2%) and every fourth child (26%) had severe iodine deficiency.

The IDD situation seems to have improved at the national level since the 2003 MNSS, in particular for children. An important decrease in severe and moderate iodine deficiency (UI 20–49 µg/L) was observed in almost all of the studied regions. Severe and moderate iodine deficiency among women dropped from 35% to 14.1%. The most remarkable improvement was observed in Sughd (from 28% to 0.9%). The category of mild iodine deficiency was observed to increase in general, from 21.6% in 2003 to 44.5% in 2009. However, the frequency of insufficient UI (< 100 µg/L) increased in Khatlon and DRD (Khatlon: 64.6% in 2003 and 84.8% in 2009; DRD: 60% in 2003 and 74.3% in 2009). Reasons for and potential factors contributing to these changes need to be further investigated.

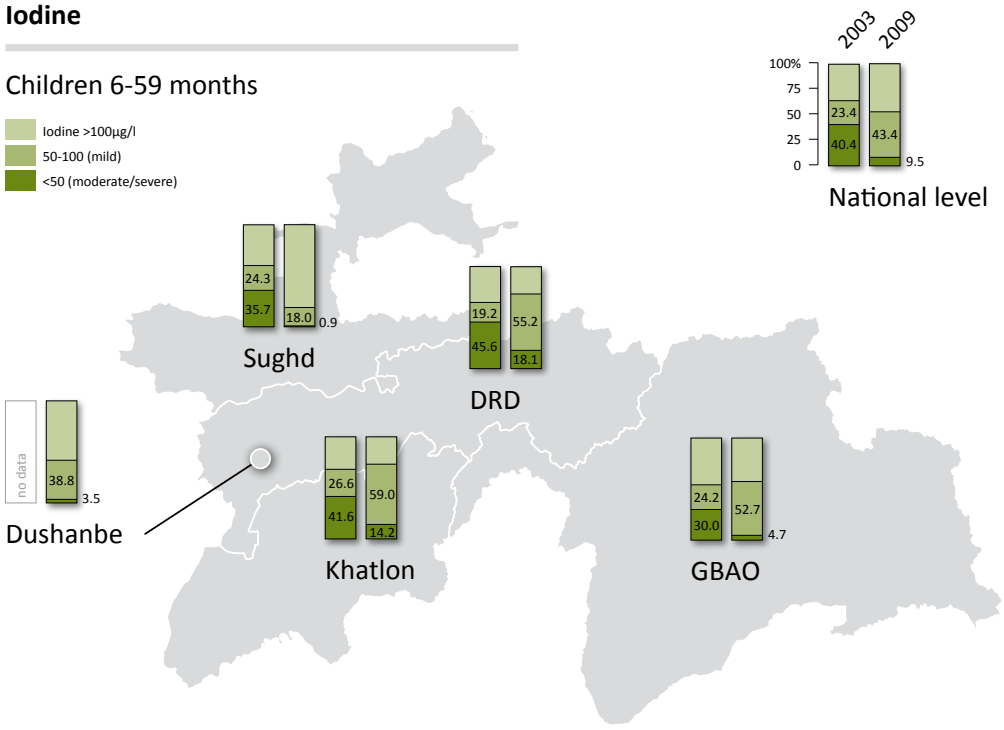
Figure 24: Iodine status of women of reproductive age (15-49 years)



The overall rate of adequate UI increased from 35.7% in 2003 to 41.4% in 2009. The prevalence of severe and moderate iodine deficiency dropped from 35.2% in 2003 to 14.1% in 2009, and the prevalence of mild iodine deficiency rose from 21.6% in 2003 to 44.5% in 2009.

At the regional level, the most obvious improvement was reported from Sughd where the rate of adequate UI increased from 40% in 2003 to 81% in 2009. However, in Khatlon the percentage of adequate UI decreased from 35.4% to 15.2%, and in DRD the decrease was from 39.7% to 25.7%.

Figure 25: Iodine status of children 6–59 months of age

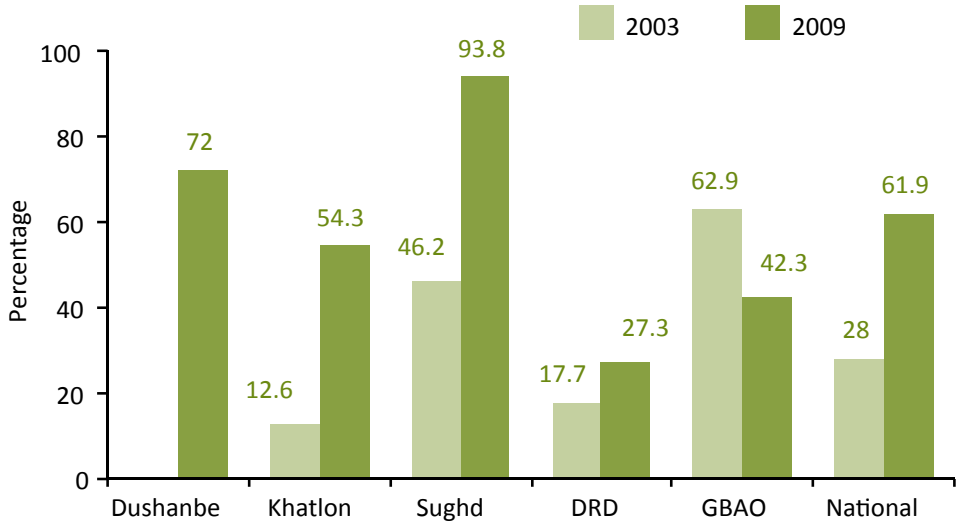


Comparing the 2003 and 2009 MNSS results, the general trend observed indicates improvement with a decreasing number of individuals being severely iodine deficient. Yet the national median UI excretion for women and children was still just at the threshold of the 100–199 µg/L category proposed by WHO (WHO, UNICEF, ICCIDD, 2007). The results confirm that IDD is still an important public health concern in Tajikistan.

The main indicator of iodized salt consumption is the proportion of households consuming adequately iodized salt. The proportion of households consuming adequately iodized salt reflects the results reported for UI excretion, because UI represents an indicator for recent or daily iodine intake and is therefore a short-term indicator (Zimmermann, 2008). The number of households consuming adequately iodized salt (> 15 ppm) increased from 28% in 2003 to 61.9% in 2009).

The observed higher mean UI concentration in women and children from urban areas might partially be explained by better access to iodized salt in urban areas. More than two thirds of all urban households (70.2%) had adequately iodized cooking salt, whereas in rural areas only every second household had adequately iodized cooking salt (51.5%). The frequency of households with iodized salt < 15 ppm was 20.0% in urban areas and 32.7% in rural areas, and the frequency of households with non-iodized cooking salt was 9.9% in urban areas and 15.8% in rural areas (Pearson $\chi 2 = 46.438$, $P < 0.001$).

Figure 26. Percentage of adequately iodized salt in households (> 15 ppm), 2003 and 2009



In Sughd the percentage households consuming adequately iodized salt considerably improved from 46% in 2003 to 94% in 2009. The results for Khatlon, however, were contrasting: the percentage of households consuming adequately iodized salt increased from 13% to 54% but the indicator to assess the impact of this improvement (UI concentration) showed a significant decrease of adequate UI values.

Findings from a school-based cross-sectional survey conducted in February/March 2009 among 602 school children 7-11 years of age from 10 rural communities within the districts of Dangara, Shahrinav, Tursunzoda and Varzob (unpublished data) revealed that goitre was diagnosed in almost every second child (46.6%): with one out of three children affected with goitre in grade one and every sixth child (16.0%) in grade two. The prevalence of goitre observed in schools varied between 19.4% and 65.1%. No gender-related differences were observed.

The overall mean UI concentration was 63.5 µg/L (mild iodine deficiency). Stratified by school, the mean UI level varied between 19.7 µg/L (severe iodine deficiency), and 100.1 µg/L (borderline of 'adequate intake'). With the exception of one school, all mean UI concentrations were below the level of 100 µg/L. Four out of five children (81.5%) showed iodine deficiency. The mean UI concentration was

significantly different between boys and girls (68.63 µg/L and 58.07 µg/L, respectively). Girls were affected more often by moderate-to-severe iodine deficiency (girls: 54.7%, boys: 44.2%).

Salt samples from villages were collected from local grocery stores (60%), private shops (36.9%), and school canteens (3.1%). One third of the samples (36.9%) were unpacked or loose. All of the packed salt had brand names. It was reported that traders of local grocery stores from all four investigated rayons obtain salt from Dushanbe for their shops, markets and other selling points in the villages.

Two thirds (67.8%) of all qualitatively tested household cooking salt samples were iodized, but only 33.2% showed a sufficient iodine content. The rate of adequately iodized household salt from schools varied between 3.2% and 76.0%. Based on quantitative analysis, 86.0% of all household salt samples were iodized but only 17.3% were adequately iodized. Quantitative analysis of salt samples from local selling points revealed that all samples were iodized but only 9.2% showed an adequate iodine level. The absence of iodized salt was statistically associated with the presence of goitre and with the presence of a lower mean UI concentration.

Two schools from the district of Shakhrinav with highest rates of non-iodized household cooking salt also showed peak rates of moderate-to-severe iodine deficiency and goitre. Likewise, high frequencies of non-iodized and inadequately iodized salt (in particular from salt samples of local selling points) were observed in schools of Tursunzoda. Investigated schools in Dangara showed relatively high rates of goitre and moderate-to-severe iodine deficiency but at the same time the rate of adequately iodized salt was high. The situation of salt iodization is probably improving in this region but delayed effects of the consumption of non-iodized salt are still visible. The highest rates of adequately iodized household salt samples and lowest frequencies of goitre were found in schools of the Varzob district. Yet, moderate-to-severe iodine deficiency was still relatively high in these schools. High rates of non-iodized household cooking salt might be explained by salt mines where small quantities of salt are obtained for free. Some of the non-iodized salt is also sold by private vendors in trucks.

In conclusion, the IDD goal of 90% of the edible salt being adequate iodized has not yet been reached for Tajikistan.

5.7 Breastfeeding

The WHO recommends that infants start breastfeeding within one hour of life, and are exclusively breastfed for six months, with timely initiation of adequate, safe and properly fed complementary foods while continuing breastfeeding for up to two years of age or beyond.

Proper infant feeding practices are key to child survival. Exclusive breastfeeding for the first six months of life has the potential to avert 13% of all under-five deaths in developing countries, making it the most effective preventive method of saving children's lives. Timely and appropriate complementary feeding could avert a further 6% of under-five deaths. Exclusive breastfeeding among children under six months of age has increased remarkably in many developing countries over the last 10 years. The breastfeeding rate in developing countries is now nearly 40% (UNICEF, 2007).

Nine out of 10 mothers and caregivers received advice or were asked about breastfeeding and infant feeding practices from health care professionals. In 2009 only 56% of the mothers of Tajikistan breastfed their baby within the first 30 minutes from delivery, followed by one third within the first six hours. In MICS 2005, 61% of Tajik mothers started breastfeeding their baby within the first hour of birth.

In the present survey almost all (98%) of the infants under two years of age were breastfed, at least during the first few months of life. Similarly, MNSS 2003 reports that the majority (97%) of children under two years of age had been breastfed at least partially at some point in their lives.

Exclusive breastfeeding started to decrease between month five (with 64.8% of mothers reporting as still breastfeeding) and month six (23.8% of mothers reporting as still breastfeeding). Most of the mothers did not remember when they stopped breastfeeding at all. Reported stopping of breastfeeding was gradual; every fifth mother stopped in month four, every third mother stopped in month six, and four out of five mothers stopped after one year.

In 2003 two thirds (64%) of infants under four months of age and 50% of infants under six months of age were exclusively breastfed. Breastfeeding rates reported in MICS 2005 showed that 36% of the sampled infants under the age of four months were exclusively breastfed and the percentage of children under six months of age who were exclusively breastfed was even lower (25%). In 2009, in the majority of cases, complementary feeding was first offered to infants at age six months and older (44.3%). Almost half of mothers started with complementary food when her child was between four and six months (48.5%), and 11.9% of the mothers within the first three months. In 2003 the proportion of children receiving complementary food at the age of six to nine months was 66%.

In GBAO, the majority of mothers started with complementary food after six months (61.2%), whereas Sughd showed the lowest proportion of mothers starting with complementary food after six months (29.2%). The highest proportion of mothers starting with complementary food during the first four months was observed in Dushanbe (31.9%) and the lowest proportion in GBAO (14.7%).

In summary, nearly all newborns in Tajikistan are breastfed. Typically, breastfeeding starts promptly after delivery for most of the children. Exclusive breastfeeding is frequently interrupted earlier than six months of age—the cut-off recommended by WHO (WHO, 2002). Regardless, breastfeeding should continue to be encouraged to prevent a decline in its prevalence. Thus, it should ensured that all delivery facilities in Tajikistan properly encourage early initiation of breastfeeding by mothers delivering in their facilities.

5.8 Early Childhood Care and Development (ECCD)

A quality ECCD programme assures that children have the opportunity to discover, explore, communicate effectively, get along with others, and play an active role in their environment. Families are the frontline for ensuring that their children will get the love, food, protection, health care and learning opportunities to which they are entitled. ECCD provides a natural platform for participatory discussion and dialogues with parents on key children's issues (UNICEF, 2004).

Effective childcare practices are crucial to the healthy development of children. One of the World Fit For Children (WFFC) goals is that "every child must get the best possible start in life. A safe environment is crucial to enable children to be physically healthy, mentally alert, emotionally secure, socially competent and ready to learn" (UN, 2002).

In MNSS 2009, among caregivers who visited a health worker, 40.6% asked for advice on child Care and Development. 72% of mothers were asked about the achievement of their child's milestones (ability to walk, to talk, to understand). 62.5% of mothers received advice on child care, discipline, and sleeping habits, and 64% received advice on how to help the child learn more. Receiving advice about how to help their child to learn more was most common in Sughd, where 89% of the caregivers were questioned about this issue (Dushanbe: 56.5%, Khatlon: 53.2%, DRD: 61.3%, GBAO: 51.6%).

6. Conclusion

The results of MNSS 2009 as compared with previous surveys (MNSS 2003 & MICS 2005) clearly demonstrate improved nutritional status among WRA (15-49 years) and children 6-59 months of age in Tajikistan.

Table 79: Summary of main results for women (MNSS 2003 and MNSS 2009)

Nutritional parameter	2003	2009 (Dushanbe included)	2009 (Dushanbe excluded)
BMI < 18.5 kg/m2	**National: 8.6%** max: 20.2% GBAO min: 5.5% DRD	**National: 6.7%** max: 9.4% GBAO min: 5.1% DRD	**National: 6.5%**
BMI > 25 kg/m2	**National: 25.6%** max: 36.6% DRD min: 12% GBAO	**National: 28.2%** max: 42.2% Dushanbe min: 18.1% GBAO	**National: 26.7%** max: 32.25 DRD
Anaemia Hb < 12 g/dL	**National: 41.2%** max: 62.9% Khatlon min: 29.0% DRD National mean Hb: 12.2 g/dL	**National: 24.2%** max: 29.8% GBAO min: 19.0% Sughd National mean serum Hb concentration: 12.8 g/dL	**National: 24.0%** National mean serum Hb concentration: 12.8 g/dL
IDA (elevated sTfR)	**National: 29.2%** max: 36.1% Khatlon min: 23.2% DRD	**National: 4.8%** max: 7.5% GBAO min: 3.6% Sughd National mean sTfR: 1.2 µg/ml	**National: 5.0%** National mean sTfR: 1.2 µg/ml
UI < 100 µg/L	**National: 56.8%** max: 64.6% Khatlon min: 39.4% GBAO	**National: 58.6%** max: 84.8% Khatlon min: 19.7% Sughd National mean UI: 107.8 µg/L	**National: 59.2%** National mean UI: 107.8 µg/L
Salt iodization < 15 ppm	**National: 72.0%** max: 82.3% DRD min: 37.1% GBAO	**National: 38.2%** max: 72.7% DRD min: 6.2% Sughd	**National: 39.5%**

Underweight status in WRA at country-level decreased from 8.6% in 2003 to 6.7% in 2009. According to the WHO expert committee (WHO technical report, 1995); a prevalence of a BMI < 18.5 between 5% and 9% of the population indicates a low prevalence of underweight, but is interpreted as a warning sign requiring regular monitoring.

The overall prevalence of **overweight** and **obesity** was found in an increasing trend: 28.2% was the frequency of overweight among women in 2009 compared to 25.6% in 2003. A higher prevalence was found more in urban areas (Dushanbe 42.2%, DRD 32.2%) than in rural regions (GBAO 18.1%). This trend indicates that overweight is a matter of concern from a public health perspective as described in the Global Database on Body Mass Index from WHO (WHO, 2006).

A remarkable improvement was observed regarding the prevalence of **anaemia** (Hb < 12 g/dL) and **iron deficiency anaemia** (IDA) (elevated sTfR) in women. The reasons for this substantial improvement were not investigated by this survey, and additional discussions might be useful in order to explore the causes of this improvement.

The national proportion of anaemic women decreased from 41.2% in 2003 to 24.2% in 2009. The mean Hb concentration among women increased from 12.2 g/dL in 2003 to 12.8 g/dL in 2009. The prevalence of IDA dropped from 29.2% to 4.8%.

During the period of 2000 to 2003 educational activities focusing on good nutrition, including anaemia prevention, were conducted by the National Reproductive Health Centre in Tajikistan. The results found in the current survey might reflect the positive impact of these activities coupled with a macro-economic situation and other external factors which have improved in Tajikistan (at least as of early 2009).

Table 80: Summary of main results for children 6-59 months of age (MNSS 2003 and MNSS 2009)

Nutritional parameter	2003	2009 (Dushanbe included)	2009 (Dushanbe excluded)
Anaemia Hb < 11 g/dL	**National: 62.3%** max: 69.4% Sughd min: 45.0% GBAO	**National: 28.8%** max: 39.8% GBAO min: 24.9% Khatlon National mean serum Hb concentration: 11.6 g/dL	**National: 28.7%** National mean serum Hb concentration: 11.6 g/dL
IDA (elevated sTfR) > 3.3 µg/ml	**National: 38.8%** max: 42.3% GBAO min: 33.0% Sughd	**National: 8.6%** max: 15.6% DRD min: 5.3% Dushanbe National mean sTfR: 1.6 µg/ml	**National: 8.9%** min: 5.8% Khatlon National mean sTfR: 1.6 µg/ml
UI < 100 µg/L	**National: 63.8%** max: 68.2% Khatlon min: 54.2% GBAO	**National: 52.9%** max: 73.2 Khatlon min: 18.9 Sughd National mean UI: 116.5 µg/L	**National: 53.0%** National mean UI: 115.5 µg/L

Table 81: Summary of main results for children 6-59 months of age (MICS 2005 and MNSS 2009)

Nutritional parameter	2005	2009 (Dushanbe included)	2009 (Dushanbe excluded)
low height-for-age (stunting)	**National: 36%** max: 41.3% GBAO min: 29.4% DRD	**National: 28.9%** max: 36.9% Khatlon min: 21.8% Dushanbe	**National: 29.6%** min: 22.8% DRD
low weight-for-height (wasting)	**National 8.8%** max: 14.9% Khatlon min: 9.3% GBAO	**National: 4.5%** max: 7.2% DRD min: 2.3% Sughd	**National: 4.6%**
Underweight		**National: 8.4 %** max: 10.5% Khatlon min: 5.9% Sughd	**National: 8.4%**

The positive trends observed in WRA could also be confirmed in children 6-59 months of age.

