GOVERNMENT OF MONGOLIA
MINISTRY OF HEALTH

NATIONAL CENTER FOR PUBLIC HEALTH

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KEY NUTRITION CONCERNS IN THE POPULATION OF MONGOLIA

FIFTH NATIONAL NUTRITION SURVEY REPORT

Ulaanbaatar, Mongolia
2017

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ABBREVIATIONS AND ACRONYMS

ANC	Antenatal care
BMI	Body mass index
HFIAS	Household food insecurity access scale
IDA	Iron deficiency anaemia
IDD	Iodine deficiency disorders
IFA	Iron and folic acid supplement
IYCF	Infant and young child feeding
MCH	Mother and child health handbook
MDD	Minimum dietary diversity
MMN	Multiple micronutrients
MMP	Multiple micronutrient powder
MOH	Ministry of Health
MUIC	Median urinary iodine concentration
NCPH	National Center for Public Health
ND	Nutrition Department
NNS	National Nutrition Survey
PE	Physical education
PW	Pregnant women
RBP	Retinol binding protein
SC	School children
UNICEF	United Nations Children's Fund
UVB	Ultraviolet B
VAS	Vitamin A supplementation
WHO	World Health Organization

SYMBOLS

>	greater than
<	less than
≥	equal to or greater than
≤	equal to or less than

FOREWORD

Mongolia is one of the countries that successfully achieved the Millennium Development Goals through the adoption and implementation of policy documents to address health, nutrition and food safety issues of the population.

The World Sustainable Development Goal for 2016-2030 and "Concept of Sustainable Development of Mongolia-2030" are aimed to end hunger, improve the food safety and nutrition status, and promote sustainable agriculture.

The Mongolian national nutrition surveys were conducted in 1992, 1999, 2004 and 2010 and were the key argument of the Government's policy on nutrition and main evidences for implementing projects and programs to improve nutrition status of the Mongolian population.

The fifth national nutrition survey was successfully completed by the National center for public health in 2016-2017, with the technical and financial support of the United Nations Children's Fund and presenting the key results of the nutrition status of school children, pregnant women and household's residents selected from 8 districts of the capital city and 95 soums of the 21 provinces of Mongolia.

By conducting the comprehensive survey to assess the nutrition status of children under 5 years of age, school children aged 6-11 years, pregnant women, women and men aged 15-49 years, the current condition of the household food security, the condition of water and sanitation compared across the household wealth index of each city and provinces in 4 major regions including Ulaanbaatar, the survey result will serve as a vital information database to help develop and implement a scientifically-proven public health policy, based on the firm statistics and research analysis dedicated for specific circumstances and needs of the people living in target area and regions.

The prevalence of micronutrient deficiency is alarming high in children and women of Mongolia. For instance, 61% of children under 5-year-old and 75% of pregnant women were deficient in vitamin D, which indicates the essential need to include vitamin D screening and treatment in the antennal care package and implement the fortification of staple food products.

The prevalence of obesity is alarmingly high in all age groups of the Mongolian population, which is the main risk factor for the leading causes of morbidity and mortality. The situation urges us to intensify our actions in their health education and communication activities.

You have a great opportunity to use the survey report in your professional and work activities.

Therefore, I am confident that the survey report will contribute a lot in the improvement of the nutrition and food security status, which is essential for health and survival of the Mongolian population.

MEMBER OF PARLIAMENT,
MEMBER OF GOVERNMENT,
MINISTER OF HEALTH **SARANGEREL.D**

ACKNOWLEDGEMENTS

In order to study and evaluate the nutrition situation of the Mongolian people, the Ministry of Health and the National Center for Public Health, with technical and financial support from the United Nations Children's Fund (UNICEF), implemented "The Nutrition Status of the Mongolian Population: National Nutrition Survey V." The NNS V includes a total of 2249 households with children 0-59 months of age; 2251 children 0-59 months old, 1755 children 6-11 years of age, 1944 mothers 15-49 years, 2220 pregnant women 15-49 years, and 1384 men 15-49 years of age from Mongolia's four economic development regions and Ulaanbaatar. For this survey a total of 2249 households and 9554 individuals participated.

The Fifth National Nutrition Survey is a large-scale survey to assess households and national food security, child breastfeeding and complementary feeding practices, the prevalence of overweight and under nutrition in children and adults, the micronutrient status of children and adults with measurements of anemia, vitamin D deficiency, vitamin A deficiency, and iodine deficiency, as well as micronutrient supplementation among children and pregnant women. The NNS V addresses many important nutrition-related issues in Mongolia including the high prevalence of overweight and obesity, micronutrient malnutrition, household use of iodized salt, and unhealthy diet patterns particularly among school-aged children. The NNS V determines the current nutrition and health status of the population, identifies changes, and provides background information and evidences for future activities to improve nutrition and health of Mongolians.

The NNS V is the first survey to assess nutrition status of the Mongolian population with regional comparisons, and household wealth and food security status, and iron, vitamin A and D deficiencies among pregnant women and iron status of men 15-49 years of age, which has not been assessed in the previous four national surveys.

NCPH expresses special appreciation to the UNICEF for providing financial and technical support for this survey. Grateful recognition also goes to the Ministry of Health of Mongolia, the members of the Research Steering Committee for providing administrative support, the Ulaanbaatar and Province Health Departments. NCPH gratefully acknowledges Jessica Blankenship, UNICEF EAPRO consultant, for her support and guidance throughout the survey process. Acknowledgement is also made to all survey team members for data collection, processing and validation, and statistical analyses. Furthermore I would also like to acknowledge with much appreciation the crucial role of Dr. Juergen Erhardt, head of "VitMin Laboratory" of Germany, and Professor Naranbat N., executive director of "Gyals" Medical Center of Mongolia for completing the micronutrient analysis. We also express our dear appreciation to Dr. Oyunchimeg D., head of Government administration and management department of Ministry of Health, Dr. Byambatogtokh B., officer in charge for Nutrition and Food safety of Ministry of Health and associate professor Dr. Gereljargal B., "Ach" medical university, Dr. Enkhtuya P., PhD and Dr. Munkhjargal L., UNICEF nutrition specialist for professional and technical support on the report editing. I would like to express my sincere gratitude and wish good health to colleagues of National Center for Public health for participation in the all stages of the survey.

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EXECUTIVE SUMMARY

CONCLUSIONS AND RECOMMENDATIONS

In order to assess the nutrition status of the Mongolian population, the 5th National Nutrition Survey (NNS V) was conducted in 150 primary sampling units randomly selected from 21 provinces of 4 economic regions and 8 districts of Ulaanbaatar in 2016-2017. The survey included a total of 2249 households, 2251 children 0-59 months, 1755 children 6-11 years, 1944 mothers 15-49 years, 2220 pregnant women, and 1384 men 15-49 years. A total of 2249 households with children under 5 years of age and 9554 individuals participated in the NNS V.

The NNS V is a large-scale survey to assess household wealth and food security status, child breastfeeding and complementary feeding practices, prevalence of over and under nutrition in children and adults, micronutrient status of children and adults, as well as micronutrient supplementation coverage among children under years of age and pregnant women. The NNS V addresses many important nutrition-related issues in Mongolia including the high prevalence of overweight and obesity, micronutrient deficiency, household use of iodized salt, and unhealthy food consumption among school children. Findings of the NNS V provide evidence based information to address the nutrition and health concerns of the Mongolian population.

MICRONUTRIENT DEFICIENCY IS A PRIORITY PUBLIC HEALTH CONCERN IN MONGOLIA

The NNS V revealed that micronutrient deficiencies are prevalent in all population groups and are most concerning for infants, young children, and pregnant women. The highest prevalence of micronutrient deficiencies was in children under 5 years of age with 27% anaemic, 21% iron-deficient, 70% insufficient in vitamin A and 90% insufficient in vitamin D. High prevalence of micronutrient deficiency and insufficiency are public health problems in Mongolia that require multiple reinforcing strategies to address them.

Awareness of mothers and caregivers on the importance of feeding young children a variety of nutritious foods is needed to improve the quality of young children's diets. While iron-rich and vitamin A-rich foods are available and are consumed by other household members, they are not fed to young children or are fed in insufficient quantities to meet their nutritional requirements. The NNS V confirmed poor infant and young child feeding practices in Mongolia with children in the critical period of 6-23 months of age consuming few dietary sources of iron and vitamin A and less than 50% receiving a diet with minimum dietary diversity. For these young children, minimum meal frequency was above 90% which means that children are being fed regularly, but their diet quality is poor with only 44% of children receiving a minimum acceptable diet of both adequate feeding frequency and dietary diversity.

The highest prevalence of anaemia, iron deficiency and vitamin A deficiency was found in the youngest children 0-23 months of age which stresses the importance of appropriate breastfeeding practices to provide adequate nutrition to infants before the introduction of complementary foods. Exclusive breastfeeding and early initiation of breastfeeding practices are unacceptably low in Mongolia; 20% of newborns are not breastfed within 1 hour of birth and more than 40% of infants under 6 months of age are not exclusively breastfed and therefore, not receiving optimum nutritional and immunity benefits from breast milk. Strengthening IYCF counselling in all regions and wealth quintiles to support women to practice optimal breastfeeding, along with counselling and awareness of timely and adequate complementary feeding for children under 2 years of age, should be a top priority for Mongolia and as it is a key strategy to reduce micronutrient deficiencies in children.

Counselling and awareness-building activities are essential to improve infant and young child feeding practices to increase children's daily intake of essential micronutrients. However, as dietary intake practices are slow to change and natural sources of micronutrients are not universally available or affordable to all household, continued high-dose and low-dose supplementation of essential micronutrients for young

children is recommended to be continued. While vitamin A-rich foods are readily available in Mongolia, the prevalence of vitamin A deficiency in children 6-59 months of age is over the 5% threshold set by the WHO for the continuation of vitamin A supplementation programmes. Per the WHO recommendation, twice-yearly high-dose vitamin A supplementation, in addition to increasing consumption of vitamin A-rich foods, should continue to be provided to all children 6-59 months of age. In contrast to vitamin A, natural sources of vitamin D are not readily available in the Mongolian diet with vitamin D also not currently available in fortified foods or obtainable from sunlight exposure as conditions are insufficient for production of vitamin D during most of the year in Mongolia. Therefore, until the provision of vitamin D through sources such as Multiple Micronutrient Powders (MNPs) can be fully scaled-up to reach all children, vitamin D supplementation will continue to be necessary for infants and young children in the country.

Improvements in infant and young child feeding practices combined with the provision of vitamin A and vitamin D supplementation, are necessary to provide essential nutrients to young infants and children for growth and development. To complement these interventions, it is strongly recommended that the provision of Multiple Micronutrient Powders (MMPs) be promoted at scale nationally for all children 6-23 months of age. MMP's provide iron, vitamin A, zinc, vitamin D, iodine, and other essential nutrients children in optimal amounts to meet their requirements for proper growth and development and are an effective way to increase micronutrient, especially iron, intake in children who are just beginning to eat family foods. These powders have the advantage of improving the micronutrient content of a children's diet without changing their usual dietary habits. However, effective rollout of MNPs at scale requires education of health providers and intensive communication and awareness-raising at the community level to ensure high compliance and to alleviate concerns mothers may have about side effects.

Pregnant women are a highly vulnerable population for micronutrient deficiencies in Mongolia. The NNS V revealed that 21% of pregnant women are anaemic, 30% are iron deficient, nearly all, or 96% have deficient or insufficient vitamin D status and 12% have deficient or insufficient vitamin A status. Additionally, pregnant women in all regions and areas of Mongolia have inadequate iodine status, placing their infants at risk of poor cognitive development. While the government-provided multiple micronutrient supplement provides all of the essential micronutrients for pregnant women, the most common privately-purchased prenatal supplements, such as Elevit, lack iodine and vitamin D which are essential during pregnancy.

Due to the high demand for prenatal vitamin supplements, which most women purchase privately from pharmacies, and nearly universal ANC attendance, Mongolia is uniquely well-positioned to reduce iron, iodine, vitamin D and other micronutrient deficiencies in pregnant women through prenatal supplementation programmes. However, challenges surrounding poor compliance with supplementation throughout pregnancy and lack of availability of free supplements provided through ANC prevent optimal benefit from prenatal micronutrient supplementation. The provision of multiple micronutrient supplements during ANC visits through the national government programme should be a priority intervention in Mongolia as it offers pregnant women affordable and equitable access to prenatal supplementation, along with the important benefit of regular counselling to improve compliance and manage side effects. In addition to provision of multiple micronutrient supplementation through ANC, it is recommended that Mongolia establish national guidelines, which apply to both privately and publicly available prenatal supplements, for a standard multiple micronutrient formulation that includes iron, folic acid, vitamin D, and iodine. This standard multiple micronutrient formulation should be promoted through all providers of ANC including private doctors and gynecologists, along with awareness of the importance of adequate iodine status during pregnancy.

A complementary strategy to address iron and folic acid deficiency in Mongolian women before they become pregnant is through the fortification of wheat flour with iron and folic acid. In Mongolia, the fortification of wheat flour with iron and folic acid has been introduced on a limited scale to prevent neural tube defects and help build women's iron stores prior to pregnancy. For optimum impact, however, mandatory fortification with iron and folic acid of all wheat flour produced and imported into the country is recommended. As raw flour is not utilized in most households on a daily basis, mandatory use of iron and folic acid fortified flour by commercial food producers, such as bakeries, has the potential to reach the majority of the population to achieve a reduction in neural tube defects and improve the iron and folic acid status of women of reproductive age with minimum risk of iron overload in men.

Vitamin D insufficiency is universally high in all populations in Mongolia with prevalence of 90% in children, 95% in pregnant women, and 82% among men. As vitamin D insufficiency affects individuals at all socio-economic levels in all regions of the country and there is limited potential to increase vitamin D status through diet and sun exposure, fortification has the greatest potential to improve the vitamin D status of the Mongolian population. While milk is a potential food vehicle for vitamin D fortification, it is not a preferred food vehicle due to lack of centralized production and processing in the country. Wheat flour is likely the most feasible and effective vehicle for vitamin D fortification as it is highly consumed by all population groups in all areas of the country via commercial baked goods. Effective fortification requires government-imposed mandatory fortification for all domestic and imported wheat flour with mandatory fortification applicable to wheat flour sold for home use and for commercial use. Stringent monitoring is required to ensure compliance with production and fortification standards. Though fortification is essential for increasing the overall intake of vitamin D in the general population, the provision of vitamin D supplementation will continue to be necessary for infants and young children and pregnant women through MNPs and prenatal micronutrient supplements, respectively, in order to meet their higher vitamin D requirements.

Due to the low availability of foods containing iodine, universal salt iodization should continue to be the main strategy for preventing iodine deficiency in Mongolia. Currently, 20% of the population does not consume adequately iodized salt and, therefore, is not protected from iodine deficiency. As iodized salt coverage is lower in Khangai and Western regions, where cheaper non-iodized salt is widely available, efforts should focus on these areas along with strict national regulations for monitoring the iodine content of all domestically-produced and imported salt. In order to ensure that health status of the Mongolian population is not adversely affected, the promotion of iodized salt needs to be balanced with ongoing programmes to reduce salt intake in the Mongolian population.

PREVALENCE OF OVERWEIGHT AND OBESITY HAS DRAMATICALLY INCREASED IN MONGOLIA

The prevalence of overweight and obesity among adults, and increasingly among children, in all regions of Mongolia has reached epidemic proportions and is likely the greatest public health challenge facing the country. The prevention of overweight and obesity requires a lifecycle approach focusing on good prenatal, infant, child, adolescent, and adult nutrition. Of greatest concern in Mongolia is that increasingly, children are becoming not only overweight, but are also transitioning to obesity at a young age. Addressing overweight in children through dietary modification and increased physical activity is critical to preventing excess weight gain and its associated chronic diseases in adulthood. If current trends are not reversed, the overweight and obesity epidemic will have enormous implications in terms of health care costs and lost productivity.

The WHO's recommendations on "Ending Childhood Obesity" provide a template for which obesity prevention programmes should be developed in Mongolia. Some key recommendations include a focus on the school as schools provide an excellent platform for educating children on healthy eating and physical fitness, for reducing consumption of unhealthy foods and snacks by limiting availability of "junk" foods in schools, and for providing physical education classes. The introduction of mandatory restrictions on marketing and advertising of high-sugar and high-fat foods is recommended to reduce children's exposure and desire for these foods. Government policies limiting access to specific foods through sugar taxes and fat taxes should also be evaluated as a strategy to reduce consumption of unhealthy foods. Reducing overweight and obesity in children requires the involvement of parents and a family approach to healthy eating, physical fitness, and maintaining a normal body weight to benefit all members of the household, along with public awareness and support necessary to change dietary and physical activity habits.

POVERTY REDUCTION STRATEGIES ARE AN INTEGRAL COMPONENT TO REDUCE MALNUTRITION IN MONGOLIA

Despite the high prevalence of overweight and obesity in Mongolia, the NNS V revealed that food insecurity is a major problem in the country, with two-thirds of households experiencing some level of food insecurity and 1 in 5 households having severe food insecurity. The term food security involves all household members so the findings of the NNS V are unclear which household members are disproportionately affected by food insecurity in Mongolia. Further understanding is needed to target programmes to ensure adequate foods are available and accessible to the most vulnerable individuals.