The nutritional status, considering low height-for-age and low weight-for-height, among children 6-59 months of age living in Tajikistan improved considerably during the past years. The prevalence of **low height-for-age children** (including severe low height-for-age children) decreased from 36% in 2005 to 28.9% in 2009. Chronic protein-energy malnutrition (or low height-for-age) is significantly elevated above the level seen in the WHO Child Growth Standard (2.3%), and according to the suggested classification (WHO, 1995), the prevalence of stunting of 28.9% is considered as high. This means that stunting remains of public health importance in Tajikistan.

The proportion of children considered being **low weight-for-height** nearly halved from 8.8% in 2005 to 4.5% in 2009. A proportion of 5–9% of low weight-for-height reflects a poor public health severity level according to WHO.

Anaemia is a common health problem in children less than five years of age, and in non-pregnant and pregnant WRA in Tajikistan. Although severe anaemia is relatively rare in these risk groups, moderate and mild anaemia can still have deleterious effects on health. Compared to 2003, a remarkable improvement for anaemia in children was reported. The prevalence of **anaemia** (Hb < 11g/dL) decreased from 62.3% in 2003 to 28.8% in 2009. The prevalence of IDA decreased from 38.8% to 8.6% with a significant difference among the different regions.

Considerable improvement could also be observed for the USI program in Tajikistan.

A UI concentration above 100 ug/L is the threshold considered as having adequate intake of iodized salt in the diet. The national median **UI** for **children** was 73 µg/L in 2003 and 116.5 µg/L in 2009, and for **women** 93.6 µg/L in 2003 and 107.8 µg/L in 2009. At the end of 2001 the regional project "Improving Nutrition for Poor Mothers and Children" was initiated by the Asian Development Bank. The project included grants to support the USI program. The reported improvements might partially explain the impact of these programs. School-based cross-sectional surveys however showed still large local variances in UI levels and a large majority of children (four out of five) having UI deficiency. These findings suggest that the national salt iodization program needs to be strengthened in general and at regulation-level (functioning monitoring system, ensuring universal iodization legislation for salt, implementation of regulations including handling and storing).

An unexpectedly high percent frequency (over 70%) of health care visits incorporated some discussion of the child›s development and care such as asking about the child›s development, or giving advice on learning or care practices such as discipline, care or sleep. Further, these recommendations have been made during visits in which the child was ill, since very few visits are made for preventative purposes

(15%). These figures would suggest that there is interest on the part of both caregivers and health workers on care and on child development. These findings, in conjunction with the results of the Care for Development assessment (which showed that in areas with training, consultation on Care for Development was more common), suggest that this may be a propitious moment to strengthen Care for Development as part of Integrated Management of Childhood Illnesses (IMCI). Further, the evidence of significant improvements in child nutrition and health also reinforce the idea that this may be a good moment to strengthen the Care for Development component.

The general health situation seems to have improved in recent years, particularly for children. The overall rate of adequate UI increased from 35.7% in 2003 up to 47.1% in 2009. Severe and moderate IDD categories dropped from 40.4% in 2003 to 9.5% in 2009, while mild IDD rose from 23% in 2003 to 43.4% in 2009.

However still more than half (52.9%) of children and 58.6% of WRA presented with a UI below 100 µg/L. These results confirm that IDD is still an important public health concern in Tajikistan.

Consistent with the improvements of UI concentrations, the number of households consuming **adequately iodized salt** (> 15 ppm) increased from 28% in 2003 to 61.9% in 2009.

However, the goal of 90% of households consuming adequately iodized salt (WHO, UNICEF, ICCIDD, 2007) in order to ideally eliminate IDD is yet not reached and further efforts are needed.

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Appendix 1. Estimated population in 2009 per administrative divisions of Tajikistan

Table 2: Estimated population in 2009 per administrative divisions of Tajikistan

Administrative divisions	Estimated Population as of 1.1.2009			% of population		
	Urban	Rural	Total	Urban	Rural	Total
Dushanbe	695'246	0	695'246	9%	0%	9%
DRD	209'294	1'436'705	1'645'999	3%	19%	22%
Sughd	550'873	1'620'321	2'171'194	7%	22%	29%
Khatlon	456'612	2'185'671	2'642'283	6%	30%	36%
GBAO	29'259	189'818	219'077	0%	3%	3%
Tajikistan	1'941'284	5'432'515	7'373'799	26%	74%	100%

Appendix 2. Selected clusters list per Oblast

URBAN Clusters:

Oblast	Rayon	City/ village	Clus-ter #	Popu-lation	Number of hhs	Cumu-lative	Sam-ple	Step	Random	ID
Dushanbe	Zheleznodorozhniy		15	203	52.05	203	1	1009	428.2222	1
Dushanbe	Zheleznodorozhniy		86	247	63.33	450	1		1437.222	2
Dushanbe	Zheleznodorozhniy		133	346	88.72	796	1		2446.222	3
Dushanbe	Zheleznodorozhniy		184	156	40.00	952	1		3455.222	4
Dushanbe	Zheleznodorozhniy		237	252	64.62	1204	1		4464.222	5
Dushanbe	Zheleznodorozhniy		292	320	82.05	1524	1		5473.222	6
Dushanbe	Zheleznodorozhniy		322	709	181.79	2233	1		6482.222	7
Dushanbe	Oktyabrskiy		33	191	44.42	2424	1		7491.222	8
Dushanbe	Oktyabrskiy		58	562	130.70	2986	1		8500.222	9
Dushanbe	Oktyabrskiy		130	333		3319	1		9509.222	10
Dushanbe	Oktyabrskiy		173	327		3646	1		10518.22	11
Dushanbe	Oktyabrskiy		218	293		3939	1		11527.22	12
Dushanbe	Oktyabrskiy		266	308		4247	1		12536.22	13
Dushanbe	Oktyabrskiy		315	283		4530	1		13545.22	14
Dushanbe	Frunzenskiy		18	486	118.54	5016	1		14554.22	15
Dushanbe	Frunzenskiy		59	361	88.05	5377	1		15563.22	16
Dushanbe	Frunzenskiy		101	413	100.73	5790	1		16572.22	17
Dushanbe	Frunzenskiy		123	448	109.27	6238	1		17581.22	18
Dushanbe	Frunzenskiy		189	326	79.51	6564	1		18590.22	19
Dushanbe	Frunzenskiy		233	233	56.83	6797	1		19599.22	20
Dushanbe	Frunzenskiy		254	407	99.27	7204	1		20608.22	21
Dushanbe	Frunzenskiy		275	455	110.98	7659	1		21617.22	22
Dushanbe	Frunzenskiy		317	405	98.78	8064	1		22626.22	23
Dushanbe	Frunzenskiy		360	477	116.34	8541	1		23635.22	24
Dushanbe	Frunzenskiy		407	371	90.49	8912	1		24644.22	25
Dushanbe	Frunzenskiy		456	186	45.37	9098	1		25653.22	26
Dushanbe	Frunzenskiy		496	301	73.41	9399	1		26662.22	27
Dushanbe	Frunzenskiy		515	300	73.17	9699	1		27671.22	28
Dushanbe	Frunzenskiy		561	445	108.54	10144	1		28680.22	29
Dushanbe	Frunzenskiy		611	404	98.54	10548	1		29689.22	30
Dushanbe	Central		28	304	82.16	10852	1		30698.22	31
Dushanbe	Central		65	418		11270	1		31707.22	32
Dushanbe	Central		100	348		11618	1		32716.22	33

Oblast	Rayon	City/ village	Cluster #	Population	Number of hhs	Cumulative	Sample	Step	Random	ID
Dushanbe	Central		130	370	100.00	11988	1		33725.22	34
Dushanbe	Central		150	429	115.95	12417	1		34734.22	35
Dushanbe	Central		193	530	143.24	12947	1		35743.22	36
Dushanbe	Central		212	490	132.43	13437	1		36752.22	37
Dushanbe	Central		237	534		13971	1		37761.22	38
Dushanbe	Central		271	365	98.65	14336	1		38770.22	39
Dushanbe	Central		303	353		14689	1		39779.22	40

Oblast	Rayon	City/ village	Cluster #	Population	Number of hhs	Cumulative	Sample	Step	Random	ID
Khatlon	Kurgan-tube	Kurgan-tube	95	305	67.78	1671	1	1836.5	1803.95	1
Khatlon	Kulyab	Kulyab	111	376	56.97	3377	1		2925.061	2
Khatlon	Sarband	Sarband	7	330		5325	1		4046.172	3
Khatlon	Avanskiy	Vakhsh	5	386		6931	1		5167.283	4
Khatlon	Kumsangirskiy	Dusti	8	501		8595	1		6288.394	5
Khatlon	Parkharskiy	Parkhar	49	428		10792	1		7409.505	6

Oblast	Rayon	City/ village	Cluster #	Population	Number of hhs	Cumulative	Sample	Step	Random	ID
Sughd	Istaravshan	Istaravshan	13	559	114.08	1497	1	1992.111	1752.355	1
Sughd	Isfarinskiy	Isfara	30	431	89.79	3693	1		2873.466	2
Sughd	Kairakkum	Kansai	25	410		5707	1		3994.577	3
Sughd	Penjikenskiy	Penjikent	13	434	81.89	7429	1		5115.688	4
Sughd	Khujand	Khujand	42	470	130.56	9455	1		6236.799	5
Sughd	Khujand	Khujand	183	415	115.28	11530	1		7357.91	6
Sughd	Khujand	Khujand	330	346	96.11	13410	1		8479.021	7
Sughd	Aininskiy	Zeravshan	3	321		15676	1		9600.132	8
Sughd	Rasulova	Prolerask	23	611		17443	1		10721.24	9

Oblast	Rayon	City/ village	Cluster #	Population	Number of hhs	Cumulative	Sample	Step	Random	ID
DRD	Vahdat	Vahdat	11	386		386	1	1314	590.7326	1
DRD	Gissarksiy	Gissar	11	352	71.84	1874	1		1711.844	2
DRD	Rashtskiy	Navobod	29	154	31.43	3033	1		2832.955	3

Oblast	Rayon	City/ village	Cluster #	Population	Number of hhs	Cumulative	Sample	Step	Random	ID
DRD	Rudaki	Somoniyon	18	743		4364	1		3954.066	4
DRD	Tursunzadevskiy	Tursunzade	51	496		5542	1		5075.177	5

Oblast	Rayon	City/ village	Cluster #	Population	Number of hhs	Cumulative	Sample	Step	Random	ID
GBAO	Khorog	Khorog	1	386	65.42	386	1	1007.2	97.7282	1
GBAO	Khorog	г.Хорог	11	359	60.85	979	1		1218.839	2
GBAO	Khorog	г.Хорог	33	320	54.24	2087	1		2339.95	3
GBAO	Khorog	г.Хорог	48	376		3010	1		3461.062	4
GBAO	Khorog	г.Хорог	67	330	55.93	3994	1		4582.173	5

RURAL Clusters:

Oblast	Rayon	Jamoat dehot	Village	Sum of hhs	Selection result	Sampling step	Random	ID
Khatlon	Вахшский	Машал	Машал	4371	1	7813.352941	4431.69	1
Khatlon	Вахшский	Таджикабад	Рохинав	12172	1		12245	2
Khatlon	Восейский	Гулистан	Файзабад	20002	1		20058.4	3
Khatlon	Восейский	Пахтакор	Пушиёни-Миёна	27833	1		27871.7	4
Khatlon	Дангаринский	Пушинг	Алиджон	35607	1		35685.1	5
Khatlon	Джиликульский	Села п.Гараути	Ачисель	43411	1		43498.5	6
Khatlon	Джиликульский	Нури Вахш	Янгиабад	51289	1		51311.8	7
Khatlon	Гозималикский	Кызылкалинский	Сарбанд	59033	1		59125.2	8
Khatlon	Кубодиён	Навабад	Шох	66925	1		66938.5	9
Khatlon	Кубодиён	им.С.Худай-кулова	Калинин	74713	1		74751.9	10
Khatlon	Кубодиён	Янгиюль	Докки	82504	1		82565.2	11
Khatlon	Колхозабадский	Маданият	Кызыл Байрак	90276	1		90378.6	12
Khatlon	Колхозабадский	Узун	Уртабуз	98170	1		98191.9	13
Khatlon	Бохтарский	села п.Бохтариен	Кавунтеппа	105935	1		106005	14
Khatlon	Бохтарский	Заргар	Кызыл Партизан	113739	1		113819	15
Khatlon	Бохтарский	Мехнатабад	Кызыл Байрак	121596	1		121632	16
Khatlon	Хочамастонский	Иттифок	Бустон	129357	1		129445	17
Khatlon	Хочамастонский	Ифтихор	Рохи Ленин	137230	1		137259	18
Khatlon	Кулябский	Зарбдор	Луликутал	144994	1		145072	19
Khatlon	Кумсангирский	им. Крупской	Навои	152827	1		152885	20
Khatlon	Кумсангирский	Пяндж	Янгиабад	160607	1		160699	21
Khatlon	Муминободский	Дехибаланд	Туткаул	168448	1		168512	22

Oblast	Rayon	Jamoat dehot	Village	Sum of hhs	Selec-tion result	Sampling step	Random	ID
Khatlon	Московский	Кахрамон	Гулистан	176320	1		176325	23
Khatlon	Пархарский	Ватан	Бахор	184223	1		184139	24
Khatlon	Пархарский	Зафар	Самончи	191859	1		191952	25
Khatlon	Пянджский	Кульдиман	Уртабулок	199649	1		199766	26
Khatlon	Сарбандский	Гулистан	Батырабад	207577	1		207579	27
Khatlon	Советский	Танобчи	Джайрали	215422	1		215392	28
Khatlon	Шаартузский	им. Дж.Назарова	Айвадж	223186	1		223206	29
Khatlon	Шаартузский	Х.Холматова (Шаартуз)	Кумшах	230946	1		231019	30
Khatlon	Шуроободский	Чаган	Бодомту	238864	1		238832	31
Khatlon	Яванский	Обимуки	Парчасой	246566	1		246646	32
Khatlon	Яванский	Чоргуль	Шурча	254368	1		254459	33
Khatlon	Бешкентский	Фируза	Бешкент-5(Фируза)	262138	1		262272	34

Oblast	Rayon	Jamoat dehot	Village	Sum of hhs	Selec-tion result	Sampling step	Random	ID
Sughd	Айнинский	Анзоб	Такфон	2692	1	8960.322581	2754.44	1
Sughd	Айнинский	Фондарья	Канте	11593	1		11714.8	2
Sughd	Аштский	Ашт	Обиашт	20602	1		20675.1	3
Sughd	Аштский	Пангаз	Пангази – Боло	29566	1		29635.4	4
Sughd	Ганчинский	Овчи	Басманда	38529	1		38595.7	5
Sughd	Ганчинский	Газантаракский	Янгиарык	47531	1		47556.1	6
Sughd	Ганчинский	Росровут	Дахкат	56463	1		56516.4	7
Sughd	Зафарободский	Равшан(С.Айни)	Бахт	65425	1		65476.7	8
Sughd	Исфаринский	Кулькент	Гулистон	74365	1		74437	9
Sughd	Исфаринский	Сурх	Сурх	83350	1		83397.3	10
Sughd	Исфаринский	Чорку	Чорку	92296	1		92357.7	11
Sughd	Канибадамский	Им. Г.Артыкова	Айни	101202	1		101318	12
Sughd	Канибадамский	Пулотон	Сарикуй	110206	1		110278	13
Sughd	Канибадамский	им.Э.Шарипова	Махрам (Гагарин)	119189	1		119239	14
Sughd	Матчинский	Палдорак	Палдорак	128174	1		128199	15
Sughd	Спитамен(Нау)	Куркат	Куркат	137091	1		137159	16
Sughd	Пенджикентский	Амондара	Амондара	146049	1		146120	17
Sughd	Пенджикентский	Колхозчиён	Гусар	155039	1		155080	18

Oblast	Rayon	Jamoat dehot	Village	Sum of hhs	Selec-tion result	Sampling step	Random	ID
Sughd	Пенджикентский	Могиён	Гезани – Боло	163985	1		164040	19
Sughd	Пенджикентский	Хурми	Шингак	172967	1		173001	20
Sughd	Дж.Расуловский	Гульхона	Гульхона	181879	1		181961	21
Sughd	Дж.Расуловский	Гулакандоз	Гулакандоз	190827	1		190921	22
Sughd	Ура-Тюбинский	Гулисурх	Боботаго	199876	1		199882	23
Sughd	Ура-Тюбинский	Коммунизм	Джаркургон	208773	1		208842	24
Sughd	Ура-Тюбинский	Пошкент	Яккабог	217754	1		217802	25
Sughd	Б.Гафурова	Овчикалача	Мичурин	226704	1		226763	26
Sughd	Б.Гафурова	Исфисор	Исфисор	235679	1		235723	27
Sughd	Б.Гафурова	Кистакуз	Кистакуз	244682	1		244683	28
Sughd	Б.Гафурова	Унджи	Унджи	253592	1		253643	29
Sughd	Б.Гафурова	им. Х.Усманова	Румон (Кызылкишлак)	262578	1		262604	30
Sughd	Б.Гафурова	Ёва	Навабад	271461	1		271564	31

Oblast	Rayon	Jamoat dehot	Village	Sum of hhs	Selec-tion result	Sampling step	Random	ID
DRD	Рогунский	Кадиоб	Калъаи нав	1787	1	4719.514286	1863.84	1
DRD	Варзобский	Чорбог	Яккачугз	6571	1		6583.36	2
DRD	Раштский	Казнок	Чашмаикизи	11169	1		11302.9	3
DRD	Раштский	Навды	Бедак	15984	1		16022.4	4
DRD	Раштский	Хоит	Хисорак	20701	1		20741.9	5
DRD	Гиссарский	Хисор	Кончи	25385	1		25461.4	6
DRD	Гиссарский	Хонакоикухи	Тахт	30117	1		30180.9	7
DRD	Гиссарский	Дурбат	Турдыкишлак	34845	1		34900.4	8
DRD	Гиссарский	Мирзо Ризо	Дехинав	39571	1		39620	9
DRD	Гиссарский	Хонако	Мортеппа	44313	1		44339.5	10
DRD	Джиргатальский	Джиргаталь	Кушай	48950	1		49059	11
DRD	Джиргатальский	Пильдон	Чубай	53733	1		53778.5	12
DRD	Район Рудаки (Ленинский)	Оккургон	Янгибад	58430	1		58498	13
DRD	Район Рудаки (Ленинский)	Гулистанский	Сабзикор	63197	1		63217.5	14
DRD	Район Рудаки (Ленинский)	Зайнабабад	Ильич (Ленин)	67870	1		67937	15
DRD	Район Рудаки (Ленинский)	им. Сардарова	Шурен	72652	1		72656.6	16

Oblast	Rayon	Jamoat dehot	Village	Sum of hhs	Selec-tion result	Sampling step	Random	ID
DRD	Район Рудаки (Ленинский)	Куктош	Каракамар	77285	1		77376.1	17
DRD	Район Рудаки (Ленинский)	Лохур	Мингичар	82037	1		82095.6	18
DRD	Район Рудаки (Ленинский)	Султанабад	Кирма	86726	1		86815.1	19
DRD	Район Рудаки (Ленинский)	Чортеппа	Арбоб-хотун	91502	1		91534.6	20
DRD	Вахдат (Кофарнихонский район)	Карасу	Тешиктош	96154	1		96254.1	21
DRD	Вахдат (Кофарнихонский район)	Кофарнихон	Эловар	100941	1		100974	22
DRD	Вахдат (Кофарнихонский район)	Симиганчский	Бакорон	105687	1		105693	23
DRD	Вахдат (Кофарнихонский район)	Чуянгарон	Хордара (Хордараи - Поен)	110371	1		110413	24
DRD	Вахдат (Кофарнихонский район)	Янгибазар	Тукалтепа	115114	1		115132	25
DRD	Тоджикободский	Нушор	Метаниен	119752	1		119852	26
DRD	Турсунзадевский	Каратог	Каратог	124488	1		124571	27
DRD	Турсунзадевский	Дж. Рахмонов(Киров)	Пахташиркат	129241	1		129291	28
DRD	Турсунзадевский	Навабад	Кызылюль	133979	1		134010	29
DRD	Турсунзадевский	Первомайский	Шайхмузафар	138596	1		138730	30
DRD	Турсунзадевский	Чапаевский(10с. истик)	Новасой	143328	1		143449	31
DRD	Файзабадский	Джавонон	Хамисеб	148156	1		148169	32
DRD	Файзабадский	Файзабад	Куруг	152804	1		152888	33
DRD	Шахринавский	Им. Хасанова	Кичикбуйникингир	157576	1		157608	34
DRD	Шахринавский	Шахринав	Шахринав(вкл. Заводи Хишт)	162303	1		162327	35

Oblast	Rayon	Jamoat dehot	Village	Sum of hhs	Selec-tion result	Sampling step	Random	ID
GBAO	Ванчский	Ванч	Ванч	198	1	694.6571429	289.078	1
GBAO	Ванчский	Ванч	Убаридаргов	945	1		983.735	2
GBAO	Ванчский	Водхуд	Вравз	1625	1		1678.39	3

Oblast	Rayon	Jamoat dehot	Village	Sum of hhs	Selec-tion result	Sampling step	Random	ID
GBAO	Ванчский	Жовид	Жовид	2250	1		2373.05	4
GBAO	Ванчский	Рованд	Гиджоваст	3016	1		3067.71	5
GBAO	Ванчский	Язгулом	Будун	3652	1		3762.36	6
GBAO	Ванчский	Язгулом	Мотравн	4171	1		4457.02	7
GBAO	Ишкашимский	Вранг	Внукут	5148	1		5151.68	8
GBAO	Ишкашимский	Зонг	Зонг	5785	1		5846.33	9
GBAO	Ишкашимский	Ишкашим	Ишкашим	6466	1		6540.99	10
GBAO	Ишкашимский	Козидех	Шанбедех	7196	1		7235.65	11
GBAO	Дарвозский	Вишхарв	Кеврон	8011	1		7930.31	12
GBAO	Дарвозский	Калаихум	Калайхум	8603	1		8624.96	13
GBAO	Дарвозский	Калаихум	Ширг	9258	1		9319.62	14
GBAO	Дарвозский	Нульванд	Ёгед	10099	1		10014.3	15
GBAO	Дарвозский	Сагирдашт	Лухч	10695	1		10708.9	16
GBAO	Дарвозский	Сагирдашт	Маргак	11351	1		11403.6	17
GBAO	Рошткалинский	Рошткала	Биджур	12067	1		12098.2	18
GBAO	Рошткалинский	Тавдем	Хабост	12796	1		12792.9	19
GBAO	Рошткалинский	Тавдем	Паршед	13401	1		13487.6	20
GBAO	Рошткалинский	Барвоз	Бидиз	14176	1		14182.2	21
GBAO	Рушанский	Бартанг	Бартанг	14912	1		14876.9	22
GBAO	Рушанский	Бахрушан	Бахрушан	15548	1		15571.5	23
GBAO	Рушанский	Бахрушан	Барзуд	16222	1		16266.2	24
GBAO	Рушанский	Рушан	Рушан	16964	1		16960.8	25
GBAO	Рушанский	Рушан	Рушан	17558	1		17655.5	26
GBAO	Рушанский	Савноб	Савноб	18313	1		18350.2	27
GBAO	Шугнанский	Ванкала	Миёншахр	19049	1		19044.8	28
GBAO	Шугнанский	Вир	Вуж	19676	1		19739.5	29
GBAO	Шугнанский	Дарморахт	Пиш	20362	1		20434.1	30
GBAO	Шугнанский	Навабад	Мун	21125	1		21128.8	31
GBAO	Шугнанский	Поршнев	Бувед	21823	1		21823.4	32
GBAO	Шугнанский	Поршнев	Тишор	22406	1		22518.1	33
GBAO	Шугнанский	Сохчарв	Барьёмдж	23158	1		23212.8	34
GBAO	Шугнанский	Сучон	Богев	23805	1		23907.4	35

Appendix 3. Estimates of sample size

Sample size calculation.

Given by (c) the clusters necessary

$c=(p \times (1-p) \times D)/s^2 \times b$ (Bennett et al. 1991)

Where p is the estimation of the proportion (e.g. prevalence of micronutrient deficiency), D the design effect (D=1+(b-1)ρ), s the standard error an d b the average number of responses to the item per cluster.

Given that the design effect is typically not known, the MNSS 2003 Tajikistan used a modified approach with the following formula:

$c = (((t^2 \times p(1-p)) / m^2) \times D) / nh + 10\%$

Where:

c = required number of cluster
t = confidence level at 95% (standard value of 1.96)
p = estimated prevalence of micronutrient deficiencies (50% for 2003 survey; 50% for 2009 survey)
m = margin of error at 6.5% (2003 survey, 2009 survey)
D = design effect (2 for 2003 survey; 1.75 for 2009 survey)
nh = number of household by cluster
10% = sample loss

2003 survey: Estimation of the number of clusters (c) per stratum for different estimations of proportion of population
$c = ((t^2 \times p(1-p)/ m^2) \times D) / 25$

95% CI	Proportion								
	2.5%	5.0%	7.5%	10.0%	15.0%	20.0%	30.0%	35.0%	50.0%
2.00%	19	36	53	69	98	123	161	175	192
2.50%	12	23	34	44	63	79	103	112	123
5.00%		6	9	11	16	20	26	28	31
6.50%			5	7	9	12	15	17	18
10.00%				3	4	5	6	7	8

2003 survey: Estimation of the number of clusters (c) per stratum with 10% safety margin
$c = ((t^2 \times p(1-p)/ m^2) \times D + 10\%) / 25$

95% CI	Proportion								
	2.5%	5.0%	7.5%	10.0%	15.0%	20.0%	30.0%	35.0%	50.0%
2.00%	21	40	59	76	108	135	177	192	211
2.50%	13	26	38	49	69	87	114	123	135
5.00%		6	9	12	17	22	28	31	34
6.50%			6	7	10	13	17	18	20
10.00%				3	4	5	7	8	8

2003 survey: Individuals included in the survey for different estimations of the proportion (p) of population
n = ((t² x p(1-p)/ m²) x D)

95% CI	Proportion								
	2.5%	5.0%	7.5%	10.0%	15.0%	20.0%	30.0%	35.0%	50.0%
2.00%	515	1'004	1'466	1'902	2'694	3'381	4'437	4'807	5'282
2.50%	330	642	938	1'217	1'724	2'164	2'840	3'076	3'381
5.00%		161	235	304	431	541	710	769	845
6.50%			139	180	255	320	420	455	500
10.00%				76	108	135	177	192	211

2009 survey: Estimation individuals included in the survey for different estimations of the proportion (p) of population
n = ((t² x p(1-p)/ m²) x D)

95% CI	Proportion								
	2.5%	5.0%	7.5%	10.0%	15.0%	20.0%	30.0%	35.0%	50.0%
2.00%	410	798	1'166	1'513	2'143	2'689	3'529	3'824	4'202
2.50%	262	511	746	968	1'371	1'721	2'259	2'447	2'689
5.00%		128	187	242	343	430	565	612	672
6.50%			110	143	203	255	334	362	398
10.00%				61	86	108	141	153	168

2009 survey: Estimation individuals included in the survey for different estimations of the proportion (p) of population with 10% safety margin
n = ((t² x p(1-p)/ m²) x D + 10%)

95% CI	Proportion								
	2.5%	5.0%	7.5%	10.0%	15.0%	20.0%	30.0%	35.0%	50.0%
2.00%	451	878	1'283	1'664	2'357	2'958	3'882	4'206	4'622
2.50%	288	562	821	1'065	1'509	1'893	2'485	2'692	2'958
5.00%		141	205	266	377	473	621	673	740
6.50%			121	158	223	280	368	398	438
10.00%				67	94	118	155	168	185

2009 survey: Estimation of the number of clusters (c) per stratum for different estimations of the proportion of population with 10% safety margin
c = ((t² x p(1-p)/ m²) x D + 10%) / 12

95% CI	Proportion								
	2.5%	5.0%	7.5%	10.0%	15.0%	20.0%	30.0%	35.0%	50.0%
2.00%	38	73	107	139	196	247	324	350	385
2.50%	24	47	68	89	126	158	207	224	247
5.00%	0	12	17	22	31	39	52	56	62
6.50%	0	0	10	13	19	23	31	33	36
10.00%	0	0	0	6	8	10	13	14	15

Appendix 4. Research consent form

Title of study: Study on national prevalence of micronutrient deficiency among children under 5 years of age and in women of child-bearing age in Tajikistan

Institutions involved: UNICEF/Tajikistan; Ministry of Health, Swiss Tropical Institute/Switzerland;

A team of experts from the Ministry of Health, technical specialists in Epidemiology and in Nutrition from UNICEF Tajikistan and from the Swiss Tropical Institute (Switzerland), is carrying out the current study.

The number identifying this study is No. 494 (approval letter from MoH Tajikistan).

Why are we giving you this form?

We are giving you this form to provide you information about this research study. You and your child have the opportunity to participate in this study. After you have learned more about the study, you can decide if you would like to participate.

Purpose of this research study.

We are interested in the health of your child as well as in yours, and we would like to improve the general nutrition situation in Tajikistan. Therefore, the Ministry of Health and UNICEF with technical support from the Swiss Tropical Institute is conducting this study.

We will evaluate the severity of micronutrient deficiency among children under 5 years and women of child-bearing age in all four oblasts of Tajikistan such as iodine or Vitamin deficiencies.

We expect around 4000 persons to participate in the study.

Procedures

If you decide to participate in this study, we will ask you some questions about your nutrition and feeding practices as well as your use and access to health services in case of an illness . The interview will take no longer than 30 minutes.

We will collect from you and from your child 1 urine sample to examine the level of iodine excretion.

An experienced laboratory technician will take 0,3 ml of blood from a finger prick. We will measure the weight and the height of you and your child.

We will assess and tell you directly your level of haemoglobin. Other analysis will be done in a laboratory in Dushanbe.

In addition we will examine the salt you commonly use for cooking on iodine content and we will give you immediately an answer about the iodine content of your salt.

Possible Risks and Discomforts

You may feel some local pain during the blood collection, this will not cause any risk.

The urine provided by you and your child in the morning in plastic cups may be inconvenient for the child , but will not cause any risk.

Benefits

Your and your child's participation in this study may contribute to benefits to the health of the population in Tajikistan.

It improves the understanding of the severity of national micronutrient nutrition deficiency. UNICEF can initiate activities at national level to reduce the burden of this deficiency.

Confidentiality of the Information used in the Study and voluntariness.

The information collected from you and your child will be kept confidential.

You are free to decide whether or not your child participates at this study.

If you agree that you and your child participate in this study, please sign or make your mark below. By signing below, you confirm that you have been informed about the study on micronutrient nutrition deficiency and that you agree that you and your child participate. If you have any questions or concerns, please talk with us today. After we have left, you can contact your provincial health director.

You will receive a copy of this signed consent form.

First and last name of the child .....

First and last name of the child's caregiver .....

Date .....

Signature of the child's caregiver .....

Signature of principal investigator .....

Witness to Consent if Subject Unable to Read or Write Date
(Must be different than the person obtaining consent)

Signed copies of this consent form must be
1) kept on file by the principal investigator, 2) given to the subject

Dushanbe, 15 July 2009

Appendix 5. Questionnaire

MINISTRY OF HEALTH	TAJIK NUTRITION SURVEY 2009 REGION - CLUSTER - HHOLD ☐ - ☐☐ - ☐☐	UNICEF

MODULE 1-4. HOUSEHOLD INFORMATION

We are from the Ministry of Health and conducting a survey on mother and child's health. All the information we obtain will remain strictly confidential and your answers will never be identified. During this time I would like to speak with all mothers or others members of the household who take care of children in the household.
EXPLAIN THE RESEARCH CONSENT FORM AND LET THE RESPONDENT WOMAN SIGN TWO FORMS. ONE FORM REMAINS WITH THE WOMAN AND ONE FORM SHOULD BE ATTACHED WITH THE QUESTIONNAIRE.

1. ELIGIBILITY CRITERIA			
1.1	HH with at least 1 woman 15-49 years	1= yes 2= no	☐
1.2	HH with at least 1 child 6 to 59 months	1= yes 2= no	☐
1.3	HH with woman, who has signed a Research Consent Form	1= yes 2= no	☐
1.4	Are all eligibility criteria answered with yes?	1= yes 2= no	☐
IF NOT ALL ELIGIBILITY CRITERIA ARE ANSWERED WITH "yes" PLEASE STOP HERE WITH THIS HOUSEHOLD AND CONTINUE WITH THE NEXT HOUSEHOLD ON THE HOUSEHOLD SURVEY LIST OF THIS CLUSTER.			

2. GENERAL INFORMATION					
2.1	Area: 1=Urban; 2=Rural	☐	2.2	Region: 1=Dushanbe; 2=Khatlon; 3=Sugd; 4=DRD; 5=GBAO	☐
2.3	District Name		2.4	Village/ Street Name	
2.5	Cluster number	☐ ☐	2.6	Survey Household number	☐☐
2.7	Day/Month/Year of interview (DD/MM/YYYY)			☐☐ / ☐☐ / 2009	
2.8	Time Start of the interview	☐☐ : ☐☐	2.9	Time End of the interview	☐☐ : ☐☐
2.10	Name of household head:				
2.11	Address of household:				
2.12	Telephone number MOBILE 1:	☐☐☐☐☐☐☐☐☐			
2.13	Telephone number MOBILE 2:	☐☐☐☐☐☐☐☐☐			
2.14	Telephone number LAND LINE :	☐☐☐☐☐☐☐☐☐			

2.15	1. Please list all eligible women 15–49 yrs (start with youngest) Woman born after 15 of november 1960 Woman born before 15 of october 1994 2. Then list all eligible children 3. Then select first all mothers of eligible children 4. If more women are needed to get same number as children select other eligible woman of this household		
	Name	**Date of birth DD/MM/YY**	**CODE for SELECTED**
2.15.2		☐☐/☐☐/☐☐	☐☐
2.15.3		☐☐/☐☐/☐☐	☐☐
2.15.4		☐☐/☐☐/☐☐	☐☐
2.15.5		☐☐/☐☐/☐☐	☐☐
2.15.6		☐☐/☐☐/☐☐	☐☐
2.15.7		☐☐/☐☐/☐☐	☐☐
2.15.8		☐☐/☐☐/☐☐	☐☐
2.15.9		☐☐/☐☐/☐☐	☐☐
2.15.10		☐☐/☐☐/☐☐	☐☐
2.15.11		☐☐/☐☐/☐☐	☐☐
CODE: START FOR WOMEN IN EVERY CLUSTER WITH ID CODE 01 AND FINISH WITH 12			

2.16	1. Please list all eligible children 06 to 59 mts (start with youngest) Child born after 15 of november 2004 Child born before 13 of april 2009 2. Start with the youngest child				
	Name	**Sex: 1=male 2=female**	**Date of birth DD/MM/YY**	**CODE for SELECTED child**	***CODE of MOTHER**
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
		☐	☐☐/☐☐/☐☐	☐☐	☐☐
CODE: START FOR CHILDREN IN EVERY CLUSTER WITH ID CODE 51 AND FINISH WITH 62 *CODE of MOTHER OF SELECTED CHILDREN ONLY					