The NNS V revealed marked regional disparities in nutritional indicators and food security status, with generally poorer conditions in Khangai and Western regions and the Ger districts in Ulaanbaatar. Targeted food security and nutrition-focused social protection measures, such as the food stamp programme which was shown to be successful in reducing vulnerability of poor households to food shortages, should be reformed and strengthened to ensure the most vulnerable households with children under 5 are prioritized for assistance. Such safety net schemes can help protect vulnerable populations from seasonal food shortages and natural disasters that are common in Mongolia.

Dietary approaches are key to address malnutrition in Mongolia, however chronic inflammation contributes to half of the anaemia in pregnant women and children in the country. To address chronic inflammation, improved access to safe water and sanitation facilities is required to reduce repeated infections and is recommended as an essential part of Mongolia's comprehensive nutrition strategy, particularly in rural areas and Ger districts that lack access to basic infrastructure services. In rural areas, 20% of the population lacks access to safe drinking water and one-third of the overall population lacks access to improved sanitation, both indicators highly associated with child malnutrition. Water, sanitation and hygiene programmes are a critical nutrition-sensitive component for reducing the burden of malnutrition in Mongolia.

Vitamin D Status

WHAT IS VITAMIN D?

Vitamin D is a fat-soluble vitamin that is naturally present in very few foods including fatty fish, fish liver oils, beef liver, and egg yolks. In addition to dietary sources, vitamin D is the only vitamin that can be produced by the skin through exposure to ultraviolet B (UVB) radiation from sunlight. Vitamin D needs are greatest at times of rapid growth, such as during pregnancy, infancy, childhood, and adolescence with vitamin D necessary to build and maintain healthy bones, to use calcium in the body, and for a healthy immune and cardiovascular system.

WHAT IS VITAMIN D DEFICIENCY?

An insufficient quantity of vitamin D adversely affects bone mineralization, leading to growth retardation in children and osteomalacia and osteoporosis in adults resulting in an increased risk of bone fracture in later life. A severe manifestation of vitamin D deficiency is rickets, which is characterized by soft bones and skeletal deformities (typically bowed legs) in children. Vitamin D deficiency has also been associated with compromised immune function, increased risk of chronic diseases including hypertension and diabetes, and some cancers. Recent research indicates that vitamin D plays an important role in the prevention of ischemic heart disease, with adequate vitamin D status associated with a reduced risk of myocardial infarction (heart attack) and mortality from heart disease[1].

Vitamin D is produced by the skin through sun exposure and is the only vitamin which humans can produce. The occurrence of vitamin D deficiency is high globally due to low consumption of vitamin D-rich foods and reduced exposure to UVB sunlight. Factors which affect the ability of people to produce vitamin D from the sun include living at a high latitude in colder climates, living in highly polluted areas, using sunscreen, having darker skin, and spending the majority of daytime indoors. These factors make it difficult or even impossible to absorb UVB rays and therefore limit the body's ability to produce vitamin D. People who are overweight are also at increased risk for vitamin D deficiency as their excess body fat affects both vitamin D absorption and utilization. Groups at highest risk for vitamin D deficiency are pregnant and lactating mothers, infants, and growing children who have high vitamin D requirements. Additionally, the elderly are at increased risk for vitamin D deficiency due to their declining ability to absorb vitamin D and reduced sun exposure.

Vitamin D status is assessed through the measurement of serum concentration of 25-hydroxy vitamin D [25(OH)D]. This biomarker reflects vitamin D produced from sun exposure as well as intake from dietary sources and supplements. Though there is no consensus on the level of 25(OH)D necessary for optimal health, Table 1 presents widely accepted indicators of vitamin D status [2]:

Table 1. Indicators of vitamin D status

Asessment criteria	25(OH)D level
Vitamin D deficiency	< 20 ng/ml
Vitamin D insufficiency	20-29 ng/ml
Vitamin D sufficiency	30-100 ng/ml
Risk of Vitamin D toxicity	> 100 ng/ml

1 Siadat ZD, Kiani K, Sadeghi M, Shariat AS, Farajzadegan Z, Kheirmand M. Association of vitamin D deficiency and coronary artery disease with cardiovascular risk factors. Journal of Research in Medical Sciences : The Official Journal of Isfahan University of Medical Sciences. 2012;17(11):1052-1055.

2 Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heaney RP, Murad MH, Weaver CM; Endocrine Society. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. The Journal of clinical endocrinology and metabolism. 2011;96(7):1911-1930.

WHAT IS THE VITAMIN D STATUS OF THE MONGOLIAN POPULATION?

Mongolians have reduced ability to synthesize vitamin D from UVB sunlight due to the country's northern geography that limits sun exposure during much of the year and the low UVB light penetration for vitamin D synthesis. High levels of air pollution during the winter months further reduce UVB absorption. Foods naturally rich in vitamin D are generally not consumed in the Mongolian diet and there is low availability of vitamin D-fortified foods in the marketplace. With the population unable to produce enough vitamin D through sun exposure for 9 months out of the year and low consumption of vitamin D-rich or fortified foods, Mongolians are at high risk for vitamin D deficiency.

The NNS V confirmed high vitamin D deficiency among the highest risk populations of children under 5 years of age and pregnant women. Ninety percent of children had inadequate vitamin D levels, with over 60% vitamin D deficient (Figure 1). In addition, over 75% of children 0-59 months displayed at least 1 of the 16 clinical signs of rickets, indicating chronic vitamin D deficiency in children. Among pregnant women, 95% had insufficient vitamin D levels and 75% were vitamin D deficient (Figure 1). Unlike deficiencies of vitamin A and iron, vitamin D deficiency affects children and pregnant women at all socio-economic levels, with high levels of deficiency occurring across all regions of Mongolia and among even the wealthiest households.

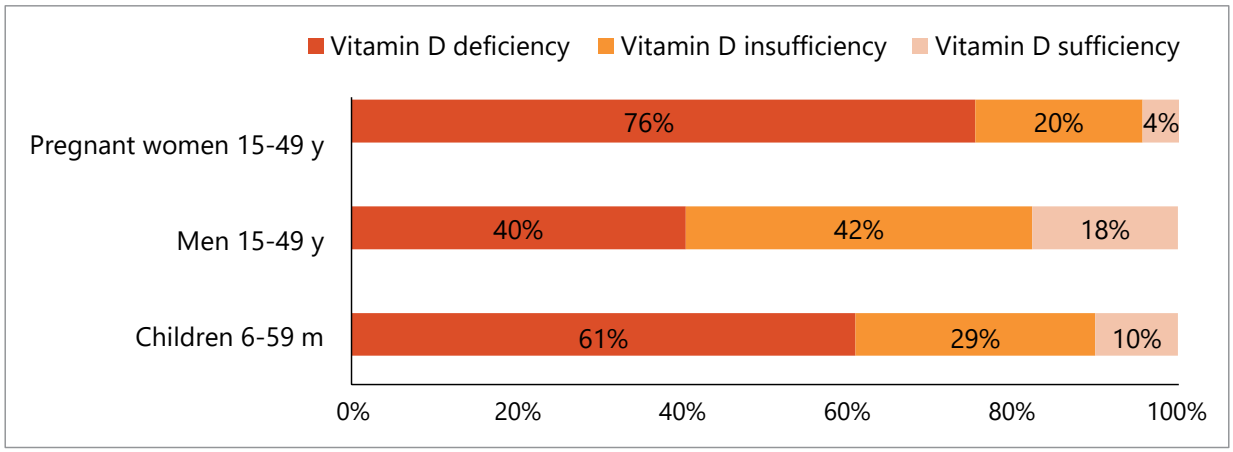

Figure 1. Vitamin D status of pregnant women, men, and children 6-59 months of age

Alarmingly, the NNS V found a high prevalence of vitamin D inadequacy among men 15-49 years of age, with over 80% having insufficient vitamin D levels and 40% vitamin D deficient (Figure 1). With ischemic heart disease the leading cause of death in Mongolia[3], the prevention and correction of vitamin D deficiency in adults, as well as children, may have significant and far-reaching benefits for morbidity and mortality reduction.

While vitamin D deficiency is universally high within all population groups and regions in Mongolia, use of vitamin D supplementation is fairly low. Only 58% of children under 5 years received vitamin D supplementation in the previous year, with only 36% of all children, receiving the appropriate frequency of supplementation: daily intake for low-dose and monthly intake for high-dose supplementation. Coverage was lowest among children under 6 months and over 2 years of age, with only 1 out of every 7 children (15.0%) over 36 months of age receiving adequate vitamin D supplementation to support their rapid growth requirements (Figure 2).

3 MOH, Health indicators, Centre for health sector development, Mongolia, Ulaanbaatar, 2016.

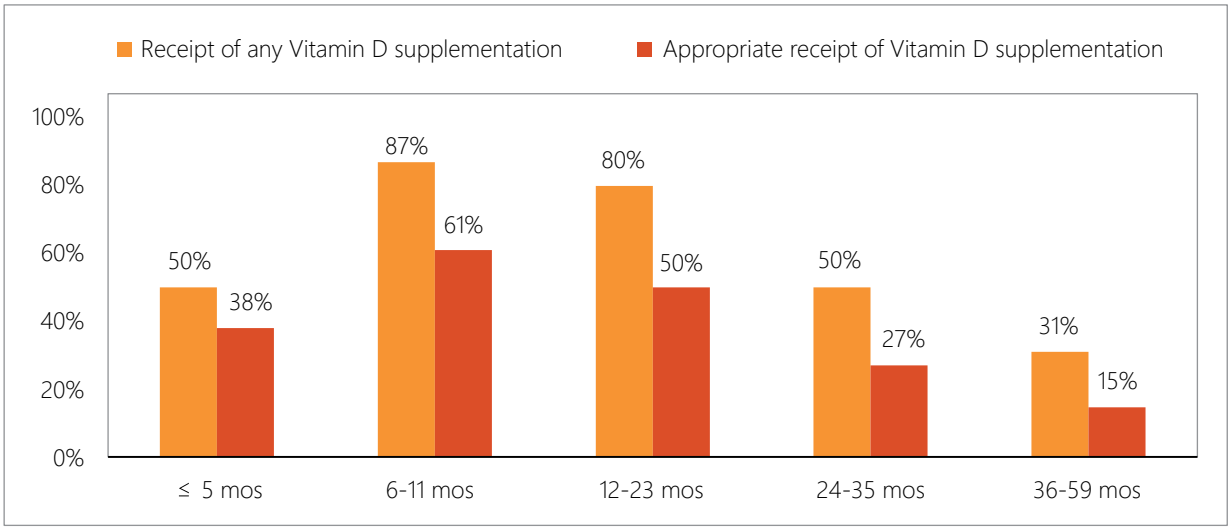

Figure 2. Vitamin D supplementation of children 0-59 months by age group

Receipt of any vitamin D supplementation ($p<0.05$) and appropriate supplementation ($p<0.001$) were significantly higher in urban areas and lowest in Western, Khangai, and Eastern regions with ≤30% of all children receiving appropriate vitamin D supplementation in these areas (Figure 3). Supplementation was also higher among children in the wealthiest households compared to the poorest households ($p<0.001$).

Notably, children who received vitamin D supplementation had significantly lower prevalence of vitamin D deficiency compared to those who were not provided supplements (57.1% vs. 66.1%, $p<0.01$).

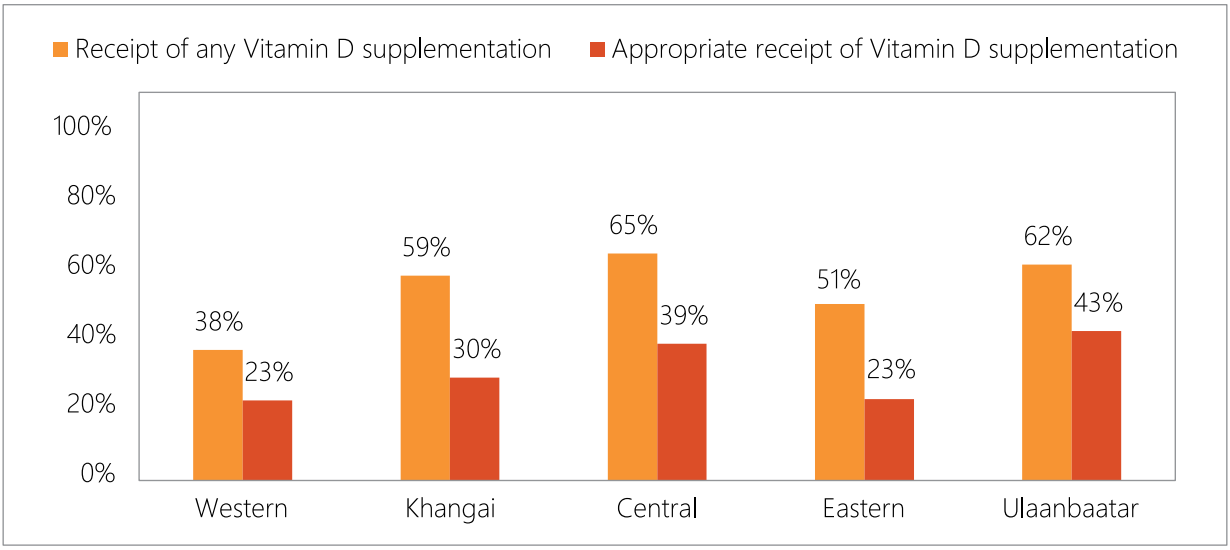

Figure 3. Vitamin D supplementation of children 0-59 months by region

Coverage of vitamin D supplementation among pregnant women was very low, indicating a serious public health concern in Mongolia. While over 75% of pregnant women were deficient in vitamin D, only 7% received any type of vitamin D supplementation, with the majority not taking supplementation frequently enough to meet their biological requirements. While the multi-micronutrient supplements provided to pregnant women through antenatal care (ANC) contain the recommended 400 IU of vitamin D, very few pregnant women (11.3%) received multi-micronutrient supplements at ANC sessions or through humanitarian relief operations during the 2015-2016 Dzud natural disaster. The vast majority of pregnant women who took vitamin D supplements purchased them independently from a pharmacy and did not receive either vitamin D or multi-micronutrient supplementation through the health system.

RECOMMENDATIONS FOR POLICY AND PROGRAMMATIC MODIFICATION

Vitamin D deficiency is a major public health problem in Mongolia that is unlikely to improve due to low availability of foods rich in vitamin D and low production of vitamin D from sunlight. Without naturally occurring sources of vitamin D readily available to all population groups in Mongolia, strategies such as food fortification and supplementation are necessary to improve vitamin D status in the country. The advantages and disadvantages of both food fortification and supplementation in Mongolia should be reviewed to determine how to meet the vitamin D needs of the general population and specifically pregnant women, infants, and young children who are most vulnerable to deficiency.

A national vitamin D supplementation programme has been implemented by the Ministry of Health since 1995 for children in rural areas and Ulaanbaatar and was expanded from 2005 to 2013 to include all children under 3 years of age nationally. Through the supplementation programme, children under 3 years receive a monthly dose (50,000 IU) of vitamin D year-round. While the vitamin D supplementation programme had a targeted coverage of 90% by 2015, it is evident that the intended coverage was not achieved with coverage declining in recent years due to funding challenges. Likewise, while the multi-micronutrient supplement provided to pregnant women contains the recommended amount of vitamin D, very few women receive the supplement from the health center, with low coverage also being attributed to funding challenges. The NNS V findings reveal the need to expand the vitamin D supplementation programme to include all children under 5 years of age and pregnant women and ensure proper compliance with supplementation protocols. Pregnant women should preferably receive vitamin D through multiple micronutrient supplementation at antenatal care visits and children should receive vitamin D through either monthly high-dose supplementation or through provision of MMPs.

In many countries, the fortification of foods with vitamin D has been an important public health strategy for ensuring adequate vitamin D consumption in the general population. The fortification of milk and breakfast cereals with vitamin D has been a longstanding strategy in the United States and Canada and, in those countries, it provides the majority of vitamin D intake. However, in the Mongolian context, both milk and breakfast cereals are poor food vehicles for vitamin D fortification due to lack of central processing of milk and low consumption of breakfast cereals. Other potential food choices for vitamin D fortification include staple foods such as wheat flour and vegetable oil which should be considered as potential food vehicles for adding vitamin D into the Mongolian diet. To ensure success of any fortification programme, fortification of multiple staple foods should be considered, such as both wheat flour and vegetable oil, with mandatory fortification applied for all imported and domestically-produced wheat flour and vegetable oil in Mongolia. In addition to wheat flour and vegetable oil purchased for the household, it is important to also ensure that all commercial baking and food production in Mongolia uses wheat flour and vegetable oil meeting mandatory fortification levels.