NAME OF RESPONDING PERSON:				
3. HOUSEHOLD IDENDIFICATION NUMBER		**REGION**	**CLUSTER**	**HOUSEHOLD**
		☐	☐☐	☐☐
3.1	Type of dwelling	1= communal flat; 2= house; 88= other → specify: ☐☐☐☐☐☐☐☐☐		☐☐
3.2	How many families stay in the household?			☐
3.3	How many people live in this household?			☐☐
3.4	Ethnic group	1=Tajik; 2=Uzbek; 3=Russian; 4=Kyrgyz; 88= other → specify: ☐☐☐☐☐☐☐☐☐		☐☐
3.5	Gender of the household head?	1=male; 2=female		☐
3.6	What is the household heads level of education?	1 = none 2 = primary (Grades 1-4) 3 = basic (Grades 1-9) 4 = secondary (Grad 9-11)	5 = secondary special 6 = secondary technical 7 = higher education 99 = don't know	☐☐
3.7	What is your family's main source of cash income?	1 = private business; 2 = salary; 3 = pension/social aid; 4 = farming/livestock;	5= remittances 6 = no cash income; 99 = don't know	☐☐
3.8	What do you grow for your own consumption?			1=yes; 2=no;
	3.8.1	Wheat, rice		☐
	3.8.2	Beans, peas, lentils, nuts		☐
	3.8.3	Potatoes or other routs or tubers		☐
	3.8.4	Yellow or orange colored vegetables (pumpkins, carrots) or fruits (yellow plums or apricots)		☐
	3.8.5	Other vegetables and fruits		☐
3.9	Do you keep animals for meat and milk production for your own consumption?			1=yes; 2=no;
	3.9.1	cows		☐
	3.9.2	sheep		☐
	3.9.3	goats		☐
	3.9.4	chickens / poultry		☐
	3.9.5	horse		☐
3.10	Are there children <5yrs in this household with the following disabilities?			1=yes; 2=no;
	3.10.1	Blindness		☐
	3.10.2	Deafness		☐
	3.10.3	Motor disability		☐
	3.10.	Mental disability		☐

3.11	What kind of edible salt do you usually use?	1= iodized salt; 2= not iodized salt 99 = don't know	☐☐
3.12	Why is it important to use iodized salt?	1=yes; 2=no; DO NOT READ THE ANSWERS	
	3.12.1	Prevents from goiter	☐
	3.12.2	Enables fetus to develop normally during pregnancy	☐
	3.12.3	Mental development	☐
	3.12.4	other → SPECIFY:	
3.13	Where do you store salt?	1=closed container (e.g. can); 2=open container; 3=sac or other material container 9=No salt in home IF NO GO TO 4	☐
3.14	We would like to check whether the salt used in your household is iodised. May I have a sample of the salt used for cooking?	1=Not iodized 0 PPM (no colour) 2=Less than 15 PPM (weak colour) 3=15 PPM or more (strong colour)	☐

4. FOOD SECURITY COPING STRATEGIES		
4.1	**Since beginning of 2009 / last winter did you have to deal or cope with the following problems?**	**1=yes 2= no**
4.1.2	Borrow food or rely on help from friends or relatives	☐
4.1.3	Decreased your amount of food consumption	☐
4.1.4	Increase the production of food products for your consumption	☐
4.1.5	Decrease buying some non-food products	☐
4.1.6	Sell more animals than usual	☐
4.1.7	Decrease expenditures for health care and drugs	☐
4.1.8	Withdrew or postponed the admission to school	☐
4.1.9	Seek for alternative employment	☐
4.1.10	Increase the number of household members who are out of the village in search for work (migrants)	☐

MINISTRY OF HEALTH	TAJIK NUTRITION SURVEY 2009 REGION - CLUSTER - HHOLD ☐ - ☐☐ - ☐☐	UNICEF

MODULE 5. CHILD HEALTH (6-59 MONTHS)

ID CODE of the CHILD (6-59 MONTHS) ☐☐

5. CHILD HEALTH FOR ALL CHILDEN 6-59 MONTHS (START WITH THE YOUNGEST) RESPONDENT: MOTHER OR PERMANENT REPLACEMENT			
5.1	Does your child have birth certificate?	1= yes; 2= no	☐
5.2	What was your child's birth weight?	Enter child's birth weight in Kg 9.99=don't know	☐,☐☐ ☐☐
5.3	Has the child had diarrhea (more than three loose stools day) in the past 4 weeks?	1=yes; 2=no; 99=don't know	☐☐
5.4	In general when your child has diarrhea does the child drink any of the following items		1=yes; 2=no 99=don't know;
	5.4.1	Breast milk	☐☐
	5.4.2	Soup	☐☐
	5.4.3	Tea (black or green)	☐☐
	5.4.4	ORS packet solution	☐☐
	5.4.5	Other milk or infant formula	☐☐
	5.4.6	Water alone	☐☐
	5.4.7	Antibiotics/anti diarrheal drugs	☐☐
	5.4.8	other → PLS SPECIFY:	
5.5	In general when your child has diarrhea does he/she drink much less, about the same, or more than usual?	1=Much less or none 2=About the same 3=More 99=Don't know/no answer	☐☐
5.6	Does your child have vision problems at night? (vision adaptation to darkness – night blindness)	1=yes; 2=no; 99=don't know	☐☐
5.7	Did your child have a goiter?	1=yes; 2=no; 99= don't know	☐☐
5.8	Has your child received iron syrup in the past six months at any time?	1=yes; 2=no; 99 = don't know	☐☐
5.9	Has your child received a Vitamin A capsule in the past 6 months? SHOW VITAMIN A CAPSULE	1= yes; 2=no 99= don't know	☐☐
5.10	Has your child received de-worming tablets in the past 6 months? SHOW DE-WORMING TABLET	1= yes; 2=no 99= don't know	☐☐
5.11	How many times did the child receive solid, semi-solid or soft foods since this time yesterday?	Enter number of times	☐☐

5.12	What did the child eat or drink since this time yesterday		1=yes; 2=no; 99= don't know
	5.12.1	Wheat, bread, rice pasta, biscuit	☐☐
	5.12.2	Potatoes or other routs or tubers	☐☐
	5.12.3	Beans, peas, lentils, nuts	☐☐
	5.12.4	Milk or milk products	☐☐
	5.12.5	Meat, liver, kidney, chicken, fish	☐☐
	5.12.6	Eggs	☐☐
	5.12.7	Yellow or orange colored vegetables (pumpkins, carrots) or fruits (yellow plums or apricots)	☐☐
	5.12.8	Other vegetables and fruits	☐☐
	5.12.9	Fats and oils	☐☐
	5.12.10	Tea (black or green)	☐☐
	5.12.11	Plain water	☐☐
	5.12.12	Sugary water or fruit juices	☐☐
	5.12.13	Infant formula	☐☐
	5.12.14	Vitamins, mineral supplements, and / or any medicine	☐☐

CHILD ANTROPOMETRICS AND LABORATORY			
5.13	Height. Measure child's height in cm to the nearest 0.1 cm	Enter value; 888.8=refused; 999.9= not present COMMA!	☐☐☐,☐
5.14	Weight. Measure child's weight in kg to the nearest 0.1 kg	Enter value; 888.8=refused; 999.9= not present COMMA!	☐☐☐,☐
COLLECT BLOOD & URINE samples			
5.15	Anemia. Record hemoglobin value (from Hemocue) to the nearest 0.1 g/dL	Enter value; 88.8=refused; 99.9= not present COMMA!	☐☐,☐
5.16	Blood taken and placed in Microtainer	1 = yes; 2 = no; 88=refused	☐☐
5.17	Urine collected and placed in Tube	1 = yes; 2 = no; 88=refused	☐☐
5.18	Please put ID label sticker for this child	REGION - CLUSTER - CHILD ☐ - ☐☐ - ☐☐	

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MODULE 6. FEEDING AND CARE OF CHILDREN 6-24 MOTHS

ID CODE OF INFANT (6-24 MONTHS) ☐☐

6. INFANT FEEDING INTERVIEW: RESPONDENT MOTHER OR PERMANENT REPLACEMENT			
6.1	Has your child ever been breastfed?	1=yes; 2=no; IF NO GO TO 6.10	☐
6.2	For how long did you exclusively breastfed your child?	Write number of months 99 = don't know	☐☐
6.3	After how many months did you stop breastfeeding at all?	Write number of months 99= still breastfeeding IF 99 GO TO 6.5	☐☐
6.4	Why did you stop breastfeeding?	1 = not enough milk; 2 = mother 's illness; 3 = baby's illness; 4 = baby was not gaining enough weight; 5 = no time; 6 = mother became pregnant; 7 = health workers recommendation 8 = relatives recommendation 9= others; specify 99 = don't know	☐☐
6.5	Since this time yesterday, has your child been breastfed and if yes, how many times?	0=no; WRITE NUMBER	☐
6.6	How long after birth did you put your child to the breast for the first time?	1 = within first 30 minutes from delivery; 2 = within the first 6 hours; 3 = more than 6 hours after delivery; 99 = don't know	☐☐
6.7	Who helped you with breastfeeding, in the first week?	1 = health professional; 2 = relatives: SPECIFY: ☐☐☐☐☐☐☐☐☐ 3 = mother's support group 4 = nobody;	☐
6.8	Since this time yesterday, has your child received any of the following drinks?	1=yes; 2=no; 99=don't know	
	6.8.1	Plain water	☐☐
	6.8.2	Herbal tea	☐☐
	6.8.3	Tea (black or green)	☐☐
	6.8.4	Fruit juices	☐☐
6.9	Did you add sugar to the above drinks?	1=yes; 2=no;	☐
6.10	Since this time yesterday, did you give animal milk to your child?	1=yes; 2=no IF NO GO TO 6.12	☐
6.11	Did you dilute the animal milk?	1 = yes; 2 = no;	☐
6.12	When did you start giving complementary feeding?	Enter age of infant in months 99=don't know	☐☐
6.13	Did your child receive complementary feeding from a bottle with a nipple?	1 = yes; 2 = no;	☐

ID CODE OF INFANT (6-24 MONTHS) ☐☐

CARE AND DEVELOPMENT (ONLY FOR CHILDREN 6 – 24 MONTS)			
6.14	Did you have a visit from health workers (e.g. patronage nurse) or volunteers for your child health and development in the past six months?	1 = yes; 2 = no; IF NO → GO TO 6.17	☐
6.15	Where did you meet the health worker?	1 = health centre; 2 = at home;	☐
6.16	Why did you meet the health worker? 1 = yes; 2 = no;	6 = child was sick 7 = for prevention (vaccination) 8 = for advice on care & development	☐ ☐ ☐ ☐
6.17	Did the health workers/volunteers ask you questions or give advice you about the following?	1 = yes; 2 = no; 99=don't know	☐☐
6.17.1	Did he ask you about breastfeeding?		☐☐
6.17.2	Did he ask you about what foods you were giving your child or how you were feeding your child?		☐☐
6.17.3	Did he ask you about what your child was able to do (e.g., talking, walking, and understanding)?		☐☐
6.17.4	Did he give you advice on how to help your child learn more?		☐☐
6.17.5	Did he give you advice on child discipline, care and sleep?		☐☐
6.17.6	Did you receive any other advice?		☐☐
	PLS SPECIFY:		
6.18	In the past 3 months, was your child measured for weight?	1 = yes; 2 = no; IF NO → GO TO 6.20	☐☐
6.19	How many times was your child measured for weight in past three months?	PLEASE ENTER NUMBER OF TIMES	☐☐
6.20	In the past 3 months, was your child measured for height?	1 = yes; 2 = no; IF NO → SKIP 6.21	☐☐
6.21	How many times was your child measured for height in past 3 months?	PLEASE ENTER NUMBER OF TIMES	☐☐

MINISTRY OF HEALTH	TAJIK NUTRITION SURVEY 2009 REGION - CLUSTER - HHOLD ☐ - ☐☐ - ☐☐	UNICEF

MODULE 7. WOMAN INTERVIEW

ID CODE of the WOMAN ☐☐

7. WOMAN INTERVIEW (ONLY FOR WOMAN 15 – 49 YEARS)				
7.1	What is the highest level of school you attended?	1 = none 2 = primary (Grades 1-4) 3 = basic (Grades 1-9) 4 = secondary (Grad 9-11)	5 = secondary special 6 = secondary technical 7 = higher education 99 = don't know	☐☐
7.2	Did you ever have a goiter or iodine deficiency disorders?	1=yes; 2=no; 99 = don't know		☐☐
7.3	Are you pregnant at this point in time?	1=yes; 2=no; 99= don't know		☐☐
7.4	Did you ever take iron tablets in the past 6 months?	1=yes; 2=no;		☐
7.5	What did you eat or drink since this time yesterday?	1=yes; 2=no;		
7.5.1	Wheat, bread, rice pasta, biscuit			☐
7.5.2	Potatoes or other routs or tubers			☐
7.5.3	Beans, peas, lentils, nuts			☐
7.5.4	Milk or milk products			☐
7.5.5	Meat, liver, kidney, chicken, fish			☐
7.5.6	Eggs			☐
7.5.7	Yellow or orange colored vegetables (pumpkins, carrots) or fruits (yellow plums or apricots)			☐
7.5.8	Other vegetables and fruits			☐
7.5.9	Fats and oils			☐
7.5.10	Tea (black or green)			☐
7.5.11	Plain water			☐
7.5.12	Sugary water or fruit juices			☐
7.5.13	Vitamins, mineral supplements, and / or any medicine			☐
7.6	Height. Measure woman's height in cm to the nearest 0.1 cm	Enter value; 888.8=refused; 999.9= not present COMMA!		☐☐☐,☐
7.7	Weight. Measure woman's weight in kg to the nearest 0.1 kg	Enter value; 888.8=refused; 999.9= not present COMMA!		☐☐☐,☐

COLLECT BLOOD & URINE SAMPLES			
7.8	Anemia. Record hemoglobin value (from Hemocue) to the nearest 0.1 g/dL	Enter value; 88.8=refused; 99.9= not present COMMA!	☐☐,☐
7.9	Blood taken and placed in Microtainer	1 = yes; 2 = no; 88=refused	☐☐
7.10	Urine collected and placed in Tube	1 = yes; 2 = no; 88=refused	☐☐
7.11	Please put ID label sticker for this woman	REGION - CLUSTER - WOMEN ☐ - ☐☐ - ☐☐	

Appendix 6. Cut-off values for haemoglobin and urinary iodine

Categories of chronic energy deficiency among non-pregnant women and men (body mass index; BMI)

BMI (kg/m2)	Category of malnutrition
< 16.0	Severe malnutrition
16.0 – 16.9	Moderate malnutrition
17.0 – 18.4	At risk
18.5 – 24.9	Normal
25.0 – 29.9	Overweight (pre-obese)
≥ 30	Obese
30.0 – 34.9	Obese Class I
35.0 – 39.9	Obese Class II
≥ 40.0	Obese Class III

Haemoglobin (Hb): Currently WHO defines haemoglobin as follows:

Haemoglobin thresholds used to define haemoglobin

Age or gender group	Haemoglobin threshold (g/L)
Children (0.5–4.9 yrs)	110
Children (5–11.9 yrs)	115
Children (12–14.9 yrs)	120
Non-pregnant women (≥ 15 yrs)	120
Pregnant women	110
Men (≥ 15 yrs)	130

Adjustments to haemoglobin cut-offs and individual haemoglobin values for Altitude

Altitude (m)	Adjustment to Haemoglobin cut-offs value (g/dL)	Adjustment to individual to Haemoglobin value (g/dL)
<1000	No adjustment	No adjustment
>1000, <1250	+0.2	-0.2
>1250, <1750	+0.5	-0.5
>1750, <2250	+0.8	-0.8
>2250, <2750	+1.3	-1.3
>2750, <3250	+1.9	-1.9
>3250, <3750	+2.7	-2.7

Altitude (m)	Adjustment to Haemoglobin cut-offs value (g/dL)	Adjustment to individual to Haemoglobin value (g/dL)
>3750, <4250	+3.5	-3.5
>4250, <4750	+4.5	-4.5
>4750, <5250	+5.5	-5.5
>5250	+6.7	-6.7

Criteria for assessing iodine nutrition based on median urinary iodine concentrations (for adults)

Median UI (µg/L)	Iodine intake	Iodine status
< 20	Insufficient	Severe iodine deficiency
20-49	Insufficient	Moderate iodine deficiency
50-99	Insufficient	Mild iodine deficiency
100-199	Adequate	Adequate iodine nutrition
200-299	Above requirements	Likely to provide adequate intake for pregnant/ lactating women, but may pose a slight risk of more than adequate intake in the overall population
> 300	Excessive	Risk of adverse health consequences

Categories of median UI concentrations in (µg/L) (WHO UNICEF ICCIDD):

< 20 = severe ID;
20-49 = moderate iodine deficiency;
50-99 = mild iodine deficiency;
100-199 = adequate iodine nutrition;
200-299 = above requirements;
> 300 = excessive (risk of adverse health consequences).

Appendix 7. Detailed results in table format

7.1 Women nutritional status: body mass index (BMI)

Table 10: Distribution BMI of women of reproductive age (15-49 yrs), by strata

	n	Low BMI			Normal BMI	High BMI			
		% < 16	% 16–16.99	% 17–18.49	% 18.5–24.99	% 25-29.99	% 30.00-34.99	% 35.00-39.99	% > 40
		CED – Grade III (Severe thinness)	CED - Grade II (Moderate thinness)	CED – Grade I (Mild thinness)		Pre Obese	Obese Class I	Obese Class II	Obese class III
Dushanbe	427	0.2	1.6	6.3	49.7	25.8	9.6	5.9	0.9
Khatlon	430	0.2	0.7	7	67	17.2	6.7	0.9	0.2
Sugd	430	0	0.9	4.7	68.8	18.1	5.6	1.4	0.5
DRD	432	0.7	0.9	3.5	62.7	23.2	7.2	1.6	0.2
GBAO	422	0.2	2.1	7.1	72.5	14	3.1	0.5	0.5
National*	2134	0.3%	1.0%	5.4%	65.1%	19.4%	6.7%	1.7%	0.4%

*weighted
BMI: ≤ 17 = severe to moderate malnutrition; 17.0–18.4 = at risk; 18.5 – 24.9 = normal; 25.0 – 29.9 = overweight (pre-obese); ≥ 30 obese

Table 11: Frequency of BMI in women, by rural/urban

Strata	n	BMI < 18.5	BMI 18.5 - 24.9	BMI ≥ 25	χ2 *	P-Value
National					43.264	< 0.001
rural	1414	6.6%	69.0%	24.4%		
urban	720	8.5%	54.7%	36.8%		

* Pearson χ2
BMI: ≤ 17 = severe to moderate malnutrition; 17.0–18.4 = at risk; 18.5 – 24.9 = normal; 25.0 – 29.9 = overweight (pre-obese); ≥ 30 obese

Table 12: BMI level in women, by rural/urban

Strata	n	Mean	SD	95% CI	P-Value (ttest)
National					< 0.001
rural	1414	23.1	3.9	(22.9, 23.3)	
urban	720	24.1	5.2	(24.0, 24.8)	

BMI: ≤ 17 = severe to moderate malnutrition; 17.0–18.4 = at risk; 18.5 – 24.9 = normal; 25.0 – 29.9 = overweight (pre-obese); ≥ 30 obese

Table 13: BMI Classes distribution according to age

Age (yrs)	BMI <18.5	18.5-25	BMI ≥ 25	Total
15-24	10.1	70.5	19.4	650
25-40	6.2	63.3	30.5	1277
41-49	4.3	49.8	45.9	207
Total	7.22	64.2	28.6	2134
Total, weighted	6.7	54.1	28.2	

BMI: ≤ 17 = severe to moderate malnutrition; 17.0–18.4 = at risk; 18.5 – 24.9 = normal; 25.0 – 29.9 = overweight (pre-obese); ≥ 30 obese

7.2 Women nutritional status: Anaemia

Table 14: Serum haemoglobin concentration (g/dL), mean, SD and median in women of reproductive age (15-49 yrs), by strata

Strata	n	Mean (g/dL)	SD	Median (g/dL)
Dushanbe	426	12.6	1.4	12.7
Khatlon	429	12.7	1.6	13.0
Sughd	431	13.1	1.4	13.2
DRD	431	12.6	1.5	12.7
GBAO	420	12.7	1.7	12.8
National*	2138	12.8	1.9	NA

Bartlett's test for equal variances: chi2 = 65.01; degrees of freedom [df] = 4; P < 0.001,Scheffe's test P < 0.05
WHO age / gender group Hb threshold (g/dL): children (0.5–4.9 yrs) = 11; non-pregnant women (≥ 15 yrs) = 120; pregnant women = 110

Table 15: Prevalence of anaemia among women of reproductive age (15-49 yrs), by strata

Strata	n	Hb<7g/dL	Hb 7-9.9g/dL	Hb 10-11.9g/dL	Hb≥12g/dL	Hb<12g/dL
Dushanbe	427	0.5%	4.2%	22.0%	73.3%	26.7%
Khatlon	429	0.7%	5.1%	19.1%	75.1%	24.9%
Sughd	431	0.2%	2.1%	16.7%	81.0%	19.0%
DRD	431	0.2%	4.2%	23.7%	71.9%	28.1%
GBAO	420	0.5%	4.8%	24.5%	70.2%	29.8%
National*	2138	0.4%	3.9%	19.9%	75.8%	24.3%

Uncorrected Pearson chi2= 19.92, df = 12, P=0.143
*Weighted; design-based Pearson F(7.61, 1331.12) = 1.75; P = 0.0879
WHO age / gender group Hb threshold (g/dL): children (0.5–4.9 yrs) = 11; non-pregnant women (≥ 15 yrs) = 120; pregnant women = 110

Table 16 : Prevalence of anaemia among women of reproductive age (15-49 yrs), by strata

Strata	Hb < 10 g/dL	Hb 10- 11.9 g/dL	≥ 12 g/dL
Dushanbe	4.7%	22.0%	73.3%
Khatlon	5.8%	19.1%	75.1%
Sughd	2.3%	16.7%	81.0%
DRD	4.4%	23.7%	71.9%
GBAO	5.3%	24.5%	70.2%
National*	4.3%	19.9%	75.8%
WHO age / gender group Hb threshold (g/dL): children (0.5–4.9 yrs) = 11; non-pregnant women (≥15 yrs) = 120; pregnant women = 110			

Table 17: Haemoglobin concentration (g/dL) in women of reproductive age (15-49 yrs),by rural/urban

Strata	n	mean (g/dL)	SD	95% CI	P-Value (ttest)
National					0.689
rural	1415	12.8	1.6	(12.7, 12.9)	
urban	723	12.7	3.2	(12.5, 13.0)	
WHO age / gender group Hb threshold (g/dL): children (0.5–4.9 yrs) = 11; non-pregnant women (≥ 15 yrs) = 120; pregnant women = 110					

Table 18: Frequency of anaemia in women of reproductive age, by rural/urban

Strata	n	Hb <10g/dL	Hb 10-11.9g/dL	Hb≥12g/dL	Hb<12g/dL	χ2 *	P-Value
National						1.421	0.491
rural	1415	4.4%	20.5%	75.1%	24.9%		
urban	723	4.7%	22.5%	72.8%	27.2%		
WHO age / gender group Hb threshold (g/dL): children (0.5–4.9 yrs) = 11; non-pregnant women (≥15 yrs) = 120; pregnant women = 110 * Pearson χ2							

Table 19: Age categories and anaemia distribution among women of reproductive age (15-49 yrs)

Age category	n	Hb<7g/dL	Hb 7-9.9g/dL	Hb 10-11.9g/dL	Hb>12g/dL
15-24	650	0.5%	4.0%	16.5%	79.1%
25-40	1280	0.4%	3.9%	23.7%	72.0%
41-49	208	0.5%	5.3%	20.2%	74.0%
National	2138	0.4%	4.1%	21.2%	74.3%
Uncorrected Pearson chi2 = 14.7841, df = 6, P = 0.022 WHO age / gender group Hb threshold (g/dL): children (0.5–4.9 yrs) = 11; non-pregnant women (≥ 15 yrs) = 120; pregnant women = 110					

7.3 Women nutritional status: iron deficiency

Table 20: Ferritin concentration (ug/L) among women of reproductive age (15-49 yrs), by strata

Strata	n	Mean (µg/l)	SD	Median (µ/l)
Dushanbe	429	154.5	114.4	128.5
Khatlon	382	127.4	100.8	103.9
Sughd	420	116.3	108.3	94.1
DRD	427	106.2	93.2	83.2
GBAO	395	145.2	123.5	111.7
National*	2036	122	104.5	NA
One-way ANOVA F=5.0; P<0.002; Bartlett's Test for equal variances: chi2= 15.526; df = 4, P<0.004; Scheffe's Test p<0.05 for comparison region 1/2, 1/3, 1/4. Log transformation				

Table 21: Frequency of low and normal values of Ferritin among women of reproductive age (15-49 yrs) with CRP <5mg/L, by strata

Strata	n	< 12 ng/ml	≥ 12 ng/ml
Dushanbe	365	1.6%	98.4%
Khatlon	339	8.0%	92.0%
Sughd	374	10.4%	89.6%
DRD	357	14.3%	85.7%
GBAO	372	1.6%	98.4%
National*	1791	9.3%	90.7%
Pearson: Uncorrected chi2(4) = 84.7976; design-based F(2.50, 425.36) = 3.6351 Pr = 0.019			

Table 22: Ferritin concentration (µg/L) in women of reproductive age (15-49 yrs), by rural/urban

Strata	n	Mean (µg/l)	SD	95% CI	P-Value (ttest)
National					0.111
rural	1341	127.1	106.7	(121.3, 132.8)	
urban	695	135.3	116.3	(126.6, 143.9)	

Table 23: Frequency of low and normal values of ferritin in women of reproductive age (15-49 yrs), by rural/urban

Strata	n	Ferritin <12ng/ml	Ferritin ≥12ng/ml	χ2 *	P-Value
National				1.869	0.172
rural	1417	6.4%	93.6%		
urban	724	8.0%	92.0%		
* Pearson χ2					

Table 24: sTfR concentration (µg/ml) among women of reproductive age (15-49 yrs), by strata

Strata	n	Mean (µg/ml)	SD	Median (µg/ml)
Dushanbe	431	0.9	1.1	0.6
Khatlon	384	1.1	1.4	0.7
Sughd	420	1.1	1	0.8
DRD	430	1.5	1.7	1.1
GBAO	425	1.6	1.7	1.2
National*	2073	1.2	1.4	NA
One-way ANOVA F=50,47; P<0.002; Bartlett's Test for equal variances: chi2= 31.118; df = 4, p<0.001; Scheffe's Test P<0.001 for comparison of regions. Log transformation				

Table 25: Frequency of normal and high values of sTfR among women of reproductive age (15-49 yrs), by strata

Strata	n	% < 3.3 mg/L	% > 3.3 mg/L
Dushanbe	431	96.3%	3.7%
Khatlon	384	95.3%	4.7%
Sughd	420	96.4%	3.6%
DRD	430	93.0%	7.0%
GBAO	425	92.5%	7.5%
National*	2073	95.2%	4.8%
Pearson: Uncorrected chi2(4) = 11.1375; design-based F(3.98, 677.09) = 2.5318 Pr = 0.040			

Table 26: Frequency of low values of Ferritin and high values of transferrin among women of reproductive age (15-49 yrs) by strata

	Ferritin <12 ng/ml	sTfR >3.3 µg/ml
Dushanbe	6.6%	3.9%
Khatlon	11.8%	4.9%
Sughd	17.1%	5.0%
DRD	19.8%	8.8%
GBAO	9.1%	9.2%
National	12.9%	6.4%

Table 27: sTfR concentration (µg/L) in women of reproductive age (15-49 yrs), by rural/urban

Strata	n	Mean (µg/ml)	SD	95% CI	P-Value (ttest)
National					< 0.001
rural	1376	1.3	1.5	(1.3, 1.4)	
urban	697	1.0	1.3	(0.9, 1.3)	

Table 28: Frequency of normal and high values of sTfR in women of reproductive age (15-49 yrs), by rural/urban

Strata	n	sTfR <3.3µg/ml	sTfR ≥3.3µg/ml	χ2 *	P-Value
National				0.132	0.727
rural	1417	91.5%	8.5%		
urban	724	92.0%	8.0%		

7.4 Women nutritional status: iodine status

Table 29 : Urinary iodine excretion among women of reproductive age (15-49 yrs) in µg/L, by strata

Strata	n	Median (µg/L)	20th Percentile	80th Percentile
Dushanbe	429	103.8	73.8	151.6
Khatlon	422	61.8	46.7	87.6
Sughd	430	178.5	100.7	219.6
DRD	431	76.6	54.3	108.2
GBAO	428	96.3	71.9	147.8
		Mean (µg/L)	SD	95% CI
National*	2121	107.8	63.69	102.5
Calculating median for survey data is not recommended. Source: Categories of median urinary iodine concentrations in (µg/L) (WHO UNICEF ICCIDD): <20 = severe ID; 20-49 = moderate ID; 50-99 = mild ID; 100-199 = adequate iodine nutrition; 200-299 = above requirements; >300 = excessive (risk of adverse health consequences)				

Table 30: Distribution of urinary iodine values in women

Strata	n	< 20 µg/L	20-49 µg/L	50-99 µg/L	100-199 µg/L	200-299µg/L	>300µg/L
Dushanbe	429	0.2%	4.4%	41.3%	46.4%	6.5%	1.2%
Khatlon	422	5.2%	22.3%	57.3%	12.1%	3.1%	0.0%
Sughd	430	0.2%	0.7%	18.8%	47.9%	32.1%	0.2%
DRD	428	0.5%	15.8%	58.0%	20.6%	4.9%	0.2%
GBAO	428	0.2%	2.2%	52.8%	36.0%	8.9%	0.0%
National*	2121	2.0%	12.1%	44.5%	28.7%	12.5%	0.2%
Pearson: Uncorrected chi2(20) = 696.3324; design-based F(12.97, 2269.26) = 18.9829 Pr = 0.000 Perarson: uncorrected chi2(20) = 817.52; design-based F(9.33, 1633.14) = 25.26; P < 0.001 Categories of median urinary iodine concentrations in (µg/L) (WHO UNICEF ICCIDD): <20 = severe ID; 20-49 = moderate iodine deficiency; 50-99 = mild iodine deficiency; 100-199 = adequate iodine nutrition; 200-299 = above requirements; >300 = excessive (risk of adverse health consequences)							

Table 31: Distribution of urinary iodine values in women of reproductive age (15-49 yrs)

	≤ 49 µg/L	50-99 µg/L	> 100
Dushanbe	4.6%	41.3%	54.1%
Khatlon	27.5%	57.3%	15.2%
Sughd	0.9%	18.8%	80.3%
DRD	16.3%	58.0%	25.7%
GBAO	2.4%	52.8%	44.8%
National*	14.1%	44.5%	41.4%

Categories of median UI concentrations in (µg/L) (WHO UNICEF ICCIDD): <20 = severe ID; 20-49 = moderate iodine deficiency; 50-99 = mild iodine deficiency; 100-199 = adequate iodine nutrition; 200-299 = above requirements; >300 = excessive (risk of adverse health consequences)

Table 32: Urinary iodine concentration (µg/L) in women of reproductive age (15-49 yrs), by rural/urban

Strata	n	Mean (µg/L)	SD	95% CI	P-Value (ttest)
National					< 0.001
rural	1405	106.9	60.7	(103.7, 110.1)	
urban	716	117.2	59.5	(112.8, 121.5)	

Categories of median UI concentrations in (µg/L) (WHO UNICEF ICCIDD): <20 = severe ID; 20-49 = moderate iodine deficiency; 50-99 = mild iodine deficiency; 100-199 = adequate iodine nutrition; 200-299 = above requirements; >300 = excessive (risk of adverse health consequences)

Table 33: Frequency of normal, mild and moderate/severe urinary iodine levels in women of reproductive age (15-49 yrs), by rural/urban

Strata	n	< 50 µg/L	50-99 µg/L	≥ 100 µg/L	χ2 *	P-Value
National					36.5	< 0.001
rural	1417	12.7%	45.8%	41.5%		
urban	724	5.3%	43.7%	51.1%		

Categories of median UI concentrations in (µg/L) (WHO UNICEF ICCIDD): <20 = severe ID; 20-49 = moderate iodine deficiency; 50-99 = mild iodine deficiency; 100-199 = adequate iodine nutrition; 200-299 = above requirements; >300 = excessive (risk of adverse health consequences)

7.5 Women nutritional status: food consumption

Table 34: Nutritional consumption of women of reproductive age (15-49 yrs) (n = 2138, recall period: 24 hrs)

Food category	%
Wheat, bread, rice, pasta, biscuit	99.9
Potatoes or other roots or tubers	96.8
Other vegetables and fruits	93.3
Fats and oil	88.4
Yellow or orange colored vegetables or fruits	82.9
Milk or milk products	66.2
Beans, peas, lentils, nuts	59.0
Eggs	41.8
Meat, liver, kidney, chicken, fish	27.3
Tea (black or green)	99.7
Plain water	90.1
Sugary water or fruit juices	67.9
Vitamins, mineral supplements and/or any medicine	5.8

Table 35: Nutritional indicators for women of reproductive age (15-49 yrs) by nutritional consumption (n = 2133)

BODY MASS INDEX (BMI)	n	Answer	Percentage (%)			Pearson un-corrected χ2	P-Value
			BMI <18.5	BMI 18.5–24.9	BMI ≥ 25		
Eating habits of women (recall period: 24 hrs)							
Wheat, bread, rice, pasta, biscuit	2133	yes	6.7	65.2	28.2	2.399	0.083
		no	18.8	18.8	62.4		
Potatoes or other roots or tubers	2133	yes	6.7	65.1	28.1	0.304	0.841
		no	5.6	63.8	30.7		
Beans, peas, lentils, nuts	2133	yes	6.9	65.2	27.9	0.325	0.898
		no	6.4	64.9	28.7		
Milk or milk products	2132	yes	6.7	66.4	26.9	3.592	0.287
		no	6.8	6.3	30.7		
Meat, liver, kidney, chicken, fish	2133	yes	6.6	65.7	27.7	0.116	0.965
		no	6.7	64.9	28.4		
Eggs	2132	yes	7.0	64.9	28.1	0.187	0.950
		no	6.5	65.2	28.3		
Yellow/orange colored vegetables/fruits	2133	yes	6.9	65.4	27.7	1.422	0.610

		no	5.9	63.5	30.5		
Other vegetables and fruits	2132	yes	6.7	65.2	28.1	0.205	0.910
		no	6.2	64.0	29.8		
Fats and oil	2133	yes	6.9	65.3	27.8	2.271	0.435
		no	5.2	63.2	31.6		
Tea (black or green)	2133	yes	6.7	65.2	28.1	3.301	0.036
		no	0.0	39.8	60.2		
Plain water	2133	yes	6.7	65.6	27.7	2.198	0.408
		no	7.0	60.7	32.4		
Sugary water or fruit juices	2132	yes	7.3	65.9	26.8	6.459	0.123
		no	5.4	63.3	31.3		
Vitamins, mineral supplements and/or any medicine	2130	yes	10.1	58.6	31.2	3.513	0.380
		no	6.5	65.5	28.0		

ANAEMIA	n	Answer	Hb <10g/dL	Hb 10–11.9g/dL	Hb ≥12g/dL	Pearson uncorrected χ2	P-Value
Eating habits of women of reproductive age (15-49 yrs) (recall period: 24 hrs)							
Wheat, bread, rice, pasta, biscuit	2137	yes	4.3	19.9	75.8	0.178	0.817
		no	0.0	15.8	84.2		
Potatoes or other roots or tubers	2137	yes	4.2	19.9	76.0	0.854	0.606
		no	6.3	21.2	72.5		
Beans, peas, lentils, nuts	2137	yes	3.8	20.6	75.7	2.332	0.477
		no	5.0	19.0	76.1		
Milk or milk products	2136	yes	4.1	20.9	75.0	2.553	0.416
		no	4.5	18.0	77.5		
Meat, liver, kidney, chicken, fish	2137	yes	5.0	19.9	75.1	1.148	0.633
		no	4.0	19.9	76.1		
Eggs	2136	yes	3.8	22.4	73.8	6.366	0.111
		no	4.6	18.1	77.3		
Yellow/orange colored vegetables/fruits	2137	yes	4.0	19.3	76.7	4.221	0.264
		no	5.4	22.8	71.8		
Other vegetables and fruits	2136	yes	4.3	19.3	76.4	5.225	0.117
		no	4.2	27.2	68.6		
Fats and oil	2137	yes	4.3	19.5	76.2	1.844	0.437
		no	4.1	23.1	72.8		
Tea (black or green)	2137	yes	4.3	19.9	75.8	0.348	0.633
		no	0.0	25.0	75.0		

ANAEMIA	n	Answer	Hb <10g/dL	Hb 10–11.9g/dL	Hb ≥12g/dL	Pearson uncorrected χ2	P-Value
Plain water	2137	yes	4.1	19.6	76.3	2.068	0.477
		no	5.6	22.3	72.1		
Sugary water or fruit juices	2136	yes	4.2	18.9	76.9	2.865	0.337
		no	4.4	22.0	73.6		
Vitamins, mineral supplements and/or any medicine	2134	yes	6.8	23.6	69.6	3.557	0.277
		no	4.1	19.7	76.2		