Fortification of staple foods with vitamin D is essential to increase the overall intake of vitamin D in the general population, however the provision of vitamin D supplementation will continue to be necessary for infants, young children, and pregnant women in order to meet their high vitamin D requirements. Both of these strategies are therefore necessary in Mongolia to address the vitamin D needs of vulnerable populations and the general population including adolescents, women, men, and the elderly, who are also at risk of vitamin D deficiency and vitamin D insufficiency. In addition to the implementation of strategies to increase vitamin D intake through fortification and supplementation, the national health policy agenda in Mongolia should support continued public awareness and education on the importance of vitamin D and updated guidelines for the screening and treatment of vitamin D deficiency in children. The universally-high level of vitamin D deficiency in Mongolia has far-reaching public health consequences for children and adults. Both general and targeted strategies to improve vitamin D status across all population groups in Mongolia are necessary to reduce deficiency and decrease morbidity and mortality in the country.

Key recommendations to reduce the prevalence of vitamin D deficiency in pregnant women, children under 5 years and the general population in Mongolia

- Targeted delivery of vitamin D supplementation for high-risk populations of pregnant women and children under 5 years of age.
  - Provide universal high-dose vitamin D supplementation in a monthly dose (50,000 IU) or provide MMPs to all children under 5 years of age year-round.
  - Provide multi-micronutrient supplements, including vitamin D, to all pregnant women through antenatal care (ANC) visits from the first trimester, along with counselling messages to increase compliance with supplementation throughout pregnancy.
- Implement mandatory vitamin D fortification of potential food vehicles, such as wheat flour and vegetable oil, to increase vitamin D intake of the general population.
  - All imported and domestically produced wheat flour or vegetable oil should be included in mandatory fortification.
  - Mandatory fortification should apply to all wheat flour and vegetable oil purchased for the household, as well as all commercial baking and food production.

Vitamin A Status

WHAT IS VITAMIN A?

Vitamin A is a fat-soluble vitamin that is naturally present in many animal and plant-based foods including liver, eggs, carrots, spinach, sweet potato, apricots, winter squash, and broccoli. Vitamin A is necessary for the maintenance of healthy cells and to help fight infection through its role as a vital component of a healthy immune system. Vitamin A needs are greatest at times of rapid growth, such as during pregnancy, lactation, infancy, and childhood.

WHAT IS VITAMIN A DEFICIENCY?

Vitamin A deficiency is caused by low dietary intake of vitamin A, the body's increased vitamin A requirements due to infection, and decreased absorption of vitamin A through episodes of diarrhoea and intestinal worms. While low intake of vitamin A can cause deficiency, the type of vitamin A consumed can also make people more vulnerable to deficiency. Globally, most people consume vitamin A through plant-based foods such as spinach, carrots, and sweet potatoes. However, vitamin A from plant foods has a lower absorption than vitamin A present in animal foods such as eggs and liver and therefore it requires higher consumption to retain the same quantity of vitamin A. Further, as vitamin A is a fat-soluble vitamin, the consumption of fats and oils is necessary for proper absorption of vitamin A. Therefore, people who consume plant-based sources of vitamin A and a low-fat diet are at increased risk for vitamin A deficiency.

Children who are deficient in vitamin A have a significantly higher risk of illness due to a weakened immune system and reduced ability to resist childhood infections such as diarrhoea and measles. In its severe form, vitamin A deficiency can result in blindness and even death with severely deficient children unable to fight off infection and illness. The risk of vitamin A deficiency is highest in infants, young children, and pregnant and lactating women as these populations have high requirements for vitamin A, but often low consumption of vitamin A-rich foods. Strategies to prevent vitamin A deficiency in young children and pregnant and lactating women include ensuring vitamin A-rich foods are: readily available in the marketplace, affordable to all households, and consumed in sufficient quantity by all individuals; fortifying staple foods such as vegetable oil and margarine with vitamin A; and providing vitamin A supplementation to young children who are the most vulnerable to deficiency.

Vitamin A deficiency is diagnosed through measurement of serum retinol or retinol-binding protein which are adjusted for the presence of inflammation, with serum retinol more commonly used. The WHO serum retinol cut-offs for defining vitamin A deficiency and its severity at a population level are the same for children, pregnant women, non-pregnant women, and men as shown in Table 2.

Table 2. Serum retinol indicators of vitamin A deficiency[4]

Population	Vitamin A Deficiency	Marginal Vitamin A Deficiency
Children < 5	< 0.7 µmol/l	≥ 0.7 and ≤ 1.05 µmol/l
Pregnant women	< 0.7 µmol/l	≥ 0.7 and ≤ 1.05 µmol/l
Non-pregnant women and men	< 0.7 µmol/l	≥ 0.7 and ≤ 1.05 µmol/l

WHAT IS THE VITAMIN A STATUS OF THE MONGOLIAN POPULATION?

The NNS V revealed the prevalence of vitamin A deficiency in children 6-59 months of age was 9.5%, with an additional 60.1% of children having insufficient vitamin A levels (Figure 4). Despite a substantial reduction from the 32% of children found to be vitamin A deficient in the 2010 NNS IV, the prevalence of vitamin A deficiency in children is still on the threshold of a moderate public health problem in Mongolia as defined by the WHO[1]. The very high prevalence of vitamin A insufficiency indicates that intake of vitamin A-rich foods is suboptimal among young children, placing them at high risk for vitamin A deficiency.

4 WHO. Serum retinol concentrations for determining the prevalence of vitamin A deficiency in populations. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization, 2011

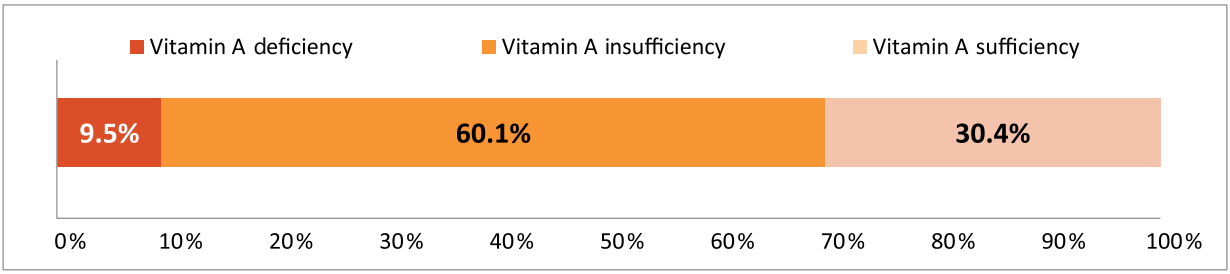

Figure 4. Vitamin A status of children 6-59 months of age

Relatively low consumption of vitamin A-rich foods was confirmed in the 24-hour dietary recall for children 6-59 months of age in the NNS V, which showed less than 20% of children consumed dark green leafy vegetables, vitamin A-rich fruits, liver, or eggs. The majority of children's vitamin A intake was from carrots with 58.0% consuming the vitamin A-rich vegetable in the previous 24 hours. Though carrots have high nutritional content, vitamin A from carrots has a lower absorption than vitamin A from eggs or liver and requires a higher intake to meet children's requirements. Younger children are unlikely able to eat sufficient quantities of vegetables containing vitamin A, such as carrots and sweet potatoes, to meet their needs.

The NNS V indicated that in Mongolian children 6-23 months of age do not consume the sufficient quantity of vitamin A-rich foods necessary for proper growth and development. While 72.5% of children 36-59 months of age consumed a vitamin A-rich food in the previous 24 hours, consumption was only 35.7% among children 6-11 months of age ($P<0.001$). Younger children, who consume fewer dietary sources of vitamin A, have a higher prevalence of vitamin A deficiency compared to older children in Mongolia. As shown in Figure 5, 17.7% of children 6-11 months and 13.9% of children 12-23 months of age were vitamin A deficient, compared to less than 6% of children older than 24 months ($P<0.001$). These data indicate that vitamin A-rich foods are available, but not fed to younger children in sufficient amounts. While the prevalence of vitamin A deficiency was significantly higher in the youngest children ($P<0.001$), there was no significant difference by region, area, wealth index quintile, or household food security status which suggests that low vitamin A intake and vitamin A deficiency are likely attributed to poorer child feeding practices among younger children.

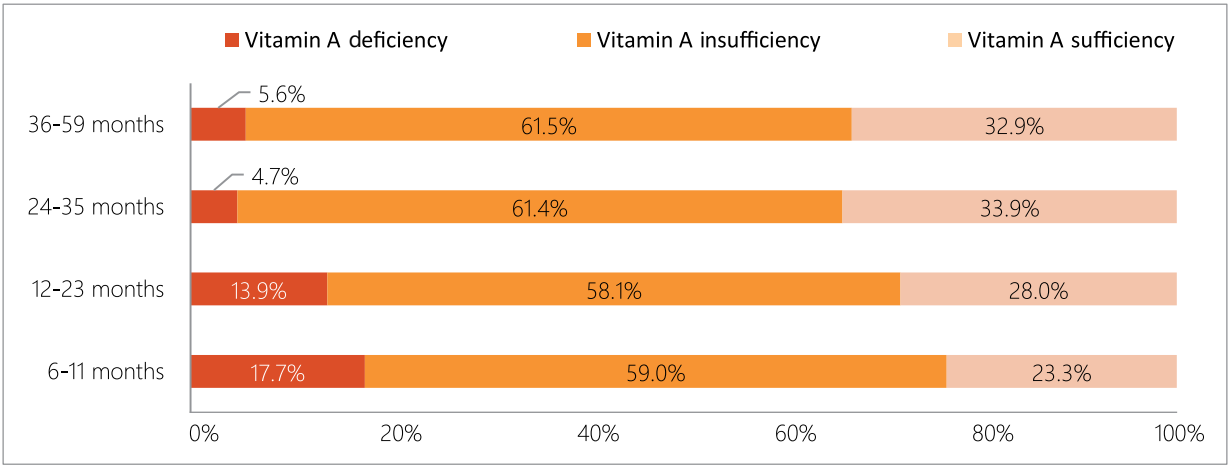

Figure 5. Vitamin A status of children 6-59 months by age group

The provision of vitamin A supplementation (VAS) to children 6-59 months of age is a national health programme in Mongolia with children receiving VAS twice a year (May and November) at health centers. Despite historically high coverage of VAS in Mongolia based on routine health facility data, the NNS V revealed that only 58.1% of children 6-59 months of age received VAS in the previous 6 months. Receipt of VAS was lowest in the youngest children 6-11 months (45.8%) and in older children 36-59 months (55.8%) ($P<0.01$) (Figure 6). In addition, there was significantly lower coverage of VAS in urban areas, with only 51.5% of children in Ulaanbaatar receiving VAS compared to 70.7% in Central region ($P<0.001$).

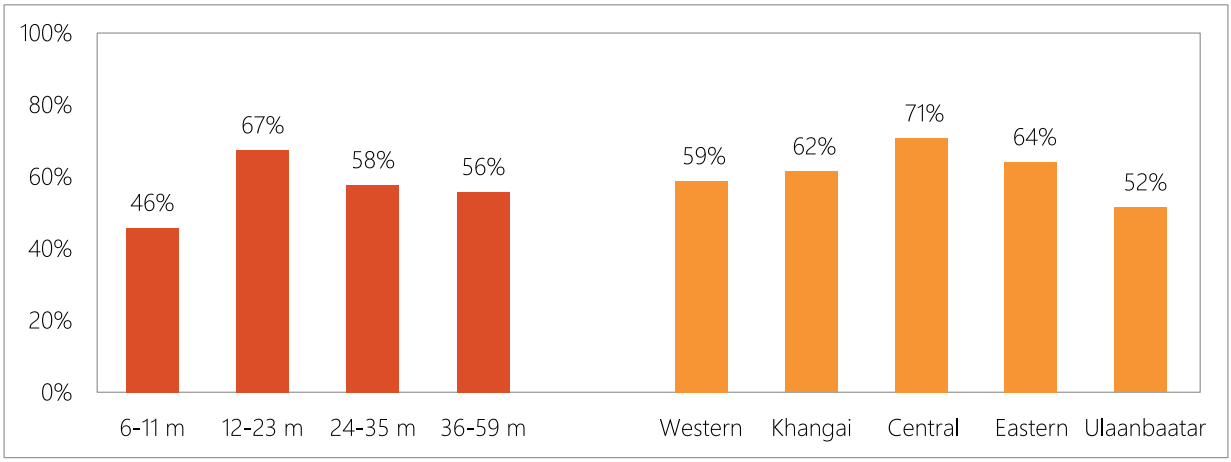

Figure 6. Coverage of vitamin A supplementation for children 6-59 months by age group and region

There was no association between receipt of VAS and prevalence of vitamin A deficiency or vitamin A insufficiency in children. The lack of association between VAS and vitamin A deficiency is not surprising as, in children with low dietary intake and vitamin A stores, a high-dose supplement improves vitamin A status for only up to 3-4 months, after which time vitamin A stores decrease. As the last VAS delivery for children was in May 2016, 5 months prior to the start of NNS V data collection, the high prevalence of vitamin A insufficiency suggests that supplementation is important to build vitamin A stores in children, but is not enough to maintain adequate vitamin A levels. Thewrefore, achieving adequate vitamin A intake through vitamin A-rich foods, along with multi-micronutrient powders or vitamin A-fortified foods, is necessary, in addition to twice-yearly vitamin A supplementation, to maintain sufficient vitamin A stores and prevent vitamin A deficiency in children.

Pregnant women are at increased risk for vitamin A deficiency throughout their pregnancy, but are most susceptible during the third trimester due to accelerated fetal development and the physiological increase in blood volume. In the NNS V, there was virtually no vitamin A deficiency among pregnant women (0.5%), although 11.3% had insufficient vitamin A status. While the risk of vitamin A deficiency and insufficiency increases with each trimester of pregnancy, the prevalence of vitamin A insufficiency was highest during the first trimester in Mongolian women (25.5%), compared to 8.0% in the second trimester and 11.4% in the third trimester (Figure 7).

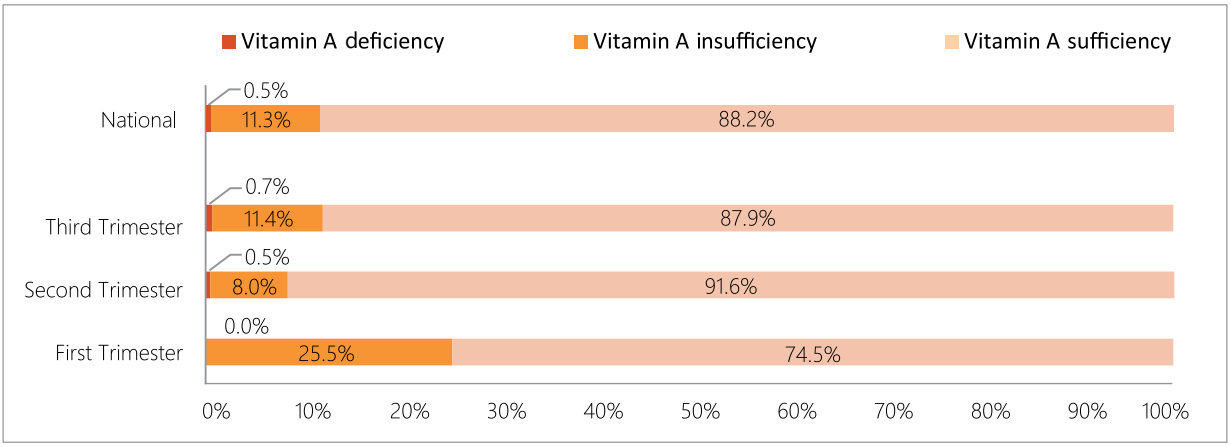

Figure 7. Vitamin A status of pregnant women by trimester of pregnancy

Vitamin A insufficiency was associated with poor minimum dietary diversity ($P<0.05$) and not taking a multi-micronutrient supplement during pregnancy ($P<0.05$), indicating that a diversified diet and consuming a prenatal vitamin supplement are important for maintaining adequate vitamin A levels in pregnant women. Improved vitamin A levels during the later stages of pregnancy may be attributed to better dietary quality and increased consumption of prenatal vitamin supplements closer to delivery. It should be noted that

prenatal supplements should not include vitamin A as per WHO recommendations[5], with pregnant women encouraged to receive their vitamin A from foods instead of supplements in areas with low prevalence of vitamin A deficiency in pregnant women.

Low vitamin A deficiency among pregnant women in their third trimester indicates breast milk concentrations of vitamin A are presumably good and that exclusively breastfed children will therefore be protected from vitamin A deficiency. However, the NNS V revealed that only 83.7% of newborns were breastfed within 1 hour of birth, a critically important time for the child's nourishment. In addition, only 58.3% of children 0-5 months of age were exclusively breastfed, leaving over 40% of young infants at risk for vitamin A deficiency. Breastfeeding is an excellent way to ensure appropriate vitamin A intake for infants, with early introduction of breastfeeding and exclusive breastfeeding for the first 6 months of life providing all the vitamin A an infant requires. Continued breastfeeding until 23 months of age complements the young child's diet to ensure appropriate intake of vitamin A and other key nutrients in breast milk. While 81.1% of children continued to receive breastfeeding for their first year of life, less than half (47.3%) of children were breastfed for 2 years.