URINARY IODINE DISTRIBUTION	n	Answer	UI <50µg/L	50–99µg/L	≥100 µg/L	Pearson uncorrected χ2	P-Value
Eating habits of women of reproductive age (15-49 yrs) (recall period: 24 hours)							
Wheat, bread, rice, pasta, biscuit	2118	yes	14.1	44.5	41.4	0.756	0.449
		no	31.7	36.7	31.7		
Potatoes or other roots or tubers	2118	yes	14.3	44.1	41.6	4.243	0.310
		no	7.6	55.4	37.0		
Beans, peas, lentils, nuts	2118	yes	14.9	41.3	43.7	12.101	0.155
		no	12.9	49.0	38.1		
Milk or milk products	2117	yes	13.4	45.5	41.1	2.309	0.648
		no	15.4	42.6	42.1		
Meat, liver, kidney, chicken, fish	2118	yes	20.9	48.9	30.2	53.721	0.000
		no	11.6	42.8	45.6		
Eggs	2117	yes	12.8	42.4	44.9	7.773	0.310
		no	15.1	46.0	39.0		
Yellow/orange colored vegetables/fruits	2118	yes	12.9	43.6	43.5	23.598	0.005
		no	20.1	48.6	31.3		
Other vegetables and fruits	2117	yes	13.6	44.2	42.3	11.594	0.047
		no	21.7	48.5	29.8		
Fats and oil	2118	yes	14.1	43.3	42.6	10.501	0.134
		no	14.4	53.3	32.3		
Tea (black or green)	2118	yes	14.2	44.5	41.4	1.036	0.359
		no	0.0	50.0	50.5		
Plain water	2118	yes	14.7	44.0	41.3	5.485	0.182
		no	8.8	48.5	42.7		
Sugary water or fruit juices	2117	yes	11.3	42.6	46.2	51.171	0.001
		no	19.9	48.6	31.5		
Vitamins, mineral supplements and/or any medicine	2120	yes	16.0	49.0	35.0	2.160	0.674
		no	14.0	44.5	41.4		

7.6 Children nutritional status: anthropometric assessment

Table 36: Frequency of low height-for-age (stunting) among children (6-59 months), by strata

Strata	n	Severely stunted	Stunted	Normal
Dushanbe	418	7.2%	14.6%	78.2%
Khatlon	421	12.3%	24.6%	63.1%
Sughd	427	7.7%	20.2%	72.1%
DRD	424	6.9%	15.9%	77.2%
GBAO	410	9.3%	16.1%	74.5%
National*	2100	9.0%	19.9%	71.1%
Pearson: Uncorrected chi2(8) = 38.7824 Design-based F(5.53, 967.07) = 4.0229 Pr = 0.001				

Table 37: Frequency of low weight-for-height (wasting) among children (6-59 months), by strata

Strata	n	Severely wasted	Wasted	Normal
Dushanbe	416	1.4%	2.6%	95.9%
Khatlon	424	1.6%	3.3%	95.0%
Sughd	429	0.2%	2.1%	97.7%
DRD	423	2.8%	4.4%	92.8%
GBAO	420	0.7%	3.3%	96.0%
National*	2112	1.4%	3.1%	95.5%
Pearson: Uncorrected chi2(8) = 18.4056 Design-based F(4.38, 766.64) = 2.0943 Pr = 0.073				

Table 37a: Frequency of underweight among children (6-59 months), by strata

Strata	n	Severely underweight	Underweight	Normal
Dushanbe	426	1.6%	6.1%	92.3%
Khatlon	424	3.5%	7.0%	89.5%
Sughd	429	1.3%	4.6%	94.1%
DRD	423	1.4%	7.2%	91.4%
GBAO	420	2.8%	5.7%	91.5%
National*	2167	2.2%	6.2%	91.7%
Uncorrected Pearson chi2(8) = 11.4949 Pr = 0.175				

Table 38: Frequency of 'low height-for-age' (stunting) in children (6-59 months), by rural/urban

Strata	n	Normal	Stunted	Severely stunted	χ2 *	P-Value
National					7.599	0.022
rural	1414	71.7%	18.7%	9.6%		
urban	715	76.4%	17.2%	6.4%		
* Pearson χ2						

Table 39: Frequency of low weight-for-height (wasting) in children (6-59 months), by rural/urban

Strata	n	Normal	Wasted	Severely wasted	χ2 *	P-Value
National					0.02	0.99
rural	1429	95.6%	3.1%	1.3%		
urban	712	95.5%	3.1%	1.4%		
* Pearson χ2						

Table 40: Frequency of underweight in children (6-59 months), by gender

Strata	n	Normal	Underweight	Severe underweight	χ2 *	P-Value
National					0.182	0.913
Boys	1444	91.7%	6.1%	2.2%		
Girls	723	92.0%	6.1%	1.9%		
* Pearson χ2						

Table 41: Frequency of low height-for-age (stunting) in children (6-59 months), by strata and gender

Strata	n	Normal	Stunted	Severely stunted	χ2 *	P-Value
Dushanbe					4.873	0.087
Boys	226	81.0%	11.1%	8.0%		
Girls	193	74.6%	18.7%	6.7%		
Khatlon					1.03	0.598
Boys	211	60.7%	26.1%	13.3%		
Girls	211	65.4%	23.2%	11.4%		
Sughd					5.558	0.062
Boys	233	68.7%	22.3%	9.0%		
Girls	221	78.3%	16.3%	5.4%		

Strata	n	Normal	Stunted	Severely stunted	χ2 *	P-Value
DRD					0.779	0.677
Boys	223	75.8%	17.5%	6.7%		
Girls	201	79.1%	14.4%	6.5%		
GBAO					5.605	0.061
Boys	206	73.8%	19.4%	6.8%		
Girls	204	75.5%	12.8%	11.8%		
National					1.85	0.397
Boys	1099	72.1%	19.2%	8.7%		
Girls	1030	74.6%	17.1%	8.4%		
* Pearson χ2						

Table 42: Frequency of underweight in children (6-59 months), by strata and gender

Strata	n	Normal	Underweight	Severe underweight	χ2 *	P-Value
Dushanbe					4.34	0.114
Boys	233	92.7%	4.7%	2.6%		
Girls	193	91.7%	7.8%	0.5%		
Khatlon					0.244	0.885
Boys	218	89.9%	6.4%	3.7%		
Girls	212	89.2%	7.6%	3.3%		
Sughd					9.247	0.01
Boys	237	91.1%	6.3%	2.5%		
Girls	220	97.3%	2.7%	0.0%		
DRD					1.167	0.558
Boys	225	92.0%	6.2%	1.8%		
Girls	204	90.7%	8.3%	1.0%		
GBAO					0.426	0.808
Boys	216	92.1%	5.6%	2.3%		
Girls	209	90.9%	5.7%	3.4%		
National					2.451	0.294
Boys	1129	91.6%	5.9%	2.6%		
Girls	1038	92.0%	6.4%	1.6%		
* Pearson χ2						

Table 43: Frequency of low weight-for-height (wasting) in children (6-59 months), by strata and gender

Strata	n	Normal	Wasted	Severely wasted	χ2 *	P-Value
Dushanbe					2.411	0.3
Boys	225	95.6%	2.2%	2.2%		
Girls	192	96.4%	3.1%	0.5%		
Khatlon					0.161	0.923
Boys	214	95.3%	3.3%	1.4%		
Girls	211	94.8%	3.3%	1.9%		
Sughd					6.101	0.047
Boys	235	96.2%	1.4%	0.4%		
Girls	221	99.6%	0.4%	0.0%		
DRD					9.011	0.011
Boys	223	93.3%	2.2%	4.5%		
Girls	200	92.5%	6.5%	1.0%		
GBAO					4.207	0.122
Boys	215	96.3%	2.3%	1.4%		
Girls	205	95.6%	4.4%	0.0%		
National					7.775	0.021
Boys	1112	95.3%	2.7%	2.0%		
Girls	1029	95.8%	3.5%	0.7%		
* Pearson χ2						

7.7 Children nutritional status: anaemia

Table 44: Haemoglobin concentration (g/dL) in children (6-59 months) by strata

Strata	n	Mean (g/dL)	SD	Median (g/dL)
Dushanbe	423	11.6	1.4	11.8
Khatlon	430	11.7	1.2	11.8
Sughd	432	11.7	1.4	11.8
DRD	430	11.5	1.3	11.6
GBAO	421	11.3	1.7	11.3
National*	2165	11.6	1.3	NA
One-way ANOVA F=5.33; P<0.002; Bartlett's Test for equal variances: chi2= 53.395; df=4, P<0.001; Scheffe's Test p<0.05 for comparison of regions. Log transformation				

Table 45: Frequency of anaemia among children (6-59 months), by strata

Strata	n	Hb<7g/dL	Hb 7-9.9g/dL	Hb 10-10.9g/dL	Hb≥11g/dL	Hb<11g/dL
Dush	433	0.2%	11.3%	16.9%	71.6%	28.4%
Kath	433	0.2%	6.9%	17.8%	75.1%	24.9%
Sugd	459	0.9%	10.5%	17.9%	70.8%	29.2%
DRD	432	0.2%	10.7%	21.1%	68.1%	31.9%
GBAO	432	0.7%	19.7%	19.4%	60.2%	39.8%
National	2189	0.5%	11.8%	18.6%	69.2%	30.8%
National*	2175	0.5%	9.7%	18.6%	71.3%	28.8%
Pearson: Uncorrected chi2(12) = 24.0143; design-based F(8.20, 1434.70) = 1.9534 Pr = 0.047 Pearson*: Uncorrected chi2(12) = 23.65; design-based chi2 F(8.29, 1451.05) = 1.86; P = 0.059						

Table 46: Frequency of anaemia among children (6-59 months), by strata

Strata	n	Hb <10 g/dL	Hb 10-10.9g/dL	Hb≥11g/dL
Dushanbe	433	11.6%	16.9%	71.6%
Khatlon	433	7.2%	17.8%	75.1%
Sugd	459	11.3%	17.9%	70.8%
DRD	432	10.9%	21.1%	68.1%
GBAO	432	20.4%	19.4%	60.2%
National	2189	12.2%	18.6%	69.2%
National*	2175	10.1%	18.6%	71.3%

Table 47: Haemoglobin concentration (g/dL) in children (6-59 months) stratified, by urban/rural

Strata	n	Mean (g/dL)	SD	95% CI	P-Value (ttest)
National					0.749
urban	1443	11.6	1.4	(11.5, 11.6)	
rural	722	11.6	1.4	(11.5, 11.7)	

Table 48: Frequency of anaemia in children (6-59 months), by rural/urban

Strata	n	Hb<10g/dL	Hb 10-10.9g/dL	Hb≥11g/dL	Hb<11g/dL	χ2 *	P-Value
National						0.676	0.713
rural	1448	12.2%	19.2%	68.6%	31.4%		
urban	727	12.5%	17.7%	69.7%	30.2%		
* Pearson χ2							

Table 49: Haemoglobin concentration (g/dL) in children (6-59 months), by strata and gender

Strata	n	Mean (g/dL)	SD	95% CI	P-Value (ttest)
Dushanbe					0.197
Boys	232	11.5	1.4	(11.4, 11.7)	
Girls	192	11.7	1.4	(11.5, 11.9)	
Khatlon					0.384
Boys	218	11.7	1.2	(11.5, 11.8)	
Girls	213	11.8	1.2	(11.6, 11.9)	
Sughd					0.055
Boys	237	11.5	1.4	(11.3, 11.7)	
Girls	222	11.7	1.4	(11.6, 11.9)	
DRD					0.854
Boys	226	11.6	1.3	(11.4, 11.7)	
Girls	204	11.5	1.3	(11.3, 11.7)	
GBAO					0.002
Boys	215	11.0	1.7	(10.8, 11.2)	
Girls	206	11.5	1.7	(11.3, 11.8)	
National					0.001
Boys	1128	11.5	1.4	(11.4, 11.5)	
Girls	1037	11.7	1.4	(11.6, 11.7)	
* Pearson χ2					

Table 50: Frequency of anaemia in children (6-59 months), by strata and gender

Strata	n	Hb<7g/dL	Hb 7-9.9g/dL	Hb 10-10.9g/dL	Hb≥11g/dL	Hb<11g/dL	χ2 *	P-Value
Dushanbe							5.023	0.17
Boys	233	0.0%	14.2%	15.9%	70.0%			
Girls	195	0.5%	8.2%	18.5%	72.8%			
Khatlon							6.071	0.108
Boys	218	0.0%	9.6%	16.5%	73.9%			
Girls	213	0.5%	4.2%	19.3%	76.1%			
Sughd							1.922	0.589
Boys	237	1.3%	11.8%	17.3%	69.6%			
Girls	222	0.5%	9.0%	18.5%	72.1%			
DRD							1.44	0.696
Boys	226	0.0%	10.2%	22.1%	67.7%			
Girls	204	0.5%	11.3%	20.1%	68.1%			

Strata	n	Hb<7g/dL	Hb 7-9.9g/dL	Hb 10-10.9g/dL	Hb≥11g/dL	Hb<11g/dL	χ2 *	P-Value
GBAO							7.733	0.052
Boys	217	0.9%	24.0%	21.7%	53.5%			
Girls	210	0.5%	15.7%	17.6%	66.2%			
National							9.413	0.024
Boys	1131	0.4%	13.9%	18.7%	67.0%			
Girls	1044	0.5%	9.7%	18.8%	71.1%			
* Pearson χ2								

Table 51: Frequency of anaemia in children (6-59 months), by strata and gender

Strata	n	Hb<10g/dL	Hb 10-10.9g/dL	Hb≥11g/dL	χ2 *	P-Value
Dushanbe					3.231	0.199
Boys	233	14.2%	15.9%	70.0%		
Girls	195	8.7%	18.5%	72.8%		
Khatlon					4.174	0.124
Boys	218	9.6%	16.5%	73.9%		
Girls	213	4.7%	19.3%	76.1%		
Sughd					1.511	0.47
Boys	237	13.1%	17.3%	69.6%		
Girls	222	9.5%	18.5%	72.1%		
DRD					0.458	0.795
Boys	226	10.2%	22.1%	67.7%		
Girls	204	11.8%	20.1%	68.1%		
GBAO					0.77	0.021
Boys	217	24.9%	21.7%	53.5%		
Girls	210	16.2%	17.6%	66.2%		
National					8.959	0.011
Boys	1131	14.3%	18.7%	67.0%		
Girls	1044	10.2%	18.8%	71.1%		
* Pearson χ2						

Table 52: Frequency of anaemia in children (6-59 months), by strata and gender

Strata	n	Hb<11g/dL	Hb≥11g/dL	χ2 *	P-Value
Dushanbe				0.425	0.514
Boys	233	30.0%	70.0%		
Girls	195	27.2%	72.8%		

Strata	n	Hb<11g/dL	Hb≥11g/dL	χ2 *	P-Value
Khatlon				0.279	0.598
Boys	218	26.2%	73.9%		
Girls	213	23.9%	76.1%		
Sughd				0.333	0.564
Boys	237	30.4%	69.6%		
Girls	222	27.9%	72.1%		
DRD				0.009	0.923
Boys	226	32.3%	67.7%		
Girls	204	31.9%	68.1%		
GBAO				7.194	0.007
Boys	217	46.5%	53.5%		
Girls	210	33.8%	66.2%		
National				4.166	0.041
Boys	1131	33.0%	67.0%		
Girls	1044	28.9%	71.1%		
* Pearson χ2					

Table 53: Frequency of anaemia in children (6-59 months), by age group

Age category	Hb <11g/dL (n=660)	Hb ≥11g/dL (n=2135)
6-12 months	48.1%	51.9%
13-24 months	50.2%	49.8%
25-36 months	31.7%	68.3%
37-48 months	17.5%	82.5%
49-59 months	9.9%	90.1%

7.8 Children nutritional status: iron deficiency

Table 54: Frequency of low and normal values of ferritin among children (6-59 months) with CRP <5mg/L, by strata

Strata	n	< 12 ng/ml	≥ 12 ng/ml
Dushanbe	369	2.4%	97.6%
Khatlon	346	7.8%	92.2%
Sughd	402	12.2%	87.8%
DRD	349	13.5%	86.5%
GBAO	352	6.3%	93.7%

Strata	n	< 12 ng/ml	≥ 12 ng/ml
National	1,818	8.5%	91.5%
National*	1805	9.7%	90.3%
Pearson: Uncorrected chi2(4) = 84.7976; design-based F(2.50, 425.36) = 3.6351 Pr = 0.019			

Table 55: Ferritin concentration (µg/L) in children (6-59 months), by rural/urban

Strata	n	Mean (µg/l)	SD	95% CI	P-Value (ttest)
National					0.098
rural	1341	91.9	92.1	(86.9, 96.8)	
urban	717	99.5	110.7	(91.3, 107.6)	
* Pearson χ2					

Table 56: Frequency of low and normal values of ferritin in children (6-59 months), by rural/urban

Strata	n	Ferritin <12ng/ml	Ferritin ≥12ng/ml	χ2 *	P-Value
National				2.335	0.127
rural	1448	8.1%	91.9%		
urban	727	10.4%	90.9%		
* Pearson χ2					

Table 57: Frequency of low and normal values of ferritin in children (6-59 months), by strata and gender

Strata	n	Ferritin <12ng/ml	Ferritin ≥12ng/ml	χ2 *	P-Value
Dushanbe				4.922	0.027
Boys	233	4.7%	95.3%		
Girls	195	1.0%	99.0%		
Khatlon				0.062	0.804
Boys	218	7.8%	92.2%		
Girls	213	8.5%	91.6%		
Sughd				0.333	0.564
Boys	237	13.5%	86.5%		
Girls	222	11.7%	88.3%		
DRD				0.751	0.386
Boys	226	14.6%	11.8%		
Girls	204	11.8%	88.2%		

Strata	n	Ferritin <12ng/ml	Ferritin ≥12ng/ml	χ2 *	P-Value
GBAO				0.012	0.912
Boys	217	6.5%	93.6%		
Girls	210	6.2%	93.8%		
National				1.554	0.213
Boys	1131	9.5%	90.5%		
Girls	1044	8.0%	92.1%		
* Pearson χ2					

Table 58: sTfR concentration (µg/ml) among children (6-59 months), by strata

Strata	n	Mean µg/ml	SD µg/ml	Median µg/ml
Dushanbe	430	1.2	1.4	0.9
Khatlon	395	1.3	1.3	1
Sughd	432	1.5	1.3	1.2
DRD	429	2	1.6	1.7
GBAO	402	2	1.7	1.5
National*	2104	1.6	1.4	NA
One-way ANOVA F=52.19; P<0.001; Bartlett's Test for equal variances: chi2= 28.129; df=4, P<0.001; Scheffe's Test p<0.05 for comparison of regions. Log transformation				

Table 59: Frequency of normal and high values of sTfR among children (6-59 months), by strata

	n	% < 3.3 ug/l	% ≥ 3.3 ug/l
Dushanbe	431	94.7	5.3
Khatlon	396	94.2	5.8
Sughd	459	93	7
DRD	429	84.4	15.6
GBAO	402	84.8	15.2
National	2117	91.5	8.5
National*	2104	91.4	8.6
Pearson: Uncorrected chi2(4) = 43.8073; design-based F(2.92, 501.95) = 9.1290 Pr = 0.000 Pearson*: Uncorrected chi2(4) = 38.5514; design-based F(1.78, 311.47) = 3.6468 P = 0.0321			