RECOMMENDATIONS FOR POLICY AND PROGRAMMATIC MODIFICATION

Vitamin A deficiency is a borderline moderate public health concern for children in Mongolia, primarily due to young children not consuming adequate vitamin A through complementary foods. The vitamin A status of pregnant women, however, is sufficient with a very low prevalence of deficiency and women maintaining sufficient vitamin A stores during later stages of pregnancy.

To prevent vitamin A deficiency in Mongolian children, newborns should be placed on the breast within 1 hour of birth and exclusively breastfed for 6 months to build vitamin A stores. After the age of 6 months, children should continue to receive vitamin A-rich breast milk and also receive complementary foods containing high amounts of vitamin A. These foods may include fortified infant cereals, liver, carrots, sweet potatoes, apricots, eggs, and dark green leafy vegetables made into purees or soft pieces for easy consumption. Dietary sources of vitamin A, such as liver and carrots, are widely available throughout Mongolia but, in areas where vitamin A-rich foods are unavailable or unaffordable, the addition of MMPs to complementary foods can provide extra vitamin A and support vitamin A supplementation.

The national vitamin A supplementation programme implemented by the Ministry of Health in Mongolia should continue to deliver twice-yearly supplements to children 6-59 months of age as the prevalence of vitamin A deficiency among children under 5 is above the 5% threshold mandated by the Global Alliance for Vitamin A for stopping VAS programmes[6]. The VAS programme in Mongolia requires an increase in coverage in all regions and for all child age groups in order to reach mortality and morbidity reduction goals. As the NNS V indicated a discrepancy between the high VAS coverage recorded from routine health facility data and the lower coverage reported in the NNS V, it is recommended that regular and effective monitoring of the twice-yearly VAS distribution at the provincial, district and health facility level be implemented. The potential to implement VAS distribution in conjunction with the delivery of high-dose vitamin D supplementation to children 6-59 months of age should be further considered as a means to achieve high coverage and compliance with both essential interventions.

In many countries, fortification of foods such as oil, grains, sugar, and milk with vitamin A has been a successful public health strategy to help achieve adequate vitamin A consumption in the general population. Fortification of vegetable oil with vitamin A is a cost-effective intervention and can improve vitamin A levels, however, as vitamin A inadequacy is not a universal problem across all population groups in Mongolia and as naturally-occurring food sources of vitamin A are available, the advantages and disadvantages of vitamin A food fortification should be carefully evaluated as part of the government's policy to meet the vitamin A needs of infants, young children, and pregnant women who are at higher risk for vitamin A deficiency. Regardless of specific vitamin A interventions, increasing public awareness of the importance of vitamin A and of the available food sources of vitamin A is important for regular and adequate consumption of

5 McCauley ME, van den Broek N, Dou L, Othman M. Vitamin A supplementation during pregnancy for maternal and newborn outcomes. Cochrane Database of Systematic Reviews 2015, Issue 10. Art. No.: CD008666. DOI: 10.1002/14651858.CD008666.pub3.

6 Global Alliance for Vitamin A (GAVA). Technical Consultation on Guidance to Vitamin A Supplementation Programmes for Children 6–59 Months of Age; GAVA: Ottawa, ON, Canada, 2012.

vitamin A-rich foods and for improving overall dietary diversity. Animal foods, particularly liver, provide excellent sources of vitamin A that are readily available to most Mongolian households.

Eliminating vitamin A deficiency in Mongolia involves improving infant and young child feeding practices and ensuring pregnant and lactating women have healthy, well-balanced diets including vitamin A-rich foods. Currently, good food sources of vitamin A are available in all regions and to all wealth index quintiles in the country, but poor practices hinder consumption of these foods by the most vulnerable populations. Through increased immediate breastfeeding and exclusive breastfeeding, infants can gain sufficient vitamin A stores. Through increased consumption of vitamin A-rich complementary foods, young children will maintain their vitamin A stores throughout childhood. Along with behavior change communication to improve child feeding practices, the use of MMPs and fortified infant cereals can provide additional necessary vitamin A to children's diets. Finally, twice-yearly vitamin A supplementation can protect children by building vitamin A stores where access to vitamin A food sources is limited. Preventing vitamin A deficiency is essential for ensuring the health and well-being of children and should be a key nutrition strategy in Mongolia.

Key recommendations to reduce the prevalence of vitamin A insufficiency in children under 5 years of age in Mongolia

- Improve breastfeeding practices, specifically early initiation of breastfeeding within 1 hour of birth and exclusive breastfeeding for infants under 6 months of age.
- Improve consumption of vitamin A-rich complementary foods among children under 2 years of age:
  - Provide counselling to mothers on continued breastfeeding of children and preparing vitamin A-rich complementary foods such as fortified infant cereals, liver, carrots, sweet potatoes, apricots, eggs, and dark green leafy vegetables made into purees or soft pieces for easy consumption
  - Provide multiple micronutrient powders to children 6-23 months of age where vitamin A-rich foods are not affordable or not available
- Achieve at least 70% coverage of twice-yearly vitamin A supplementation to all children 6-59 months of age with improved monitoring at the provincial, district and health facility level.

Iodine Status

WHAT IS IODINE?

Iodine is a mineral important for making thyroid hormones that regulate the body's metabolism and is essential for brain development and proper fetal and infant growth. Iodine is largely concentrated in fish, other seafood, seaweed, and is present in very small amounts in dairy products, grains, and eggs. The amount of iodine found in fruits and vegetables, as well as animal products, is dependent on the iodine content of the soil where crops are grown, with iodine-poor soils leading to low iodine content in food products. Due to globally poor iodine consumption through natural foods, the main dietary source of iodine is iodized salt. Iodine needs are greatest during periods of rapid growth and development such as pregnancy, infancy, and childhood, however iodine is essential for the health and nutrition of people of all ages.

WHAT IS IODINE DEFICIENCY?

Iodine deficiency contributes to a series of growth and developmental delays that are collectively referred to as Iodine Deficiency Disorders (IDD). These disorders are common globally and result in a spectrum of negative consequences for both fetal and child development. Insufficient iodine intake of women during pregnancy is associated with an increased risk of miscarriage, stillbirth, congenital abnormalities, and irreversible fetal growth retardation and brain damage with permanent mental retardation in children. Even mild maternal iodine deficiency can reduce a child's learning capacity, educational attainment, and level of intelligence. In areas where iodized salt is not available, iodine inadequacy can have widespread impacts on school performance, work productivity, and the social and economic development of communities.

The main cause of iodine deficiency is poor dietary intake of iodine. People living in areas with iodine-poor soils, such as mountainous areas and river valleys, may not be getting enough iodine from locally grown foods. Because staple diets in many areas lack sufficient amounts of iodine, the WHO recommends universal salt iodization to prevent iodine deficiency. Implemented in more than 140 countries, salt iodization programmes have been very effective in reducing the global prevalence of iodine deficiency and related disorders and is the most widely used global strategy to control iodine deficiency at the population level.

Iodine deficiency is diagnosed through clinical signs of deficiency and measurement of urinary iodine levels. The most visible clinical sign of iodine deficiency in older children and adults is goitre which is an enlarged thyroid gland that appears as a swollen neck. In less advanced stages, goitre is palpable, but not visible. Severe iodine deficiency in the feotus can result in cretinism, a condition of severe and irreversible stunting and mental retardation in children. Urinary iodine concentration is used as a marker of iodine status as the majority of iodine absorbed by the body is excreted in the urine. Because an individual's urinary iodine level varies within a 24-hour period, urinary iodine concentration is used to assess iodine status at the population level. The WHO cut-offs[7] for defining iodine deficiency and its severity for pregnant women and school-aged children 6 years and older are presented in Table 3.

Table 3. Indicators of iodine status in pregnant women and children 6 years and older

Pregnant women	
Median urinary iodine	Iodine status
<150 µg/l	Insufficient
150–249 µg/l	Adequate
250–499 µg/l	Above requirement
≥ 500 µg/l	Excessive

Children ≥ 6 years of age	
Median urinary iodine	Iodine status
<100 µg/l	Insufficient
100–299 µg/l	Adequate
≥300 µg/l	Excessive

7 WHO. Urinary iodine concentrations for determining iodine status in populations. Vitamin and Mineral Nutrition Information System. Geneva: World Health Organization; 2013

WHAT IS THE IODINE STATUS OF THE MONGOLIAN POPULATION?

In the NNS V, household coverage of adequately iodized salt was 78.9%, with no significant change from the 75.7% measured in the 2010 NNS IV (Figure 8). Consumption of adequately iodized salt was higher in urban (81.6%) compared to rural (73.7%) areas (P<0.001) and highest in Eastern region (92.4%) and lowest in Western (60.4%) and Khangai (70.6%) regions (P<0.001).

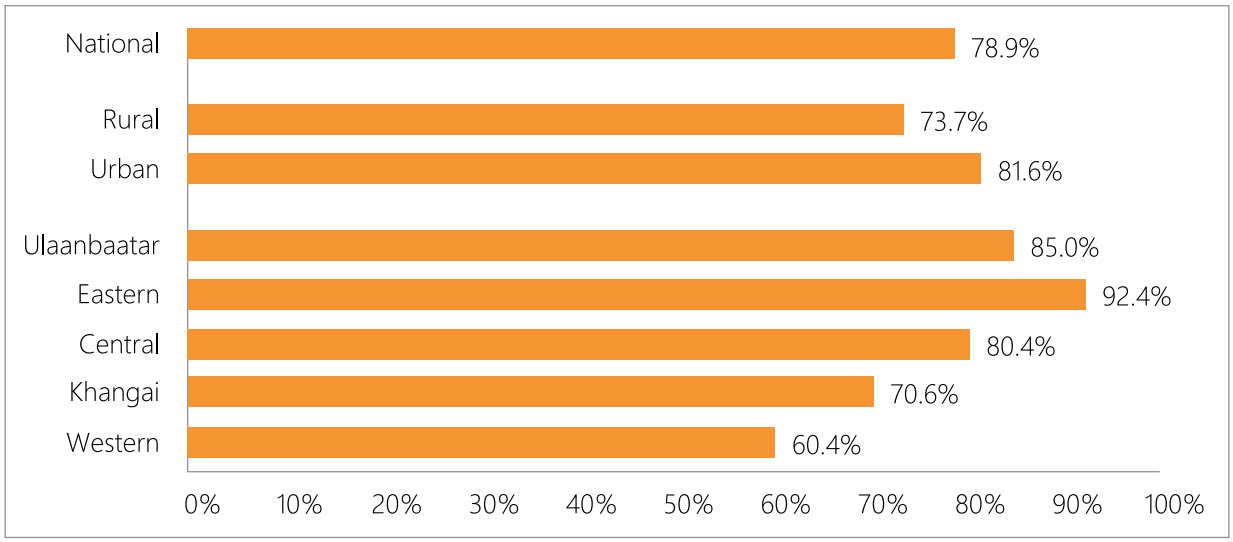

Figure 8. Prevalence of adequately iodized salt by area and region

While there was significant variation in coverage of adequately iodized salt by region, there were no differences by household wealth or household food security status, which suggests that economic factors are not the major barrier to accessing iodized salt. While coverage of iodized salt has been consistently high in Mongolia, coverage should optimally exceed 90% nationally and regionally to prevent IDDs[8]. Lower than 90% coverage in Central, Khangai, and Western regions and in Ulaanbaatar indicates that vulnerable populations in Mongolia may be at risk for iodine deficiency.

The NNS V measured iodine status in school-aged children as a proxy for the general population and in pregnant women as they are at increased risk of iodine deficiency. The median urinary iodine concentration (MUIC) in school-aged children was adequate at 144.6 µg/l, while the MUIC in pregnant women was 120.5 µg/l indicating insufficient iodine status for pregnant women in Mongolia. Regionally, lower coverage of adequately iodized salt was associated with lower MUIC for school-aged children and pregnant women, with both children and pregnant women in Western region having insufficient iodine status (Figure 9). Consumption of adequately iodized salt is strongly associated with sufficient iodine status in the general population as the NNS V showed >80% coverage of adequately iodized salt was associated with higher median iodine status in school-aged children.

8 WHO. Assessment of iodine deficiency disorders and monitoring their elimination: a guide for programme managers. – 3rd ed; 2007.

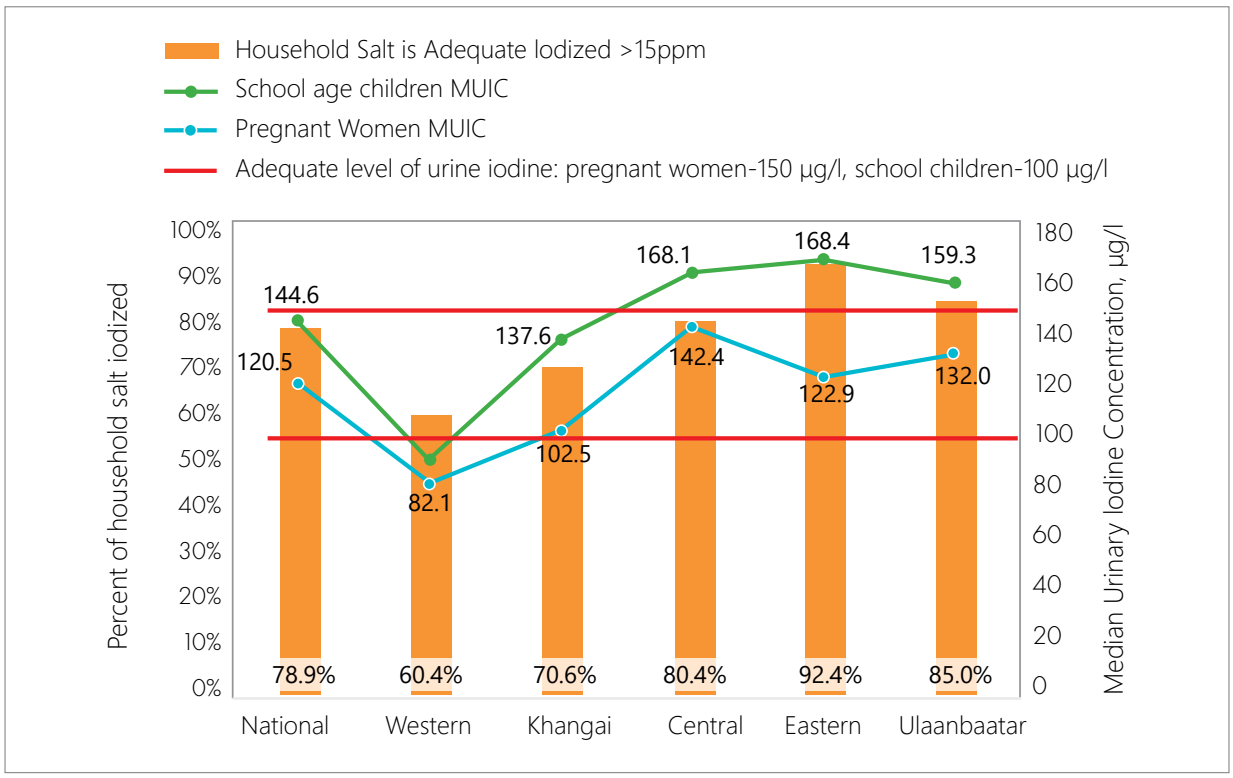

Figure 9. Prevalence of adequately iodized salt and median urinary iodine concentration of school-aged children and pregnant women by region

Nationally and regionally, pregnant women were classified as iodine deficient, having a MUIC far below the 150 µg/l threshold for adequate iodine status, even in Eastern region, where 92.4% of salt was adequately iodized. Iodine deficiency increased in later stages of pregnancy with MUIC lowest in the third trimester (110.6 µg/l) compared to 132.9 µg/l in the first trimester and 129.5 µg/l in the second trimester (Figure 10).

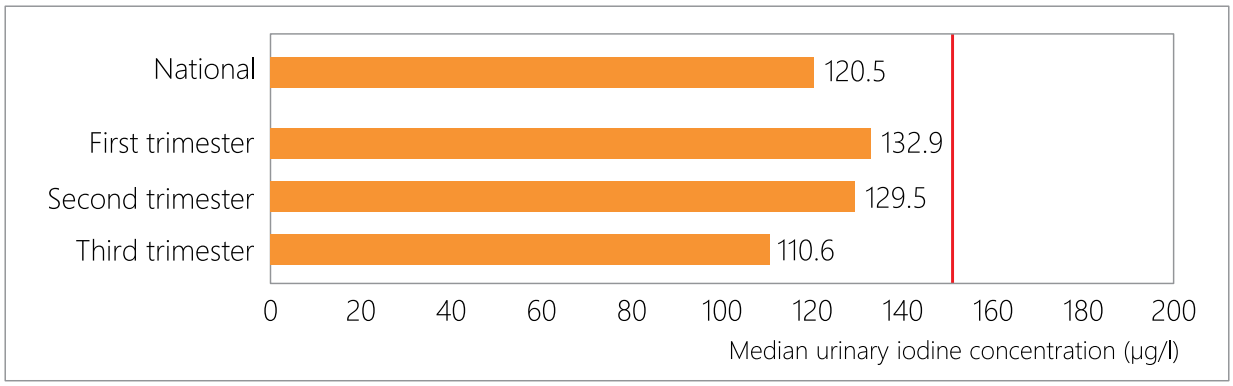

Figure 10. Median urinary iodine concentration of pregnant women by trimester of pregnancy

The findings from the NNS V indicate that pregnant women are not able to meet their increased iodine requirements through their existing salt consumption during pregnancy. Additional sources of iodine, either through the diet or through supplementation, may play an important role in maintaining pregnant women's iodine status. While the multi-micronutrient supplement provided through antenatal care contains the recommended level of iodine for pregnant women, coverage is poor, with the majority of pregnant women purchasing their prenatal vitamin supplements from private pharmacies. These micronutrient supplements rarely contain iodine, leaving pregnant women at risk for iodine deficiency.

While iodized salt is an essential intervention for preventing Iodine Deficiency Disorders in Mongolia, awareness of iodine deficiency and prevention methods was low among school-aged children and pregnant

women. Only 7% of children and 48% of pregnant women were aware of iodine deficiency, though 36% of children and 85% of pregnant women had heard about iodized salt. This discrepancy in awareness indicates that, while they may know about iodized salt, Mongolians are not aware of its importance to health and development.

RECOMMENDATIONS FOR POLICY AND PROGRAMMATIC MODIFICATION

In Mongolia, there are very few iodine-rich food sources in the diet, with nearly all Mongolians reliant on iodized salt to meet their daily requirements. The most effective, and affordable strategy to prevent iodine deficiency in Mongolia is through salt iodization. The prevention of iodine deficiency has been a national priority of the Ministry of Health in Mongolia since 1992 when the first IDD survey found severe iodine deficiency in the Mongolian population. The iodization of salt was introduced in Mongolia in 1995 with iodization of all edible salt having been mandated in the Salt Iodization and Prevention of Iodine Deficiency Law of 2003. While the mandatory salt iodization law continues to be in place, monitoring and enforcement of the law is poor, which prevents the country from achieving universal salt iodization.

Though there is good coverage of adequately iodized salt in Ulaanbaatar, Central, and Eastern regions, coverage is low in Western and Khangai regions, with poor iodized salt coverage in Western region likely contributing to iodine deficiency in school-aged children and pregnant women. Regional focus of the salt iodization programme in Western and Khangai regions is necessary to ensure households in these areas have affordable access to iodized salt, either through provision of imported iodized salt or through iodizing locally-produced salt in the region. Improving coverage of adequately iodized salt should be a priority intervention in Mongolia as it provides essential iodine to the general population in a cost-effective and efficient way. In order to increase coverage, strong monitoring of salt importation is required to ensure imported salt meets national salt iodization requirements and is universally available and affordable in Mongolia with a focus on the regions of Western and Khangai.

In addition to increasing coverage of affordable iodized salt, it is recommended that public awareness activities emphasizing the importance of iodine deficiency and the benefits of iodized salt be integrated into curricula at schools, provided to doctors and other medical professionals, and provided to women through counselling during ANC visits. As nearly all pregnant women attend ANC with a skilled health worker, targeted advocacy is necessary to doctors and medical professionals to increase their awareness of iodine deficiency and the need to prescribe and recommend prenatal supplements containing iodine in addition to iron, folic acid and vitamin D. The ANC and well-baby clinics are also an excellent platform to provide counselling to mothers on the use of iodized salt in the preparation of complementary foods for children and in all household foods.

Iodized salt is intended to provide sufficient iodine intake for the general population and is unlikely to meet the full iodine requirement of pregnant and lactating women and young children. As increased salt consumption is not recommended for pregnant women and young children, other sources of iodine such as prenatal supplements and multiple micronutrient powders may be necessary in Mongolia to meet the increased iodine needs of these vulnerable populations. In Mongolia, pregnant women have insufficient iodine status which places the developing feotus and breastfeeding infant at risk for irreversible damage caused by iodine deficiency. Prenatal multivitamin and mineral supplementation can ensure adequate iodine status in pregnant and lactating women; however, uptake of prenatal vitamins is poor in Mongolia with only 58% of pregnant women taking a prenatal multi-micronutrient supplement and only 11% of women receiving multi-micronutrient supplements containing iodine from ANC. The majority of women who do take prenatal supplements purchase them from private pharmacies, with many of, such as the commonly-consumed Elevit and Pregnavit, not containing iodine. The government-mandated multi-micronutrient supplement for pregnant women contains the essential micronutrients of iron, iodine, folic acid, and vitamin D and should be a priority intervention in Mongolia to ensure safe motherhood and the healthy cognitive and physical development of children. Additionally, the use of multi-micronutrient powders containing iodine is an excellent strategy to provide iodine and other essential nutrients to the diets of young children.

Iodine deficiency has serious lifelong health impacts in children with prevention crucial during pregnancy, lactation, and early childhood. Iodine deficiency can be eleminated in Mongolia through achieving universal salt iodization and by ensuring high, equitable, and sustainable coverage of multi-micronutrient supplementation including iodine, iron, folic acid, and vitamin D for all pregnant women.

Key recommendations to reduce the prevalence of iodine deficiency in pregnant women and the general population in Mongolia

- Support mandatory salt iodization legislation to improve coverage of adequately iodized salt
  - Ensure strict monitoring of imported and locally-produced salt to ensure all edible salt meets national salt iodization requirements and is universally available and affordable with a focus on Western and Khangai regions
- Provide multi-micronutrient supplements to all pregnant women through antenatal care (ANC) visits from the first trimester, along with counselling messages to increase compliance with supplementation throughout pregnancy
- In areas with poor coverage of iodized salt, provide multiple micronutrient powders (MNPs) to all children 6-23 months of age
- Develop guidelines for the inclusion of iodine in all prenatal supplements distributed and sold in Mongolia
- Ensure awareness on the importance of iodine deficiency and the benefits of iodized salt are integrated into curricula at schools, provided to doctors and other medical professionals, and provided to women through counselling during ANC visits
- Conduct targeted advocacy to doctors and medical professionals to increase their awareness of iodine deficiency and the need to prescribe and recommend prenatal supplementation containing iodine in addition to iron, folic acid and vitamin D

Iron Status

WHAT IS IRON?

Iron is an essential mineral needed for physical and cognitive development with iron needs greatest during pregnancy, infancy, childhood, and adolescence. Iron is vital throughout the lifespan as it is a component of haemoglobin, the protein responsible for transporting oxygen from the lungs to body cells for energy production. Iron is naturally present in both animal and plant-based foods with meat, poultry, and fish excellent sources of iron. Plant-based foods rich in iron include beans, peas, lentils, nuts, seeds, and dark green leafy vegetables such as spinach. Iron from plant sources has a lower absorption than iron from animal foods and requires higher consumption to obtain the same amount of iron as animal sources to meet nutrition requirements. Therefore, people who consume mainly plant-based sources of iron are at increased risk for iron deficiency.

WHAT IS IRON DEFICIENCY?

Iron deficiency results from a depletion of body iron stores due to increased iron needs, inadequate dietary iron intake, reduced iron absorption, or loss of iron from infections caused by malaria, hookworms, and other intestinal parasites. In advanced stages, iron deficiency leads to iron deficiency anaemia, a condition of low red blood cells and reduced oxygen-carrying capacity. Anaemia is a serious global public health problem causing impaired physical and cognitive development of children and reduced work productivity of adults. Approximately 50% of all anaemia globally is caused by iron deficiency [9]. Though iron deficiency is the most common cause of anaemia[10], infections and inflammatory diseases can affect red blood cell production and function, as well as iron absorption and utilization, leading to anaemia of chronic inflammation.

As iron needs are greatest during periods of rapid growth and when frequent blood loss occurs (such as during menstruation), pregnant women, young children, adolescent girls, and women of reproductive age are most vulnerable to becoming iron deficient if they are not able to meet their dietary iron requirements. Iron needs are greater during pregnancy due to increased blood volume to support the growing foetus and maternal anaemia is associated with an increased risk of maternal and newborn mortality, premature birth, stillbirth, and low birth weight babies. A woman who is anaemic during childbirth is less likely to survive excess bleeding or postpartum haemorrhage with and an estimated 20% of all maternal deaths globally are attributed to anaemia[11]. If maternal iron status is adequate, infants are generally born with sufficient iron stores for the first 6 months of life, after which they are at risk for iron deficiency if they do not obtain adequate amounts of iron from complementary foods in addition to continued breastfeeding.

The prevalence of anaemia in a population is assessed through measurement of haemoglobin and the measurement of iron deficiency assessed through either serum ferritin or soluble transferrin receptor. The most commonly used indicator to assess iron status is serum ferritin, which measures body iron stores and detects iron depletion at an early stage, with soluble transferrin receptor used as a supporting indicator of tissue iron deficiency. Serum ferritin distinguishes between iron deficiency anaemia and anaemia of chronic inflammation. Anaemia without iron deficiency (anaemia of chronic inflammation) occurs when a person has low haemoglobin and acceptable serum ferritin, whereas iron deficiency with anaemia occurs when a person has low levels of both haemoglobin and serum ferritin. The WHO cut-offs for defining anaemia[12], as measured by haemoglobin, and iron deficiency[13], as measured by serum ferritin, for children under 5, pregnant women, and adults are shown in Table 4 and Table 5.

9 WHO. The global prevalence of anaemia in 2011. Geneva: World Health Organization; 2015.

10 Iron Disorders Institute: iron deficiency anaemia. http://www.irondisorders.org/iron-deficiency-anaemia.

11 WHO Micronutrient Deficiencies: iron deficiency anaemia. http://www.who.int/nutrition/topics/ida/en/index.html.

12 WHO. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization, 2011.

13 WHO. Serum ferritin concentrations for the assessment of iron status and iron deficiency in populations. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization, 2011.

Table 4. Haemoglobin indicators of anaemia[a]

Haemoglobin (g/l)	Mild anaemia	Moderate anaemia	Severe anaemia
Children < 5	100-109 g/l	70-99 g/l	< 70 g/l
Pregnant women	100-109 g/l	70-99 g/l	< 70 g/l
Women 15-49	110-119 g/l	80-109 g/l	< 80 g/l
Men 15-49	110-129 g/l	80-109 g/l	< 80 g/l

a WHO. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity, 2011

Table 5. Serum ferritin concentration indicators of iron deficiency

Serum ferritin (µg/l)	Iron deficiency[a]	Iron sufficiency	Iron overload[b]
Children < 5	< 12 µg/l		
Pregnant women	< 15 µg/l	15-150 µg/l	> 200 µg/l
Women 15-49	< 15 µg/l	15-150 µg/l	> 200 µg/l
Men 15-49	< 15 µg/l	15-200 µg/l	> 300 µg/l

a WHO. Serum ferritin concentrations for the assessment of iron status and iron deficiency in populations, 2011

b Koperdanova M, Cullis JO. Interpreting raised serum ferritin levels. BMJ 2015;351:h3692.

Assessment of soluble transferrin receptor levels has been used to distinguish iron deficiency anaemia from anaemia of chronic disease because the receptors are generally unaffected by concurrent infection or inflammation. A serum transferrin receptor value above 8.3 mg/l is indicative of iron deficiency in children under 5 years, pregnant women and men[14].

WHAT IS THE IRON STATUS OF THE MONGOLIAN POPULATION?

Anaemia and iron deficiency are moderate public health problems in Mongolia. The NNS V revealed that 26.6% of children 0-59 months and 21.4% of pregnant women are anaemic, as measured by haemoglobin, and 20.7% of children 6-59 months and 29.6% of pregnant women are iron deficient, as measured by serum ferritin (Figure 11). There has been little change in the prevalence of anaemia and iron deficiency in children and pregnant women since the 2010 NNS IV, despite Mongolia's high economic growth during this period. Men, surveyed for the first time in the NNS V, had very low prevalence of anaemia and iron deficiency with only 3% of men anaemic and 1.1% of men iron deficient. There were no cases of iron overload (serum ferritin > 300 µg/l) in men[15].

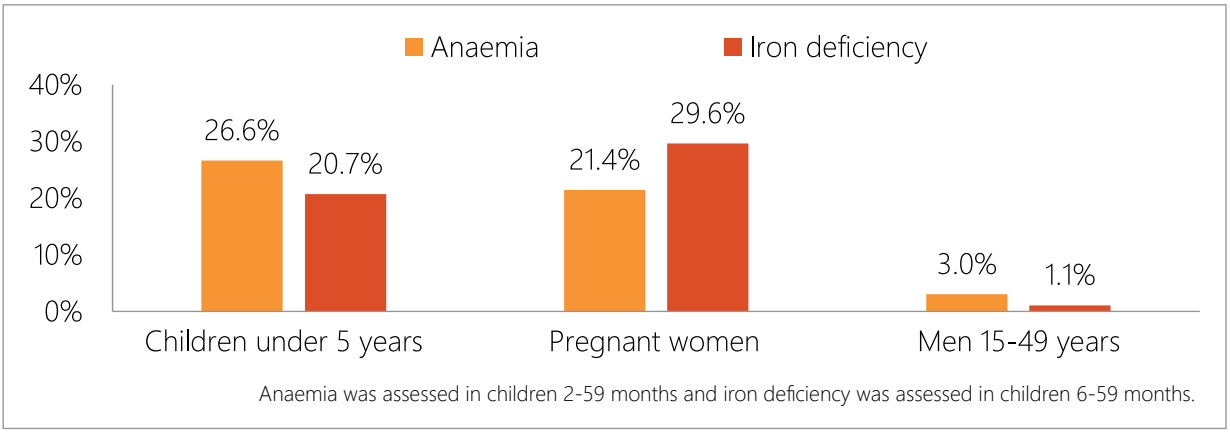

Figure 11. Prevalence of anaemia and iron deficiency in children under 5, pregnant women, and men 15-49 years

14 WHO Serum transferrin receptor levels for the assessment of iron status and iron deficiency in populations. Vitamin and Mineral, Nutrition Information System. Geneva, World Health Organization, 2014.

15 Koperdanova M, Cullis JO. Interpreting raised serum ferritin levels. BMJ 2015;351:h3692.

Iron status of children 6-59 months

In the NNS V, anaemia was assessed in children 2-59 months, while iron status was assessed in children 6-59 months of age. Of the children 6-59 months measured for iron status, 20.7% were iron deficient and 23.8% were anaemic, with 10.9% of the anaemia attributed to iron deficiency (Figure 12). The 12.9% of anaemia not caused by iron deficiency was due to anaemia of chronic inflammation resulting from underlying illness or disease likely caused by infections due to poor hygiene and sanitation and micronutrient deficiencies of vitamin A, vitamin B12, and or folate. Therefore, anaemia in this 12.9% of children cannot be directly addressed through iron interventions, unlike anaemia due to iron deficiency and iron deficiency itself which are preventable and treatable through iron interventions.

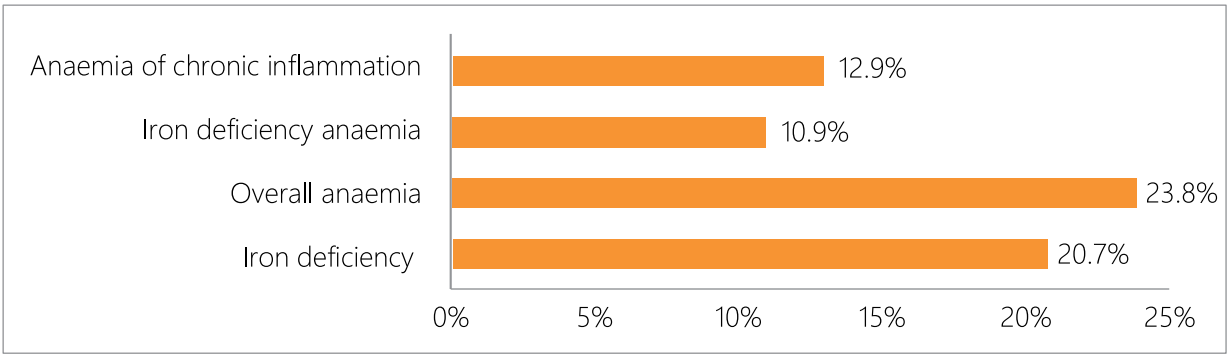

Figure 12. Prevalence of iron deficiency, overall anaemia, iron deficiency anaemia, and anaemia of chronic inflammation in children 6-59 months

The prevalence of anaemia due to both iron deficiency and chronic inflammation was highest in the youngest children and significantly reduced after 2 years of age, with only 9.4% of children 36-59 months anaemic compared to 45.2% of children 6-11 months of age (Figure 13). Iron deficiency anaemia was also highest in the youngest children. One in five children 6-11 months of age (21.5%) had iron deficiency anaemia, which accounted for approximately 50% of total anaemia in this age group. The prevalence of iron deficiency anaemia reduced dramatically in older children with only 1.8% of children 36-59 months of age having iron deficiency anaemia, accounting for only 19% of overall anaemia in this age group. The reduction in both iron deficiency anaemia and anaemia of chronic inflammation in children after 2 years of age coincides with both the increase in dietary intake of iron and other essential nutrients, which comes as children grow and start consuming adult foods more frequently and in larger portions, and the reduced prevalence of diarrhoeal and other illnesses in older children.