Table 60: sTfR concentration (µg/ml) in children (6-59 months), stratified, by rural/urban

Strata	n	Mean (µ/ml)	SD	95% CI	P-Value (ttest)
National					< 0.001
rural	1384	1.7	1.5	(1.7, 1.8)	
urban	720	1.4	1.4	(1.3, 1.5)	

Table 61: Frequency of normal and high values of sTfR in children (6-59 months), by rural/urban

Strata	n	sTfR <3.3µg/ml	sTfR ≥3.3µg/ml	χ2 *	P-Value
National				12.854	< 0.001
rural	1448	85.5%	14.5%		
urban	727	90.9%	9.1%		
* Pearson χ2					

Table 62: sTfR concentration (µg/ml) in children (6-59 months) ,by strata and gender

Strata	n	Mean (µ/ml)	SD	95% CI	P-Value (ttest)
Dushanbe					0.043
Boys	232	1.3	1.6	(1.1, 1.5)	
Girls	194	1.1	1.0	(0.9, 1.2)	
Khatlon					0.922
Boys	201	1.3	1.1	(1.2, 1.5)	
Girls	194	1.3	1.5	(1.1, 1.5)	
Sughd					0.11
Boys	237	1.6	1.4	(1.4, 1.8)	
Girls	222	1.4	1.2	(1.3, 1.6)	
DRD					0.964
Boys	225	2.1	1.5	(1.9, 2.3)	
Girls	202	2.0	1.7	(1.8, 2.3)	
GBAO					0.158
Boys	203	2.1	1.9	(1.9, 2.4)	
Girls	194	1.9	1.4	(1.7, 2.1)	
National					0.031
Boys	1098	1.7	1.5	(1.6, 1.8)	
Girls	1006	1.5	1.4	(1.5, 1.6)	

Table 63: Frequency of normal and high values of sTfR in children (6-59 months), by strata and gender

Strata	n	sTfR <3.3µg/ml	sTfR ≥3.3µg/ml	χ2 *	P-Value
Dushanbe				4.334	0.037
Boys	233	92.3%	7.7%		
Girls	195	96.9%	3.1%		
Khatlon				0.267	0.606
Boys	218	87.2%	12.8%		
Girls	213	85.5%	14.6%		
Sughd				2.696	0.101
Boys	237	91.1%	8.9%		
Girls	222	95.1%	4.9%		
DRD				0.334	0.563
Boys	226	82.7%	17.3%		
Girls	204	84.8%	15.2%		
GBAO				0.003	0.954
Boys	217	78.8%	21.2%		
Girls	210	78.6%	21.4%		
National				1.196	0.274
Boys	1131	86.6%	13.4%		

7.9 Children nutritional status: urinary iodine levels

Table 64: Urinary iodine Excretion among children 6-59 months, by strata

Strata	n	Median (µg/L)	20th Percentile	80th Percentile	
Dushanbe	428	107.7	73.9	164.5	
Khatlon	422	71.9	53.0	113.4	
Sughd	427	176.8	103.0	217.8	
DRD	431	72.9	50.9	116.3	
GBAO	429	93.3	67.0	149.0	
		mean (µg/L)	SD	95% CI	
National*	2153	116.46	63.91	110.81	122.11

Table 65: Distribution of urinary iodine values in children (6-59 months), by strata

Region	n	% <20µg/L	% 20-49µg/L	% 50-99µg/L	% 100-199µg/L	% 200-299µg/L	% ≥300µg/L
Dushanbe	428	0.0%	3.5%	38.3%	44.4%	11.9%	1.9%
Khatlon	422	1.2%	13.0%	59.0%	20.6%	5.7%	0.5%
Sughd	427	0.0%	0.9%	18.0%	50.4%	30.7%	0.0%
DRD	431	0.9%	17.2%	55.2%	22.3%	4.2%	0.2%
GBAO	429	0.0%	4.7%	52.7%	32.6%	10.0%	0.0%
National*	2175	0.6%	8.9%	43.4%	32.9%	13.8%	0.4%

Table 66: Urinary iodine concentration (µg/L) in children (6-59 months), by rural/urban

Strata	n	Mean (µg/L)	SD	95% CI	P-Value (ttest)
National					< 0.001
rural	1432	112.3	61.2	(109.1, 115.4)	
urban	721	123.8	64.0	(119.1, 128.5)	

Table 67: Frequency of normal, mild and moderate/severe urinary iodine levels in children (6-59 months), by rural/urban

Strata	n	< 50 µg/L	50-99 µg/L	≥ 100 µg/L	χ2 *	P-Value
National					22.959	< 0.001
rural	1448	9.5%	45.6%	44.9%		
urban	727	5.2%	40.3%	54.5%		

Table 68: Urinary iodine concentration (µg/L) in children (6-59 months), by strata and gender

Strata	n	Mean (µg/L)	SD	95% CI	P-Value (ttest)
Dushanbe					0.282
Boys	232	122.7	62.5	(114.7, 130.8)	
Girls	192	129.6	67.8	(119.9, 139.2)	
Khatlon					0.751
Boys	209	90.8	54.8	(83.3, 98.2)	
Girls	213	89.1	50.9	(82.2, 96.0)	
Sughd					0.528
Boys	234	163.7	55.1	(156.6, 170.8)	
Girls	220	166.9	54.8	(159.6, 174.2)	
DRD					0.177
Boys	226	84.3	46.6	(78.2, 90.4)	
Girls	203	90.9	54.3	(83.4, 98.4)	

Strata	n	Mean (µg/L)	SD	95% CI	P-Value (ttest)
GBAO					0.714
Boys	215	109.9	53.3	(102.7, 117.0)	
Girls	209	108.0	51.6	(101.0, 115.0)	
National					0.414
Boys	1116	115.1	61.7	(111.4, 118.7)	
Girls	1037	117.3	63.2	(113.4, 121.1)	

Table 69: Frequency of urinary iodine levels in children (6-59 months), by strata and gender

Strata	n	<20µg/L	20-49µg/L	50-99µg/L	100-199µg/L	200-299µg/L	≥300µg/L	χ2 *	P-Value
Dushanbe								6.874	0.143
Boys	233	0.0%	3.4%	36.1%	49.4%	9.0%	2.2%		
Girls	195	0.0%	3.1%	40.5%	38.5%	14.4%	3.6%		
Khatlon								9.229	0.1
Boys	218	1.4%	12.8%	57.3%	17.0%	7.3%	4.1%		
Girls	213	0.9%	12.7%	58.2%	23.5%	3.8%	0.9%		
Sughd								1.608	0.807
Boys	237	0.0%	0.4%	17.7%	50.6%	30.0%	1.3%		
Girls	222	0.0%	1.4%	16.2%	49.6%	32.0%	0.9%		
DRD								5.243	0.387
Boys	226	0.4	17.7	58.0%	19.9%	4.0%	0.0%		
Girls	204	1.5%	16.2%	52.5%	24.5%	4.4%	1.0%		
GBAO								1.198	0.879
Boys	217	0.0%	4.2%	51.2%	33.2%	10.6%	0.9%		
Girls	210	0.0%	5.2%	54.3%	31.0%	9.1%	0.5%		
National								0.899	0.97
Boys	1131	0.4%	7.6%	43.6%	34.4%	12.4%	1.7%		
Girls	1044	0.5%	7.7%	44.1%	33.5%	12.9%	1.3%		
* Pearson χ2									

Table 70: Frequency of normal, mild and moderate/severe urinary iodine levels in children (6-59 months), by strata and gender

Strata	n	< 50 µg/L	50-99 µg/L	≥ 100 µg/L	χ2 *	P-Value
Dushanbe					0.901	0.637
Boys	233	3.4%	36.1%	60.5%		
Girls	195	3.1%	40.5%	56.4%		
Khatlon					0.046	0.978
Boys	218	14.2%	57.3%	28.4%		
Girls	213	13.6%	58.2%	28.2%		
Sughd					1.294	0.524
Boys	237	0.4%	17.7%	81.9%		
Girls	222	1.4%	16.2%	82.4%		
DRD					2.051	0.359
Boys	226	18.1	58.0%	23.9%		
Girls	204	17.7%	52.5%	29.9%		
GBAO					0.917	0.632
Boys	217	4.2%	51.2%	44.7%		
Girls	210	5.2%	54.3%	40.5%		
National					0.099	0.952
Boys	1131	8.0%	43.6%	48.5%		
Girls	1044	8.1%	44.1%	47.8%		
* Pearson χ2						

7.10 Children nutritional status: Vitamin D status

Table 71: Vitamin D concentration among infants (6-24 months), by strata

	n	Mean (nmol/L)	SD (nmol/L)	CI (nmol/L)	
Dushanbe	129	44.1	25.3	39.7	48.5
Khatlon	113	54.9	25.7	50.1	59.6
Sughd	205	64.7	29.9	60.6	68.9
DRD	114	44.5	26.3	39.5	49.4
GBAO	69	41.6	29.9	34.5	48.8
National*	625	56.1	28.8	51.9	60.2
One-way ANOVA F=18.46 p<0.001, Bartlett's test for equal variances: chi2(4) = 2.19 Prob>chi2 = 0.701; log transformation					

Table 72: Vitamin D distribution among infants (6-24 months), by strata

	n	% <25 nmol/L	% 25-49 nmol/L	% 50-74 nmol/L	% ≥75 nmol/L
Dushanbe	129	27.1	31.8	32.6	8.5
Khatlon	113	11.5	29.2	39.8	19.5
Sughd	205	9.3	16.6	42.0	32.2
DRD	109	21.1	38.5	26.6	13.8
GBAO	69	23.2	43.5	26.1	7.3
National*	625	13.6	26.1	37.6	22.7

Table 73: Vitamin D concentration (nmol/L) in infants (6-24 months), by rural/urban

Strata	n	Mean (nmol/L)	SD	95% CI	P-Value (ttest)
National					0.001
rural	408	55.4	30.6	(52.4, 58.4)	
urban	217	47.4	25.2	(44.0, 50.8)	

Table 74: Vitamin D concentration (nmol/L) in children (6-59 months), by gender

Strata	n	Mean (nmol/L)	SD	95% CI	P-Value (ttest)
Dushanbe					0.399
Boys	72	45.8	25.7	(39.8, 51.9)	
Girls	57	42.0	24.8	(35.4, 48.6)	
Khatlon					0.84
Boys	56	55.4	25.6	(48.5, 62.2)	
Girls	57	54.4	25.9	(47.5, 61.2)	
Sughd					0.001
Boys	107	71.5	30.2	(65.7, 77.2)	
Girls	98	57.4	27.8	(51.8, 63.0)	
DRD					0.398
Boys	52	46.7	23.6	(40.1, 53.5)	
Girls	57	42.5	28.5	(34.8, 50.0)	
GBAO					0.372
Boys	39	38.8	28.6	(29.5, 48.1)	
Girls	30	45.3	31.7	(33.5, 57.2)	
National					0.022
Boys	326	55.2	29.8	(51.9, 58.4)	
Girls	299	49.8	28.1	(46.6, 53.0)	

7.11 Children nutritional status: food consumption

Table 75: Eating habits of children (6-59 months) (recall period: 24 hours)

Food category	n	%
Wheat, bread, rice, pasta, biscuit	2173	96.7
Potatoes or other roots or tubers	2173	92.8
Other vegetables and fruits	2172	87.4
Fats and oil	2172	83.7
Yellow or orange colored vegetables or fruits	2173	77.0
Milk or milk products	2172	72.2
Meat, liver, kidney, chicken, fish	2173	61.4
Beans, peas, lentils, nuts	2172	42.6
Eggs	2172	36.9
Plain water	2172	96.1
Tea (black or green)	2173	94.0
Sugary water or fruit juices	2171	77.9
Infant formula	2171	13.4
Vitamins, mineral supplements and/or any medicine	2163	5.2

Table 76: Nutritional consumption of children (6-59 months) and comparison with nutritional indicators

ANAEMIA	n	Answer	Hb <10g/dL	Hb 10–10.9 g/dL	Hb ≥11g/ dL	Pearson uncorrected χ2	P-Value
Type of food grown for own consumption							
Wheat, rice	2165	no	11.5	19.1	69.4	7.077	0.101
		yes	8.4	17.9	73.7		
Beans, peas, lentils, nuts	2165	no	11.3	20.0	68.8	16.652	0.002
		yes	7.4	15.3	77.3		
Potatoes, roots, tubers	2165	no	9.8	18.8	71.4	0.279	0.902
		yes	10.5	18.4	71.1		
Yellow or orange colored vegetables or fruits	2165	no	9.9	17.3	72.8	1.994	0.488
		yes	10.4	19.5	70.1		
Other vegetables or fruits	2163	no	10.3	16.1	73.6	3.534	0.268
		yes	10.1	19.5	70.4		
At least one animal (cows, sheep, poultry horse)	2165	no	11.9	16.0	72.1	5.565	0.185
		yes	9.5	19.6	71.0		

ANAEMIA	n	Answer	Hb <10g/dL	Hb 10–10.9 g/dL	Hb ≥11g/ dL	Pearson uncorrected χ2	P-Value
Drink more, less or the same if diarrhea	2136						
Much less or none		-	12.8	28.3	58.9	35.453	0.004
About the same		-	10.6	16.9	72.5		
More		-	9.2	16.4	74.4		

Eating habits of children (recall period: 24 hours)							
Wheat, bread, rice, pasta, biscuit	2164	no	12.4	24.7	62.9	2.574	0.346
		yes	10.1	18.4	71.6		
Potatoes or other roots or tubers	2164	no	12.3	24.8	62.9	5.910	0.087
		yes	10.0	18.1	71.9		
Beans, peas, lentils, nuts	2163	no	11.4	22.2	66.4	34.552	0.001
		yes	8.5	13.7	77.8		
Milk or milk products	2164	no	10.1	19.4	70.5	2.314	0.534
		yes	10.2	16.6	73.3		
Meat, liver, kidney, chicken, fish	2164	no	12.9	21.2	68.9	20.608	0.012
		yes	8.4	17.0	74.6		
Eggs	2163	no	11.3	20.1	68.7	12.526	0.014
		yes	8.2	16.1	74.7		
Yellow or orange colored vegetables or fruits	2164	no	11.5	22.5	66.1	8.817	0.084
		yes	9.7	17.4	72.8		
Other vegetables and fruits	2163	no	11.0	23.0	66.0	4.673	0.274
		yes	9.9	18.0	72.1		
Fats and oil	2163	no	14.2	24.8	61.1	21.783	0.001
		yes	9.3	17.4	73.3		
Tea (black or green)	2164	no	17.2	21.6	61.2	9.538	0.037
		yes	9.7	18.4	71.9		
Plain water	2163	no	9.9	13.4	76.7	1.615	0.456
		yes	10.2	18.8	71.1		
Sugary water or fruit juices	2162	no	12.3	23.6	64.1	15.204	0.006
		yes	9.6	17.2	73.3		
Infant formula	2162	no	10.0	18.7	71.3	0.384	0.866
		yes	11.2	18.2	70.7		
Vitamins, mineral supplements and/or any medicine	2164	no	9.8	18.4	71.9	7.850	0.072
		yes	17.3	21.0	61.7		

Table 77: Nutritional consumption for children (6-59 months), by rural/urban

	n	Rural	Urban	Pearson uncorrected χ2 *	P-Value
Drink more, less or the same if diarrhea					
Much less or none	2145	14.1	17.6	20.534	0.000
About the same		27.0	33.9		
More		58.9	48.6		
Nutritional consumption of children (recall period: 24 hrs) (%)					
Wheat, bread, rice, pasta, biscuit	2173	96.6	94.6	4.564	0.033
Potatoes or other roots or tubers	2173	92.7	90.6	2.780	0.095
Beans, peas, lentils, nuts	2172	40.7	32.5	13.849	0.000
Milk or milk products	2172	76.5	75.0	0.571	0.450
Meat, liver, kidney, chicken, fish	2173	59.5	67.3	12.428	0.000
Eggs	2172	33.2	41.4	14.156	0.000
Yellow or orange colored vegetables or fruits	2173	80.9	74.6	11.558	0.001
Other vegetables and fruits	2172	87.7	86.3	0.796	0.372
Fats and oil	2172	84.0	82.3	0.919	0.338
Tea (black or green)	2173	94.9	88.0	33.426	0.000
Plain water	2172	92.2	89.8	3.529	0.060
Sugary water or fruit juices	2171	70.8	59.6	27.213	0.000
Infant formula	2171	11.3	13.5	2.154	0.142
Vitamins, mineral suppl. and/or any medicine	2163	3.8	10.2	35.327	0.000

Table 78: Epidemiological criteria for assessing iodine nutrition based on median urinary iodine concentrations (for adults)

median UI (µg/L)	iodine intake	iodine status
<20	insufficient	severe iodine deficiency
20-49	insufficient	moderate iodine deficiency
50-99	insufficient	mild iodine deficiency
100-199	adequate	adequate iodine nutrition
200-299	above requirements	likely to provide adequate intake for pregnant/lactating women, but may pose a slight risk of more than adequate intake in the overall population
>300	excessive	risk of adverse health consequences

Appendix 8. Socio-economic information

Table 81: Type of dwelling

	n	Communal flat	House
Dushanbe	328	73.5%	26.5%
Khatlon	257	7.4%	92.6%
Sughd	258	11.2%	88.8%
DRD	242	2.1%	97.9%
GBAO	330	7.9%	92.1%
National*	1415	15.6%	84.3%
rural	904	1.8	98.2
urban	511	59.5	40.5

Table 82: Families per household

	n	1 family per household	2 families per household	3 families per household
Dushanbe	328	62.8%	22.3%	14.9%
Khatlon	257	32.3%	22.2%	45.5%
Sughd	260	21.5%	30.0%	48.5%
DRD	242	20.7%	29.8%	49.6%
GBAO	330	44.9%	38.5%	16.7%
National*	1417	30.8%	26.6%	42.6%
rural	906	30.8%	30.2%	39.0%
urban	511	51.7%	26.0%	22.3%

Table 83: Persons per household

	n	1 person per household	2 persons per household	3 persons per household	4 persons per household
Dushanbe	328	18.9%	64.6%	15.6%	0.9%
Khatlon	257	6.6%	41.6%	43.6%	8.2%
Sughd	260	5.0%	50.0%	41.9%	3.1%
DRD	242	2.9%	42.6%	46.7%	7.9%
GBAO	330	10.0%	67.9%	21.5%	0.6%
National*	1417	6.9%	48.0%	39.5%	5.5%
rural	906	5.5%	51.3%	38.3%	4.9%
urban	511	16.1%	60.9%	21.3%	1.8%