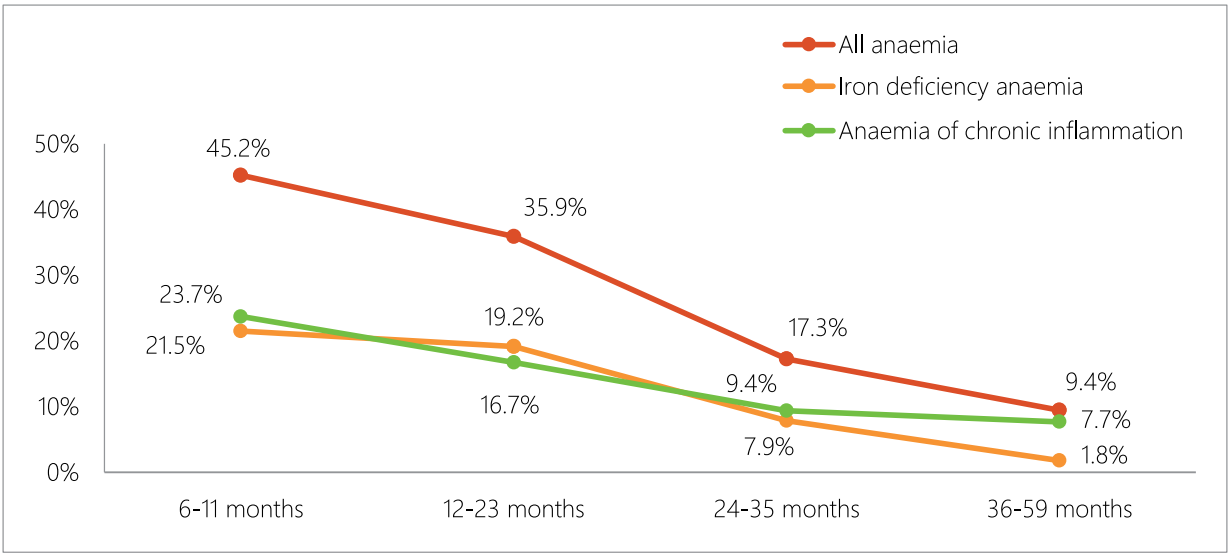

Figure 13. Prevalence of all anaemia, iron deficiency anaemia and anaemia of chronic inflammation in children 6-59 months by age group

The highest prevalence of anaemia and iron deficiency anaemia in the youngest children indicates that iron stores are depleted prior to children turning 6 months of age. This may result from insufficient iron stores at birth due to inadequate maternal iron status and or low iron consumption in children who do not receive exclusive breastfeeding. The NNS V revealed only 83.7% of newborns were breastfed within 1 hour of birth and only 58.3% of children 0-5 months of age were exclusively breastfed, both of which are important to ensure infant iron stores are maintained and not quickly depleted. Feeding children animal milk or unfortified formula and the early introduction of other liquids and complementary foods do not provide adequate iron and increase iron loss through the digestive system, leaving infants at risk for iron deficiency and iron deficiency anaemia.

Once complementary foods are introduced after the age of 6 months, the majority of children start to receive iron-rich foods in their diet which contributes to increasing their iron stores. In the NNS V, consumption of iron was mostly from animal sources, with 87% of children 6-11 months consuming meat in the previous 24 hours compared to only 3.6% of children who received a dark green leafy vegetable. Despite high meat consumption, the > 20% prevalence of iron deficiency anaemia in the 6-11 month age group suggests portion sizes may be too small and or frequency of feeding may not be optimal. While meat consumption improves the absorption of iron, children of all ages had very high consumption of tea which reduces absorption of iron from food. Almost three-quarters of children 6-11 months and 86% of children 12-23 months of age consumed tea and mainly with meals. However, even with this potentially-reduced absorption of iron, children's consumption of iron is likely high enough after 2 years of age to continue to build iron stores as they grow, as evidenced by the lower prevalence of iron deficiency and iron deficiency anaemia in that age group.

Anaemia and iron deficiency anaemia were significantly higher in Khangai and Western regions with the lowest prevalence of anaemia in Eastern region ($P<0.001$) (Figure 14). Though anaemia was due to both iron deficiency and chronic inflammation in Khangai and Western regions, the majority of anaemia was attributed to chronic inflammation which may be associated with the high prevalence of unimproved drinking water and unimproved sanitation and high burden of diarrhoea and fever in young children in these regions.

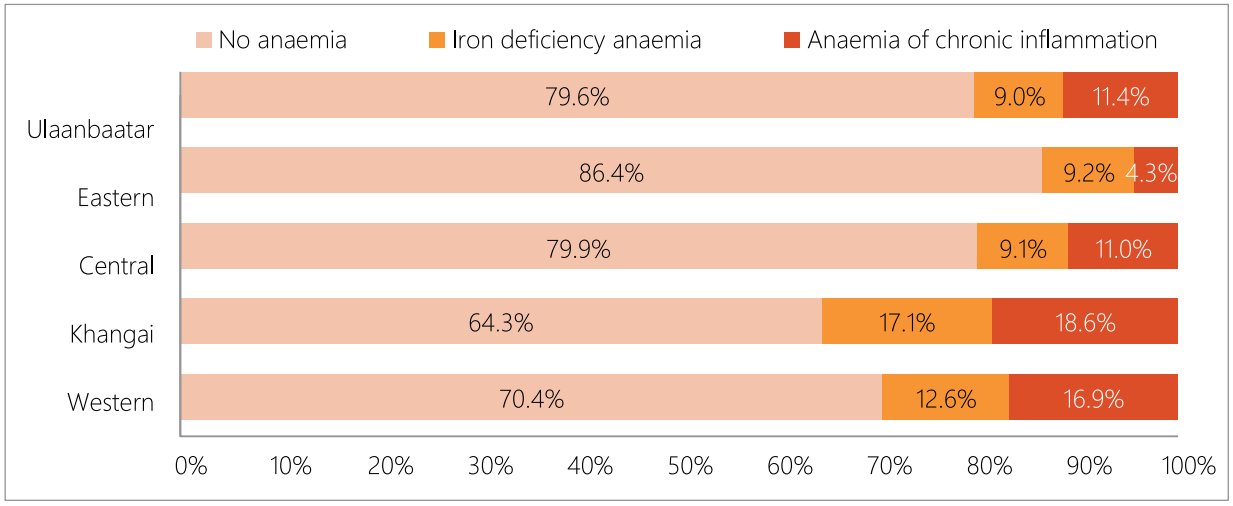

Figure 14. Prevalence of iron deficiency anaemia and anaemia of chronic inflammation in children 6-59 months by region

Anaemia and iron deficiency anaemia were highest in children from households in the poorest two wealth index quintiles, with nearly 1 in 3 children anaemic and over 50% of the anaemia due to iron deficiency. However, the prevalence of anaemia was also relatively high among children in the wealthiest households with 18.5% of these children anaemic (Figure 15).

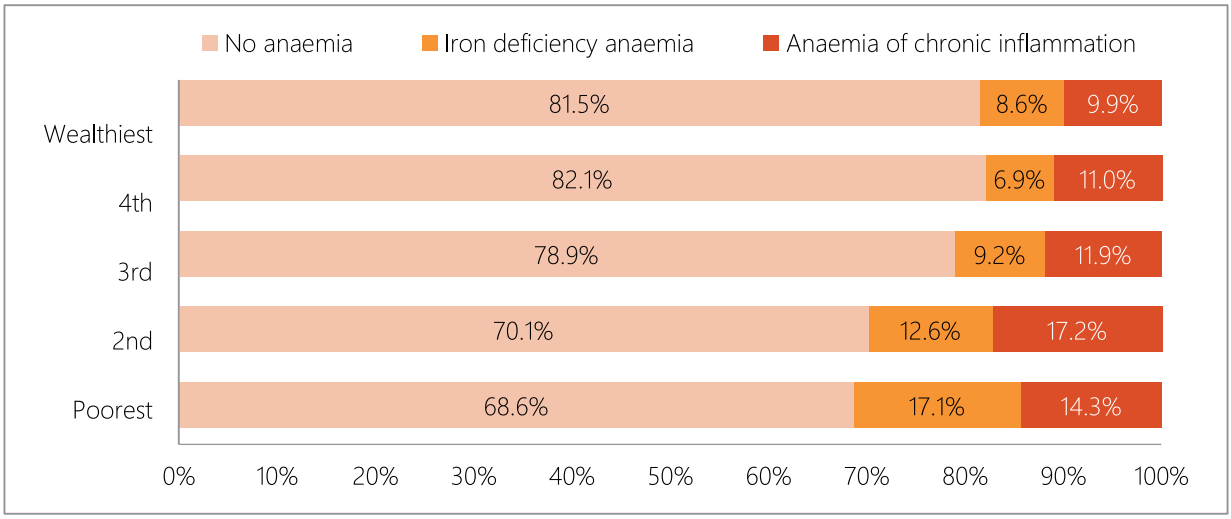

Figure 15. Prevalence of iron deficiency anaemia and anaemia of chronic inflammation in children 6-59 months by household wealth quintile

The NNS V revealed less than one-third of children received any type of iron supplementation or multi-micronutrient containing iron and, of those who received an iron-containing supplement, only one-third received the recommended daily dose of supplementation. Anaemia prevalence was highest in children under 1 year of age while receipt of any form of iron supplementation was low in that age group. Receipt of any form of iron supplementation was highest in children older than 2 years of age who also received more iron-rich foods in their diets and had the lowest prevalence of anaemia (P<0.01) (Figure 16). Young children under 12 months of age were less likely to receive both iron-rich foods and iron supplementation which places them at a higher risk for iron deficiency and iron deficiency anaemia.

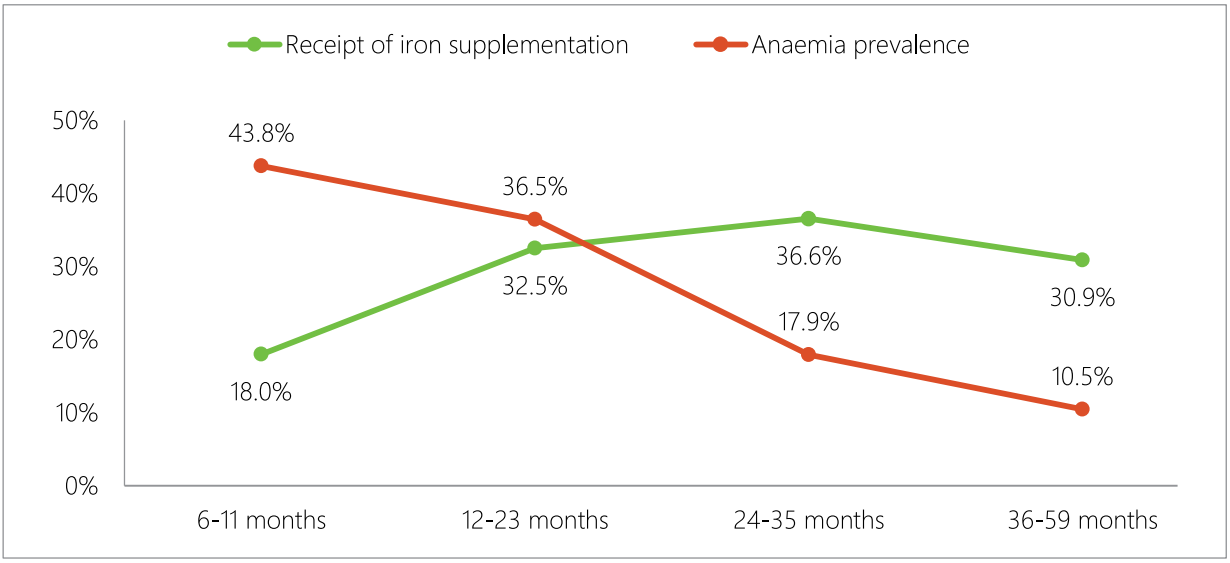

Figure 16. Prevalence of any form of iron supplementation and anaemia in children 6-59 months by age group

Iron status of pregnant women

The NNS V revealed that 29.6% of pregnant women were iron deficient and 21.4% were anaemic, with about 50% of anaemia attributed to iron deficiency and the other 50% to chronic inflammation (Figure 17). Similar to the finding for children, prevalence of both anaemia and iron deficiency anaemia in pregnant women was highest in Khangai and Western regions and lowest in Eastern region (P<0.001).

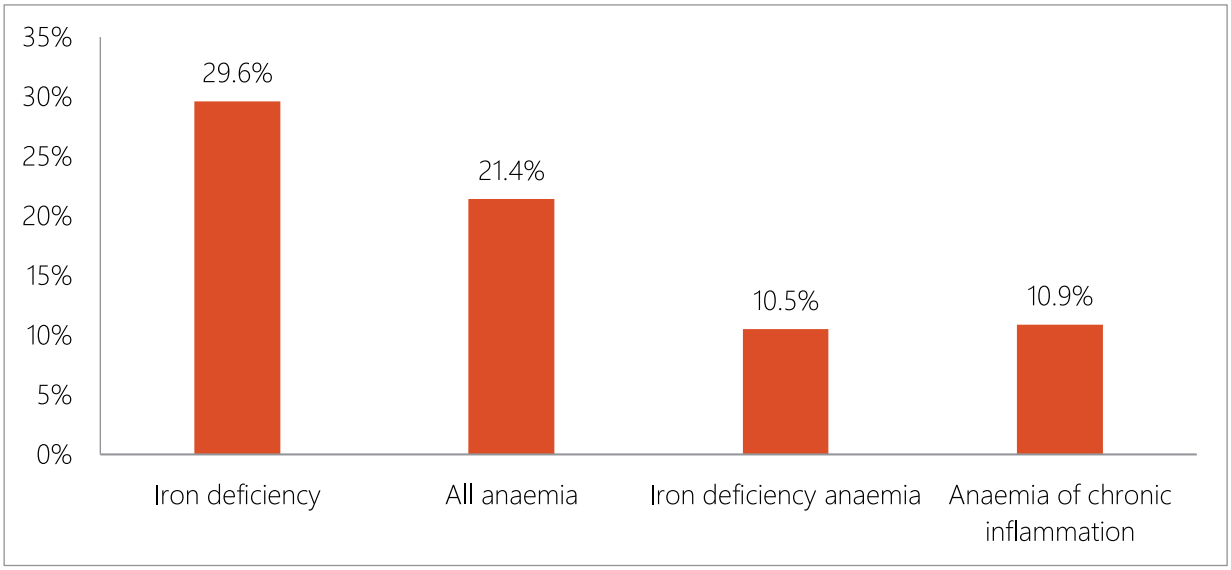

Figure 17. Prevalence of iron deficiency, all anaemia, iron deficiency anaemia, and anaemia of chronic inflammation in pregnant women

Prevalence of both iron deficiency and anaemia, due to iron deficiency and due to chronic inflammation, increased significantly throughout pregnancy with nearly half of pregnant women iron deficient (47.5%) and 28.5% anaemic in their third trimester (Figure 18). A high prevalence of iron deficiency and iron deficiency anaemia late in pregnancy suggests that the high prevalence of anaemia in infants under 6 months of age is due to low iron stores at birth due to poor maternal iron status.

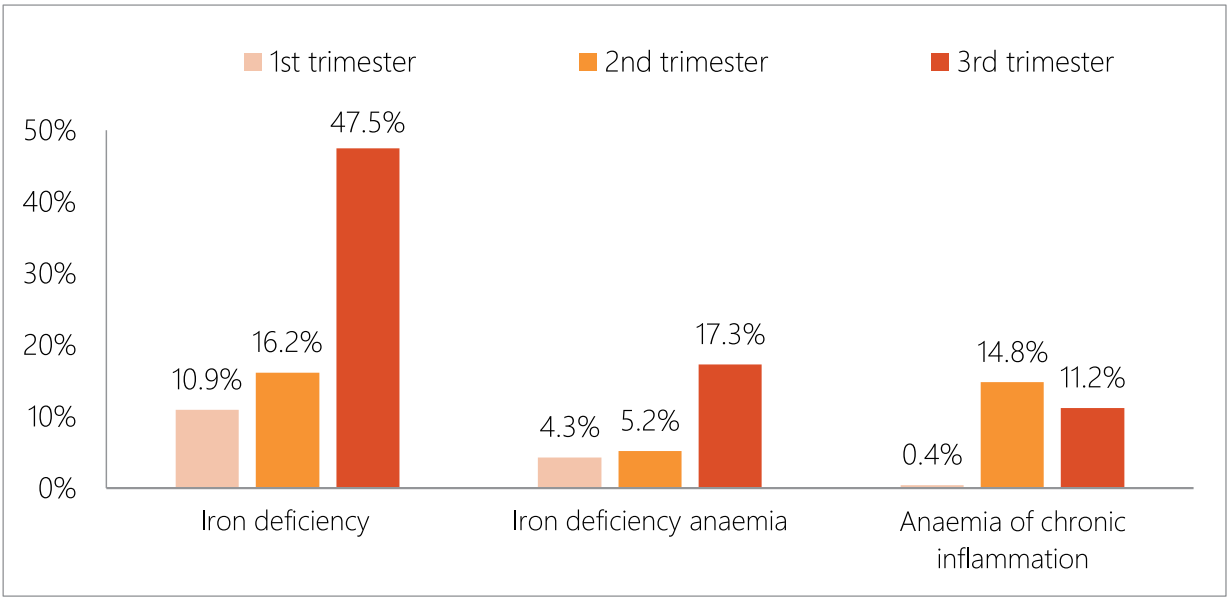

Figure 18. Prevalence of iron deficiency, iron deficiency anaemia, and anaemia of chronic inflammation in pregnant women by trimester

The majority of pregnant women (75%) consumed some type of iron supplementation, with most women having purchased a prenatal multiple micronutrient supplement such as Elevit. Though most women started taking a supplement during the first trimester, compliance with supplementation throughout pregnancy was poor with women taking fewer than the 60 iron folic acid supplements recommended per trimester (Figure 19). Poor compliance with iron folic acid/multi-micronutrient supplementation increases women's risk for iron deficiency, poor foetal development, and complications during delivery.

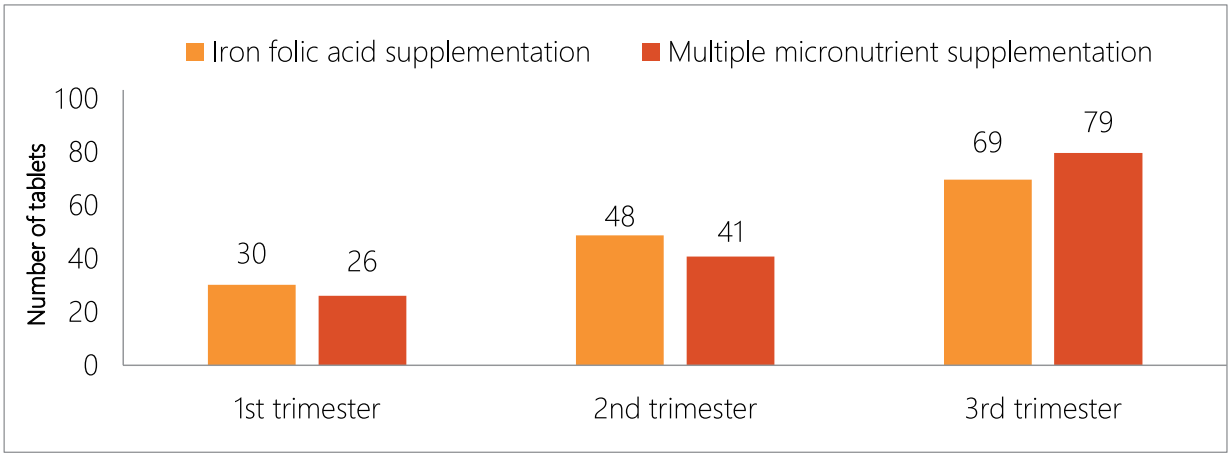

Figure 19. Average number of iron and multiple micronutrient tablets consumed by pregnant women by trimester of pregnancy

Although ANC attendance is very high in Mongolia, only a small percentage (11.3%) of women received the government-mandated multiple micronutrient supplements through antenatal care (ANC) sessions (Figure 20). High ANC attendance early in pregnancy and willingness to purchase multi-micronutrient or iron folic acid supplements indicate that provision of multiple micronutrient supplements through the national government programme is an excellent opportunity to reduce iron deficiency and anaemia in pregnant women and young infants.

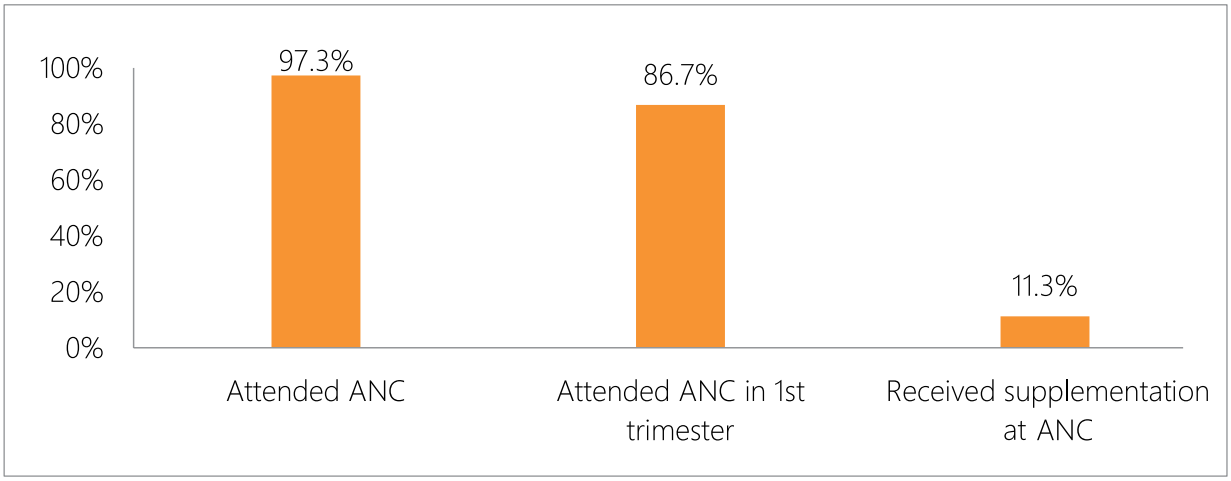

Figure 20. Prevalence of antenatal care attendance and receipt of iron or multiple micronutrient supplementation through antenatal care

Iron status of men

The NNS V revealed a very low prevalence of anaemia and iron deficiency among men 15-49 years of age (Figure 21). Despite high consumption of meat and organ meats by men in Mongolia, there is no indication of iron overload in the male population, with the mean serum ferritin concentration of 141 µg/l well below the 300 µg/l threshold for iron overload. There was no difference in mean serum ferritin concentration or body iron stores by household wealth index quintile or men's nutritional status. Mongolian men 15-49 years of age have adequate iron levels with all indicators of iron status falling within the normal range. There is no indication of iron overload, or risk of iron overload, in men based on current dietary consumption patterns.

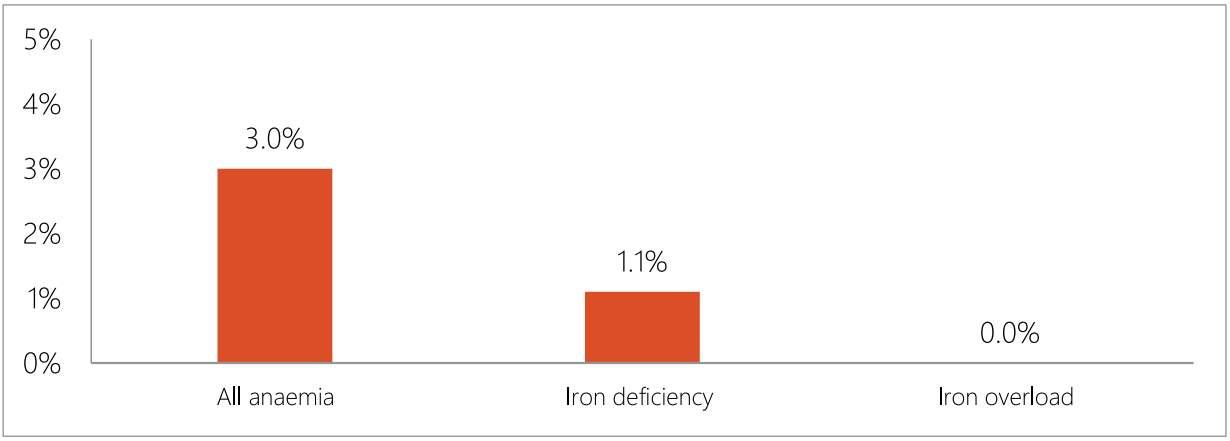

Figure 21. Prevalence of all anaemia, iron deficiency, and iron overload in men 15-49 years

RECOMMENDATIONS FOR POLICY AND PROGRAMMATIC MODIFICATION

Anaemia and iron deficiency are moderate public health problems among pregnant women and young children in Mongolia, with little improvement during the past decade. The prevalence of iron deficiency is highest among children under 1 year of age, indicating infants are becoming anaemic early in life. Children born to women with good iron status will have adequate iron stores at birth and, if exclusively breastfed, they will receive 100% of their iron requirement from breast milk. However, the NNS V revealed that iron status is a concern in pregnant women during the third trimester, with 47.5% of pregnant women iron deficient and 17.3% having fully depleted iron stores resulting in iron deficiency anaemia. Though infants born to mothers with poor iron status are likely to have poor iron stores at birth, suboptimal infant feeding practices exacerbate poor iron stores which can quickly lead to iron deficiency and iron deficiency anaemia in young children. Only 83.7% of newborns were breastfed within 1 hour of birth and only 58.3% of children 0-5 months of age were exclusively breastfed, leaving more than 40% of young infants at increased risk for iron deficiency.

As the prevalence of iron deficiency and iron deficiency anaemia significantly reduce when children grow and start to eat larger portions of iron-rich foods, the focus of iron deficiency and anaemia prevention programmes in Mongolia should be on pregnant women and children under 2 years of age. Strategies to prevent iron deficiency include ensuring adequate maternal iron status during pregnancy through maternal supplementation with iron folic acid or multi-micronutrients, exclusive breastfeeding of infants for the first 6 months, and providing iron-rich complementary foods, iron-fortified foods for children, and or MMPs after 6 months of age.

While ANC attendance is nearly universal in Mongolia, only 11.3% of pregnant women received the government-provided multi-micronutrient supplements during ANC sessions due to lack of supply as a result of insufficient funding. Therefore, the majority of pregnant women purchased a prenatal supplement privately through pharmacies. However, most women did not take the supplement with the proper frequency or quantity to achieve the full health benefit. Provision of multi-micronutrient supplements to all pregnant women through ANC services as part of the national health programme is an excellent way to ensure pregnant women receive their daily requirements of not only iron and folic acid, but also essential iodine and vitamin D. Therefore, the delivery of multi-micronutrient supplements through ANC is a vital strategy to address maternal and infant iron deficiency and anaemia in Mongolia.

Counselling during ANC should focus on increasing compliance with multiple micronutrient supplementation through creating greater awareness about the importance of taking supplements daily throughout pregnancy and addressing concerns women experience with consuming supplements. Also, educating pregnant women on the importance of having a diverse diet and good food sources of iron and other micronutrients should be a key component of prenatal care.

As women and children have the highest prevalence of both iron deficiency and iron deficiency anaemia in Mongolia, policy and decision-makers should consider food fortification to ensure women have adequate iron and folic acid status prior to pregnancy and to increase the iron content of children's foods. The fortification of wheat flour with iron and folic acid is a proven effective strategy and should be considered

in Mongolia to improve iron and folic acid intake of vulnerable women of reproductive age and children and the wider Mongolian population, given the low risk of iron overload in men.

Appropriate infant and child feeding practices are important to ensure young children meet their dietary requirements for iron and other essential nutrients. Encouraging these behaviours involves counselling mothers during pregnancy and the postpartum period on appropriate breastfeeding practices, particularly early introduction of breastfeeding and exclusive breastfeeding, and introducing iron-rich complementary foods after 6 months such as meat, liver, eggs, dark green leafy vegetables, and iron-fortified infant cereals. In areas where children are not able to meet their high nutritional requirements through their diet alone, provision of MMPs should be implemented to reduce the risk of iron deficiency and improve overall consumption of essential vitamins and minerals. Targeted supplementation is particularly important for the poorest households where iron-rich and other nutritious foods may be in limited supply. MMPs have shown to be a safe, effective, and affordable intervention for reducing iron deficiency and anaemia in children 6-23 months of age in many countries[16]. The WHO recommends fortification of complementary foods with iron-containing multi-micronutrient powders to improve iron status and reduce anaemia in infants and young children 6–23 months of age where the prevalence of anaemia in children under 2 years of age or under 5 years of age is 20% or higher[17].

The NNS V revealed that half of all anaemia in pregnant women and children is due to anaemia of chronic inflammation. Therefore, factors contributing to repeated infection such as intestinal parasites that affect iron absorption and cause blood loss should be identified with measures to prevent and treat these infections. As poor sanitation is a problem for one-third of the population in Mongolia, the promotion of good hygiene and sanitation should be a priority as it has far-reaching impact on health and well-being. As anaemia due to iron deficiency and chronic inflammation is highest in pregnant women and children in the poorest households, efforts should focus on targeting these most vulnerable populations who are at higher risk of becoming anaemic due to poorer quality diets and lack of sanitation.

Iron deficiency is a public health concern for pregnant women and children in Mongolia. Interventions should focus on ensuring adequate iron levels for women during pregnancy and for infants and young children especially during the critical first two years of life. Reaching this goal requires an integrated approach that includes dietary improvement, supplementation, and public health measures for infection and disease control.

Key recommendations to reduce the prevalence of iron deficiency and anaemia in women and children under 5 years of age in Mongolia

- Provide multi-micronutrient supplements to all pregnant women through antenatal care (ANC) visits from the first trimester along with counselling messages to increase compliance with supplementation throughout pregnancy
- Improve breastfeeding practices with increased early initiation of breastfeeding within 1 hour of birth and exclusive breastfeeding for infants under 6 months of age
- Improve consumption of iron-rich complementary foods for young children under 2 years of age:
  - Provide counselling to mothers on preparing iron-rich complementary foods such as bantan with increased amounts of meat or liver, or iron-fortified infant cereals for young children Provide multi-micronutrient supplements to all pregnant women through antenatal care (ANC) visits from the first trimester along with counselling messages to increase compliance with supplementation throughout pregnancy
- Provide multiple micronutrient powders (MNPs) to children 6-23 months of age where iron-rich foods are not affordable or not available
- Implement mandatory fortification of wheat flour with iron and folic acid to improve iron status of women of reproductive age, children and adolescent girls with no risk of iron overload in men
- Improve access to safe drinking water and sanitation and implement other public health measures for disease and infection control

16 De-Regil L.M., Suchdev P.S., Vist G.E., Walleser S., Pena-Rosas J.P. Home fortification of foods with multiple micronutrient powders for health and nutrition in children under two years of age. Evid. Based Child Health. 2013; 8: 112–201. doi: 10.1002/ebch.1895.

17 WHO guideline: Use of multiple micronutrient powders for point-of-use fortification of foods consumed by infants and young children aged 6–23 months and children aged 2–12 years. Geneva: World Health Organization; 2016.

Overweight and Obesity Status

WHAT ARE OVERWEIGHT AND OBESITY AND HOW ARE THEY MEASURED?

Overweight and obesity are conditions of overnutrition resulting from consumption of more calories than the body requires leading to excess body fat accumulation. The prevalence of both overweight and obesity is increasing globally in all age groups in high, middle, and low-income countries and is largely attributed to the "nutrition transition" with a shift from traditional diets to readily available and inexpensive high-energy and low-nutrient foods. The move away from traditional to "junk" foods often occurs at the same time as populations transition from daily physical activity to increasingly sedentary lifestyles with more time spent in front of a phone, computer, or television, furthering increasing the risk of becoming overweight. People who are overweight or obese are at higher risk for serious health problems including hypertension, heart disease, stroke, diabetes, some cancers, and osteoarthritis. The increase in overweight and obesity is accompanied by a dramatic increase in global prevalence of these chronic diseases. While the long-term repercussions of overweight and obesity are severe, they are largely preventable and treatable through good diets and healthy lifestyle behaviors.

Overweight and obesity are defined in adults by their Body Mass Index (BMI), which is a person's weight in kilograms divided by the square of the person's length or height in meters (kg/m^2)[18]. In adult men and women, overweight is defined as BMI ≥ 25 kg/m^2 and obesity is defined as BMI ≥ 30 kg/m^2. For school-aged children and adolescents (5-19 years), overweight is defined as BMI-for-age that is more than 1 standard deviation above the WHO growth reference median and obesity is defined as BMI-for-age that is more than 2 standard deviations above the WHO growth reference median[19]. For children under 5 years of age, overweight is defined as weight-for-height that is more than 2 standard deviations above the median of the WHO Child Growth Standards reference population[20].

WHAT CAUSES OVERWEIGHT AND OBESITY?

Overweight and obesity are the result of excessive weight gain created by an imbalance between calories consumed from the diet and calories used in daily activity. Genetics also play a role. There has been a global increase in the consumption of poor quality diets that are high in energy (calories) and low in nutritional value, with a concurrent increase in the amount of time people spend in sedentary behaviors with reduced physical activity. While adults have the highest prevalence of overweight and obesity globally, the availability and affordability of unhealthy "junk" foods containing high amounts of fat, sugar, and salt are increasingly associated with both overweight and obesity in school-aged children and adolescents[21]. This is particularly evident in urban areas where marketing and availability of unhealthy foods more prevalent and sedentary lifestyles are more common.