Table 84: Ethnic group

	n	Tajik	Uzbek	Russian	Kyrgyz	Other
Dushanbe	328	89.9%	7.9%	0.6%	0.0%	1.5%
Khatlon	257	71.2%	28.0%	0.4%	0.4%	0.0%
Sughd	260	70.8%	29.2%	0.0%	0.0%	0.0%
DRD	242	78.1%	15.7%	0.0%	6.2%	0.0%
GBAO	330	99.7%	0.0%	0.0%	0.3%	0.0%
National*	1417	75.9%	22.2%	0.2%	1.5%	0.2%
rural	906	79.8%	18.3%	0.0%	1.9%	0.0%
urban	511	89.4%	9.0%	0.6%	0.0%	1.0%

Table 85: Gender

	n	Male	Female
Dushanbe	328	79.0%	21.0%
Khatlon	257	87.2%	12.8%
Sughd	259	84.9%	15.1%
DRD	242	83.9%	16.1%
GBAO	325	90.2%	9.8%
National*	1411	85.0%	15.0%
rural	901	87.4%	12.6%
urban	510	80.8%	19.2%

Table 86: Level of education of household head (4 categories)

	n	None, primary (1-4), basic (1-9)	Secondary (9-11)	Secondary special / technical	Higher education
Dushanbe		11.3%	21.3%	20.1%	47.3%
Khatlon		18.3%	33.9%	22.6%	25.3%
Sughd		9.2%	48.5%	20.0%	22.3%
DRD		20.3%	36.8%	28.9%	14.0%
GBAO		2.4%	47.0%	23.3%	27.3%
National*	1394	14.6%	37.6%	22.9%	24.9%
rural		11.7%	43.4%	22.4%	22.5%
urban		11.6%	26.2%	23.5%	38.8%

Table 87: Level of education of household head (full)

	n	None	Primary (1-4)	Basic (1-9)	Secondary (9-11)	Secondary special	Secondary technical	Higher education
Dushanbe	325	1.2%	4.0%	6.2%	21.5%	10.2%	10.2%	46.8%
Khatlon	241	4.6%	5.4%	9.5%	36.1%	14.1%	10.0%	20.3%
Sughd	259	0.8%	2.3%	6.2%	48.7%	12.0%	8.1%	22.0%
DRD	241	2.9%	4.2%	13.3%	36.9%	20.3%	8.7%	13.7%
GBAO	328	1.2%	0.6%	0.6%	47.3%	10.1%	13.4%	26.8%
National*	1394	2.6%	3.8%	8.6%	38.5%	14.2%	9.4%	23.0%
rural	888	2.1%	3.5%	6.3%	44.3%	13.6%	9.2%	21.0%
urban	506	1.8%	2.6%	7.3%	26.5%	11.7%	12.1%	38.1%

Table 88: Women's level of education

	n	None	Primary (1-4)	Basic (1-9)	Secondary (9-11)	Secondary special	Secondary technical	Higher education
Dushanbe	430	2.1%	8.8%	26.5%	37.9%	7	1.6%	15.6%
Khatlon	431	3.0%	9.1%	37.8%	44.8%	3	0.9%	1.6%
Sughd	431	0.5%	1.9%	23.0%	55.2%	10	4.6%	5.3%
DRD	432	1.0%	2.8%	6.3%	44.2%	37	6.0%	0.9%
GBAO	1	1.0%	0.2%	2.8%	69.2%	10	3.6%	13.3%
National*	2139	2.0%	5.9%	33.0%	46.0%	6	2.2%	4.6%
rural	1416	1.9%	3..9%	27.8%	53.8%	6	2.3%	4.0%
urban	723	2.2%	7.9%	25.3%	39.0%	8	2.5%	14.7%

Table 89: Income

	n	Private business	Salary	Pension / social aid	Farming / livestock	Re-mittances	No cash income
Dushanbe	328	34.2%	38.7%	4.6%	0.3%	20.1%	2.1%
Khatlon	257	8.2%	14.0%	1.2%	45.1%	27.6%	3.9%
Sughd	260	23.9%	17.9%	0.4%	21.2%	33.9%	3.1%
DRD	242	10.3%	16.1%	2.1%	31.8%	39.3%	0.4%
GBAO	330	10.3%	33.3%	4.2%	21.5%	30.3%	0.3%
National*	1417	16.2%	19.2%	1.6%	29.2%	21.2%	2.6%
rural	906	10.9%	18.0%	2.0%	33.7%	33.7%	1.8%
urban	511	30.3%	38.2%	3.9%	2.9%	22.5%	2.2%

Table 90: Food crops grown for own consumption

	n	Cereal	Pulses	Potatoes roots,tubers	Yellow/orange veg & fruits	Other veg
Dushanbe	328	0.9%	2.4%	4.0%	5.8%	6.7%
Khatlon	257	63.4%	37.7%	55.3%	60.3%	68.9%
Sughd	260	29.6%	17.3%	33.1%	53.5%	79.2%
DRD	242	41.3%	36.4%	52.9%	62.0%	80.0%
GBAO	330	46.7%	20.9%	79.7%	80.9%	81.0%
National*	1417	40.8%	26.7%	43.2%	52.8%	66.9%
rural	906	53.1%	31.5%	64.7%	73.0%	81.4%
urban	511	3.1%	4.3%	9.0%	13.5%	19.2%

Table 91: Animals kept for meat and milk production for own consumption

	n	Cows	Sheep	Goats	Poultry	Horses
Dushanbe	328	4.0%	0.9%	0.9%	2.1%	0.3%
Khatlon	257	69.7%	25.7%	24.5%	48.3%	4.3%
Sughd	260	55.0%	29.7%	11.5%	26.9%	1.2%
DRD	242	72.3%	28.1%	31.4%	39.7%	9.1%
GBAO	330	74.6%	67.3%	68.8%	48.8%	2.4%
National*	1417	58.1%	25.9%	21.1%	34.9%	3.9%
rural	906	76.6%	45.1%	41.5%	47.4%	4.6%
urban	511	12.1%	5.3%	4.5%	5.7%	0.6%

Appendix 9. Salt iodization

Table 92: Iodization of cooking salt from households

	n	Not iodized (0 PPM)	Poorly Iodized (< 15 PPM)	Sufficiently iodized (≥ 15 PPM)
Dushanbe	325	9.9%	18.1%	72.0%
Khatlon	254	22.8%	22.8%	54.3%
Sughd	259	2.7%	3.5%	93.8%
DRD	242	35.1%	37.6%	27.3%
GBAO	329	3.3%	54.4%	42.3%
National*	1409	17.4%	20.8%	61.9%
rural	903	15.8%	32.7%	51.5%
urban	506	9.9%	20.0%	70.2%

Table 93: Importance of using iodized salt

	n	Prevents from goitre	Enables fetus to develop normally	Mental development
Dushanbe	328	83.5%	4.6%	12.3%
Khatlon	257	70.0%	0.4%	2.3%
Sughd	259	85.7%	1.5%	1.5%
DRD	241	78.0%	1.7%	3.7%
GBAO	330	87.9%	4.9%	20.6%
National*	1415	78.7%	1.7%	4.2%
rural	905	80.2%	2.3%	8.5%
urban	510	83.9%	3.7%	9.4%

Table 94: Ever heard about goitre and iodine deficiency disorders (IDD)

	n	Pregnant	n	Heard about Goitre/IDD
Dushanbe	426	4.2%	394	54.3%
Khatlon	431	0.7%	404	42.8%
Sughd	430	0.5%	416	35.3%
DRD	432	0.5%	400	37.3%
GBAO	422	5.7%	388	16.5%
National*	2134	1.0%	1995	39.8%
rural	1415	2.0%	1328	32.3%
urban	719	2.9%	667	47.1%

Table 95: Storing of salt

	n	Closed container (e.g. can)	Open container	Sac or other material container
Dushanbe	328	88.4%	7.9%	3.7%
Khatlon	257	75.1%	5.5%	19.5%
Sughd	260	95.0%	2.3%	2.7%
DRD	242	75.6%	8.7%	15.7%
GBAO	330	93.9%	2.1%	3.9%
National*	1417	83.4%	5.4%	11.2%
rural	906	84.8%	4.2%	11.0%
urban	511	89.0%	7.1%	3.9%

Appendix 10: Infant and child health, care and development

Table 96: Birth certificate of child

	n	Yes
Dushanbe	431	73.8%
Khatlon	432	73.6%
Sughd	459	95.0%
DRD	432	70.1%
GBAO	427	89.7%
National*	2174	79.9%
rural	1448	81.9%
urban	726	78.2%

Table 97: Incidence of diarrhea (recall period: 4 weeks)

	n	Yes
Dushanbe	427	36.3%
Khatlon	431	44.3%
Sughd	457	31.5%
DRD	432	33.3%
GBAO	426	45.1%
National*	2166	37.2%
rural	1445	39.5%
urban	721	35.0%

Table 98: Drinks/liquids given to child when it has diarrhea

	n	Breast milk	Soup	Tea	ORS packet solution	Other milk or infant formula	Water	Anti-biotics
Dushanbe	430	44.7%	72.0%	77.7%	65.9%	34.5%	87.5%	74.1%
Khatlon	432	65.3%	93.7%	94.9%	68.8%	36.3%	95.4%	82.6%
Sughd	459	74.1%	95.0%	93.9%	78.7%	27.5%	97.6%	72.6%
DRD	431	63.3%	87.7%	92.8%	69.2%	22.2%	97.9%	83.8%
GBAO	427	51.3%	71.9%	80.6%	94.6%	35.8%	76.1%	75.1%
National*	2172	65.1%	90.2%	91.9%	72.6%	30.1%	95.3%	78.8%
rural	1448	64.2%	87.5%	91.4%	78.3%	31.1%	91.1%	78.3%
urban	724	51.7%	78.0%	81.5%	69.8%	31.4%	90.9%	76.1%

Table 99: Question 'When your child has diarrhea does he/she drink much less, about the same, or more than usual?

	n	Much less or none	About the same	More
Dushanbe	415	23.9%	35.4%	40.7%
Khatlon	429	24.7%	21.0%	54.3%
Sughd	456	14.5%	29.6%	55.9%
DRD	428	6.8%	33.6%	59.6%
GBAO	423	6.4%	27.0%	66.7%
National*	2145	16.9%	27.8%	55.2%
rural	1439	14.1%	27.0%	58.9%
urban	706	17.6%	33.9%	48.6%

Table 100: Health problems of child

	n	Vision problems at night	Goitre	Iron syrup received (past 6 months)	Vitamin A capsule received (past 6 months)	Deworming (past 6 months)
Dushanbe	411	5.4%	6.2%	16.0%	69.7%	42.7%
Khatlon	417	1.7%	0.6%	5.1%	80.5%	44.9%
Sughd	458	1.5%	0.2%	13.9%	91.1%	46.9%
DRD	404	0.7%	0.6%	27.6%	90.5%	49.4%
GBAO	412	3.2%	2.7%	36.6%	93.6%	62.1%
National*	2096	1.8%	1.0%	14.7%	85.1%	46.4%
rural	1405	1.8%	1.1%	22.5%	89.5%	51.9%
urban	691	3.9%	3.5%	14.2%	76.7%	43.5%

Table 101: Children in households with disabilities

	n	Blindness	Deafness	Motor disability	Mental disability
Dushanbe	328	0.3%	0.3%	0.9%	1.2%
Khatlon	257	0.8%	0.8%	1.2%	1.2%
Sughd	260	0.0%	0.4%	0.0%	1.2%
DRD	242	0.4%	0.0%	0.8%	2.5%
GBAO	330	0.9%	0.6%	0.6%	0.9%
National*	1417	0.4%	0.4%	0.7%	1.5%
rural	906	0.6%	0.6%	0.8%	1.5%
urban	511	0.4%	0.2%	0.6%	1.0%

Table 102: Number of times the child received solid, semi-solid or soft foods (24 hour recall period)

	n	0–2	3–5	6–10	11 and more
Dushanbe	433	10.9%	54.7%	25.4%	9.0%
Khatlon	433	0.5%	30.3%	49.2%	20.1%
Sughd	459	0.4%	24.2%	48.8%	26.6%
DRD	432	1.6%	11.1%	75.9%	11.3%
GBAO	432	2.8%	59.7%	28.5%	9.0%
National*	2175	1.7%	27.3%	52.2%	18.9%
rural	1448	1.5%	31.7%	51.2%	15.7%
urban	727	6.3%	44.7%	34.9%	14.0%

Table 103: Advice/questions from health workers on following topics

	n	Asking about Breastfeeding	Asking about foods given to child / how feeding the child	Asking about child's ability (talking, walking, understanding,…)	Giving advice on how to help the child to learn more	Giving advice on child discipline, care and sleep	Giving other advices
Dushanbe	144	74.3%	76.4%	59.7%	58.3%	63.9%	19.4%
Khatlon	142	83.1%	86.6%	69.0%	53.5%	55.3%	19.7%
Sughd	211	94.8%	97.6%	93.4%	91.5%	69.2%	12.3%
DRD	160	88.1%	85.6%	65.6%	61.3%	66.3%	14.4%
GBAO	157	89.2%	85.4%	70.7%	51.6%	54.1%	20.1%
National*	811	88.2%	89.6%	76.7%	69.6%	63.6%	16.3%
rural	555	89.6%	89.4%	75.5%	65.6%	62.5%	14.1%
urban	256	80.5%	82.4%	68.8%	64.5%	62.1%	22.0%

Table 104: Weighing the child

	n	Weighing the child in past 3 months for weight (yes answers)	n	Weighing once during past 3 months	Weighing twice during past 3 months	Weighing 3 times or more during past 3 months
Dushanbe	148	41.9%	62	53.2%	19.0%	17.7%
Khatlon	142	37.3%	52	88.5%	9.6%	1.9%
Sughd	213	63.9%	136	43.4%	13.2%	43.4%
DRD	160	39.4%	63	61.9%	22.2%	15.9%
GBAO	156	85.9%	134	4.0%	15.7%	44.0%
National*	816	49.3%	446	57.5%	15.3%	27.2%
rural	557	58.5%	325	51.4%	15.7%	32.9%
urban	259	46.7%	121	52.9%	19.8%	27.3%

Table 105: Measuring the child

	n	Measuring the child in past 3 months for weight (yes answers)	n	Measuring once during past 3 months	Measuring twice during past 3 months	Measuring 3 times or more during past 3 months
Dushanbe	148	39.2%	58	44.8%	32.8%	22.4%
Khatlon	142	33.8%	48	85.4%	12.5%	2.1%
Sughd	213	61.5%	131	44.3%	13.7%	42.0%
DRD	160	36.9%	59	64.4%	18.6%	17.0%
GBAO	156	78.2%	122	41.8%	15.6%	42.6%
National*	816	46.3%	416	57.0%	15.9%	27.1%
rural	557	54.2%	302	52.7%	15.6%	31.8%
urban	259	44.0%	114	48.3%	21.9%	29.8%

Appendix 11. Breastfeeding and infant feeding

Table 106: Pregnancy

	n	Pregnant
Dushanbe	426	4.2%
Khatlon	431	0.7%
Sughd	430	0.5%
DRD	432	0.5%
GBAO	422	5.7%
National*	2134	1.0%
rural	1415	2.0%
urban	719	2.9%

Table 107: Number of months the mother stopped breastfeeding at all

	n	0-3 months	4-6 months	7-12 months	12-24 months
Dushanbe	47	31.9%	14.9%	21.3%	31.9%
Khatlon	52	17.3%	13.5%	40.4%	28.9%
Sughd	46	19.6%	8.7%	37.0%	34.8%
DRD	48	8.3%	12.5%	45.8%	33.3%
GBAO	46	15.2%	21.7%	34.8%	28.3%
National*	238	17.5%	12.3%	38.6%	31.7%
rural	156	12.8%	15.4%	41.7%	30.1%
urban	82	28.1%	12.2%	25.6%	34.2%

Table 108: Number of times the child has been breastfed (recall period: 24 hours)

	n	0 times	1-6 times	7-12 times	13-24 times
Dushanbe	132	25.0%	28.0%	40.1%	6.8%
Khatlon	138	37.0%	18.8%	38.4%	5.8%
Sughd	203	21.7%	21.7%	39.4%	17.2%
DRD	139	21.6%	27.3%	46.8%	4.3%
GBAO	155	26.5%	36.1%	27.1%	10.3%
National*	764	26.9%	22.6%	40.3%	10.2%
rural	523	25.6%	27.7%	37.9%	8.8%
urban	241	26.6%	22.8%	39.0%	11.6%

Table 109: Time after birth the child was put under breast for first time

	n	Within first 30 minutes from delivery	Within first 6 hours from delivery	More than 6 hours after delivery
Dushanbe	141	45.7%	24.8%	18.4%
Khatlon	140	52.1%	37.1%	10.7%
Sughd	149	72.3%	18.9%	8.7%
DRD	154	37.7%	42.9%	19.5%
GBAO	156	58.3%	28.9%	12.8%
National*	794	57.1%	30.3%	12.6%
rural	543	54.9%	32.8%	12.3%
urban	251	59.8%	23.5%	16.7%

Table 110: Age of infant in months when complementary feeding was started

	n	Within first 3 months	Within month 4 and 6	Within month 7 and 12	After 12 months
Dushanbe	139	24.5%	41.0%	31.7%	2.9%
Khatlon	140	11.4%	47.1%	35.0%	6.4%
Sughd	212	10.4%	62.7%	25.5%	1.4%
DRD	159	10.7%	32.1%	55.4%	1.9%
GBAO	157	11.5%	27.4%	60.5%	0.6%
National*	806	11.9%	48.5%	36.3%	3.2%
rural	554	10.7%	43.9%	43.7%	1.8%
urban	252	18.7%	42.5%	34.9%	4.0%

Table 111: Age of infant in months when complementary feeding was started

	n	Within first 3 months	Within month 4 and 6	Within month 7 and 12	After 12 months	n	Receiving complementary feeding from bottle with nipple
Dushanbe	139	24.5%	41.0%	31.7%	2.9%	147	55.1%
Khatlon	140	11.4%	47.1%	35.0%	6.4%	142	42.3%
Sughd	212	10.4%	62.7%	25.5%	1.4%	213	47.9%
DRD	159	10.7%	32.1%	55.4%	1.9%	160	50.6%
GBAO	157	11.5%	27.4%	60.5%	0.6%	157	58.6%
National*	806	11.9%	48.5%	36.3%	3.2%	816	47.5%
rural	554	10.7%	43.9%	43.7%	1.8%	557	51.9%
urban	252	18.7%	42.5%	34.9%	4.0%	259	48.3%

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