Maternal nutrition is an important factor in overweight children as maternal overweight and obesity during gestation are associated with larger and heavier babies[22,23]. Babies with high birth weight (≥ 4000g) are twice as likely to be overweight than babies born at a normal weight in adulthood. High birth weight babies also have an increased risk, in adulthood, of developing type 2 diabetes and hypertension, conditions that are linked to being overweight. Along with maternal overweight, high infant birth weight, and being

18 http://www.who.int/mediacentre/factsheets/fs311/en/

19 http://www.who.int/nutrition/publications/growthref_who_bulletin/en/. The new curves are closely aligned with the WHO Child Growth Standards at 5 years, and the recommended adult cut-offs for overweight and obesity at 19 years. They fill the gap in growth curves and provide an appropriate reference for the 5–19-year age group.

20 WHO Multi-centre Growth Reference Study Group. WHO Child Growth Standards based on length/height, weight and age. Acta Paediatr Suppl 2006; 450: 76-85

21 K. Schellong et al. Birth weight and long-term overweight risk: Systematic review and a meta-analysis including 643,902 persons from 66 studies and 26 countries globally. PLos One 7 (2012): e47776.

22 Miao Miao et al. Influence of maternal overweight, obesity and gestational weight gain on the perinatal outcomes in women with gestational diabetes mellitus. Scientific Reports 7, Article number: 305 (2017). Doi: 10.1038/s41598-017-00441-z.

23 Catalano PM., Ehrenberg HM. Review article: The short- and long-term implications of maternal obesity on the mother and her offspring. BJOG: Volume 113, Issue 10. October 2006: Pages 1126-1133. DOI: 10.1111/j.1471-0528.2006.00989.x.

overweight in childhood, there is increasing evidence that early childhood undernutrition, such as stunting and wasting, is associated with a higher risk of being overweight and obese in adulthood through reduced metabolic function[24]. Good nutrition practices by women prior to conception, during gestation, and throughout infancy and childhood are important to reducing a child's risk of becoming overweight.

WHAT IS THE STATUS OF OVERWEIGHT AND OBESITY IN THE MONGOLIAN POPULATION?

The NNS V revealed a high prevalence of overweight and obesity in all regions and among all population groups in Mongolia, with almost half of mothers (46.2%) and men 15-49 (48.8%) years of age overweight or obese (Figure 22). Most concerning is that more than 1 in 4 school-aged children (28.6%) are overweight or obese and 1 in 8 children under 5 years of age (11.7%) are overweight, indicating that practices leading to overweight and obesity in Mongolia are being established from an early age.

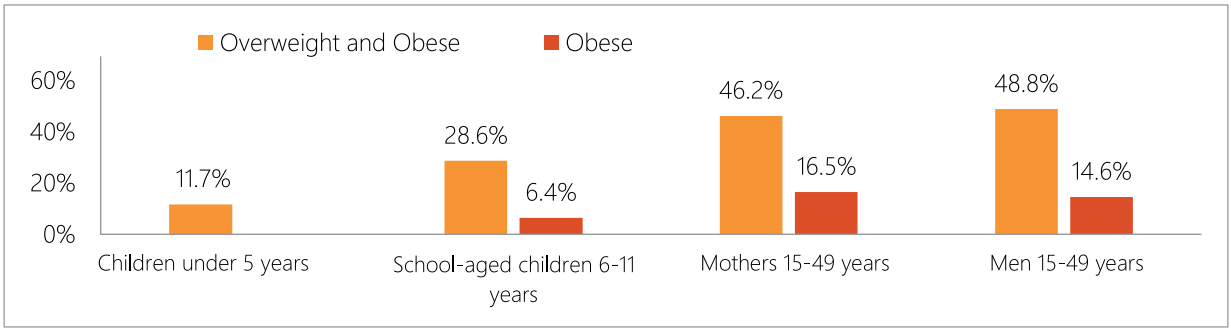

Figure 22. Prevalence of overweight and obesity by population group

Mothers and men 15-49 years

The prevalence of overweight and obesity is universally high among adults in Mongolia and has significantly increased since the 2010 NNS IV. Compared to the NNS IV which showed 32.9% of women 15-49 years of age were overweight or obese, the NNS V revealed a 40% increase in overweight or obesity with nearly half (46.2%) of mothers aged 15-49 years overweight or obese (P<0.001). The prevalence of obesity in mothers increased 49% from 11.1% to 16.5% from the NNS IV to NNS V (P<0.001). In men 15-49 years of age, both overweight and obesity increased dramatically since the 2010 NNS IV and 2016 NNS V. Overweight and obesity increased 76% with 1 out of every 2 men overweight or obese in Mongolia in the NNS V. The prevalence of obesity in men increased by a staggering 147% from 5.9% in the NNS IV to 14.6% in the NNS V.

The prevalence of overweight was highest in Western region for men and Eastern region for mothers, however more than 40% of both mothers and men were overweight or obese in all regions (Figure).

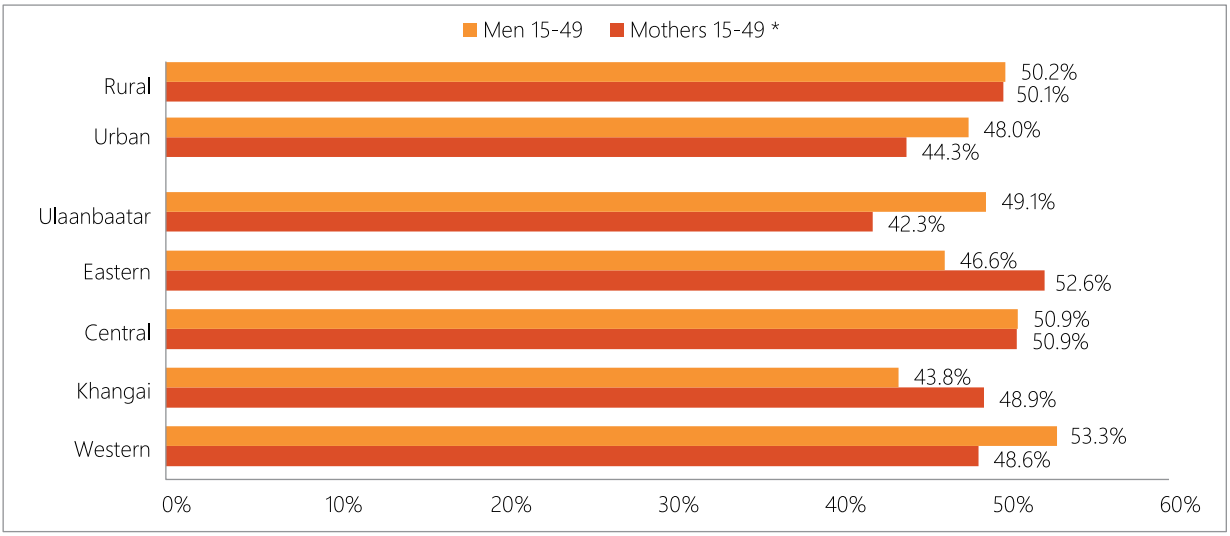

Figure 23. Prevalence of overweight and obesity in mothers and men 15-49 years by region

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There was little difference in the prevalence of overweight and obesity in mothers by household wealth index quintile (Figure 24). In men, however, the prevalence of overweight and obesity increased significantly by wealth index quintile, with the highest prevalence among men in wealthier households (P<0.001).

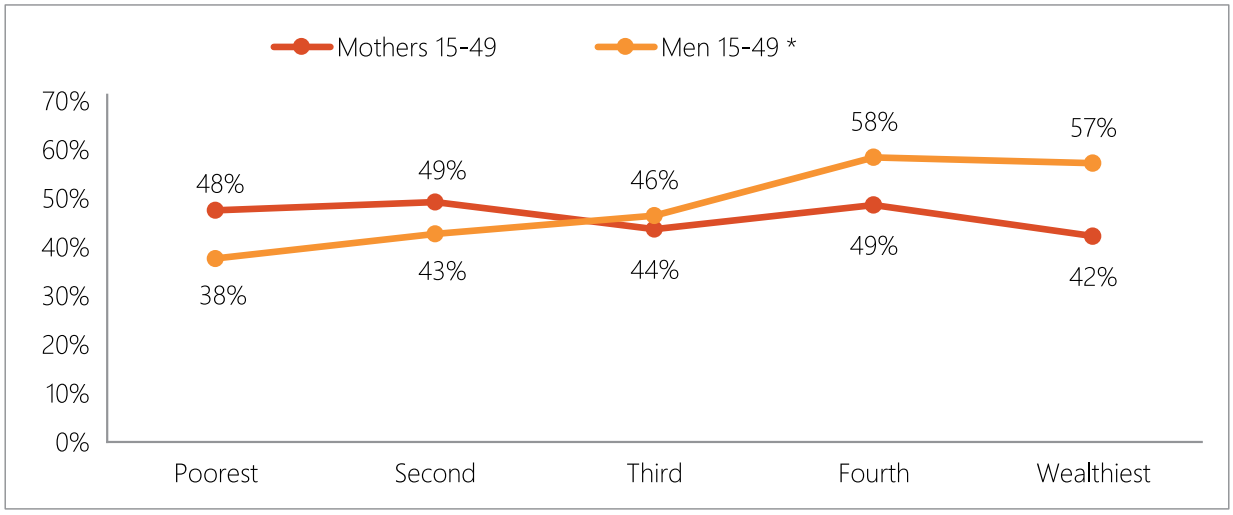

Figure 24. Prevalence of overweight and obesity in mothers and men 15-49 years by household wealth index quintile

Figure 25 presents the association between household food security status and the prevalence of overweight and obesity among mothers and men. In men, the prevalence of both overweight and obesity significantly reduced with increasing household food insecurity (P<0.01), while there was no difference in the prevalence of overweight and obesity for mothers by household food security status. The prevalence of both overweight and obesity was high even in severely food insecure households with over 40% of mothers and men either overweight or obese.

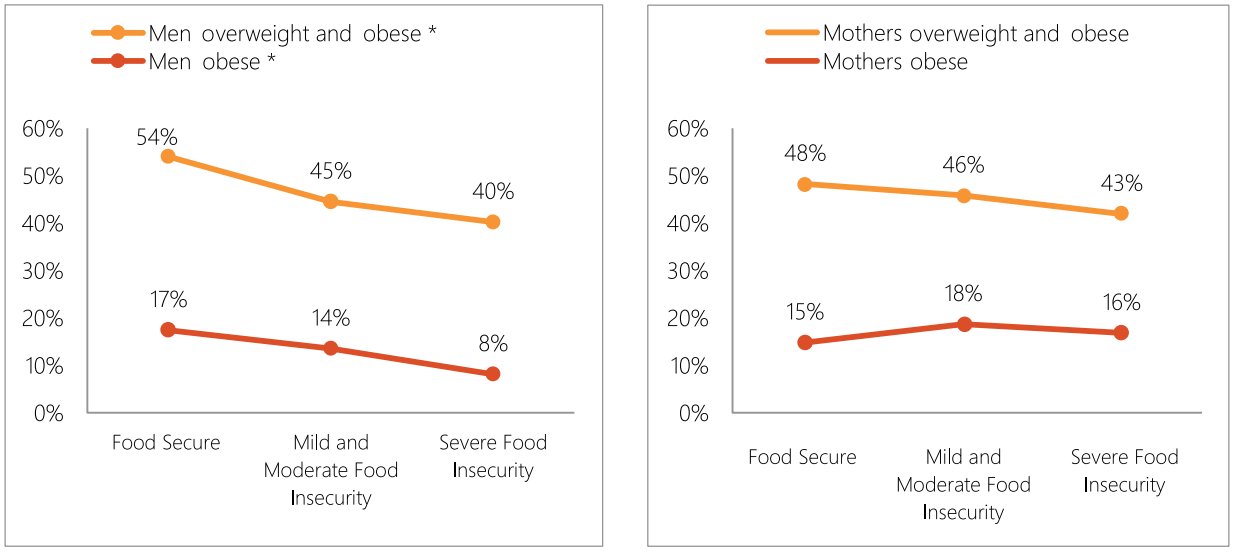

Figure 25. Prevalence of overweight and obesity in mothers and men 15-49 years by household food security status

There was no strong correlation between overweight and obesity in mothers and men and the consumption of a diverse diet or "junk" foods. Consumption of high-energy and low-nutrient foods like cakes, cookies, fried snacks, and sugar-sweetened beverages was high for both mothers and men, with 57% of mothers and 65% of men having consumed at least one sugar-sweetened beverage in the previous 24 hours. By comparison, consumption of high-nutrient and low-calorie foods, such as dark green leafy vegetables, was poor with only 13% of mothers and 11% of men reporting consumption of spinach, kale, and other dark green leafy vegetables in the previous 24 hours.

School children 6-11 years

Overweight and obesity have dramatically increased in school children from 4.3% in the NNS IV (7-11 year old) to 28.6% in the NNS V (6-11 year old) (P<0.001). The severity of overweight also increased with obesity rising from 0.6% to 6.4%, indicating that children are not only becoming increasingly overweight, but they are also transitioning to obesity at a young age. Overweight and obese children are at increased risk of having chronic health problems such as type 2 diabetes, asthma, and risk factors for heart disease and they are more likely to be obese as adults.

Unlike adults, the prevalence of overweight in school children 6-11 years was higher in urban (23.9%) compared to rural (17.6%) areas (P<0.01) and it was highest in Ulaanbaatar (25.6%, P<0.01) (Figure 26). In urban areas, the prevalence of obesity was also higher (7.4%), compared to rural areas (3.7%) (P<0.01). Boys had a higher prevalence of overweight (26.6 %) compared to girls (17.8%) and had over double the prevalence of obesity (9.0%) compared to girls (3.8%) (P<0.001).

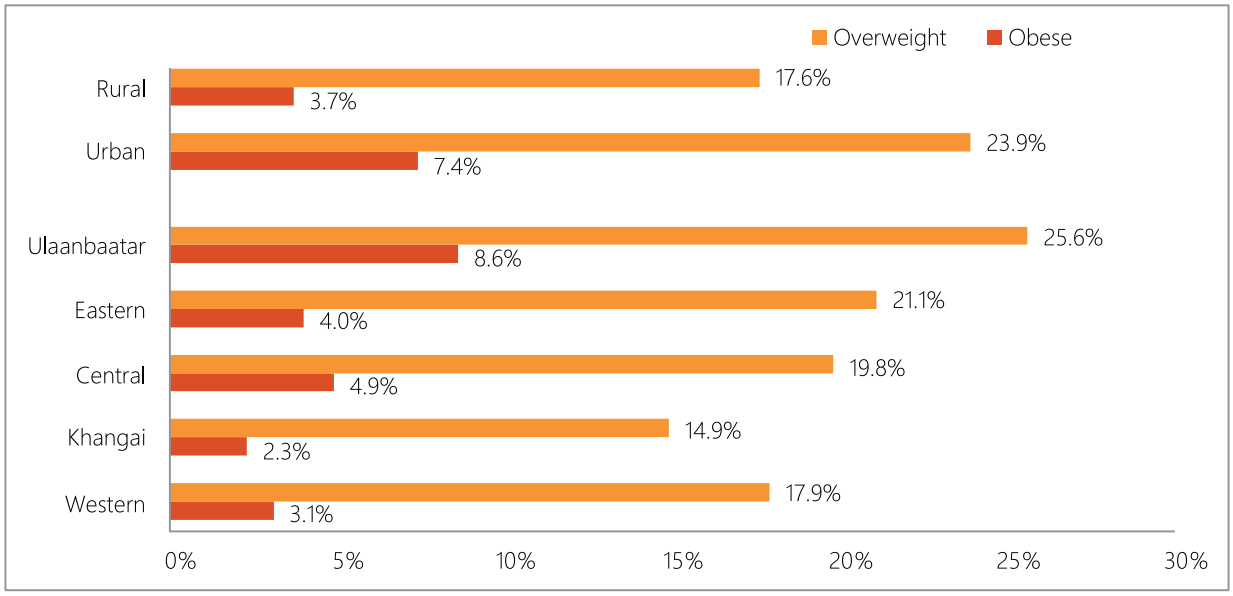

Figure 26. Prevalence of overweight and obesity in school children 6-11 years by area and region

For school children, increased exposure to and consumption of unhealthy "junk" foods and lower levels of physical activity are considered to be key drivers of weight gain. The NNS V revealed high levels of consumption of sugar-sweetened beverages and tea, such as carbonated soda and sweetened teas by school children 6-11 years with 81% consuming these drinks at least once a week. Consumption of other "junk" items including fried snacks such as chips and crisps and sweet foods like cakes, cookies, and pies was nearly universal amongst children 6-11 years with 99% consuming these types of foods at least once in the previous week.

Of children in Central, Eastern, Khangai, and Western regions, 99% had a physical education class in their school, with lower coverage (89%) in Ulaanbaatar. While children had access to physical education classes and attendance was high in all regions, the majority of children received only two classes per week which is insufficient to meet the WHO's recommended 60 minutes of moderate to vigorous physical activity for children per day[25].

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Children under 5 years

Among children under 5 years of age, the prevalence of overweight remained consistently high at 11.7%, with no significant change from the 10.5% prevalence of overweight measured in the 2013 Social Indicator Sample Survey. There was no difference in overweight prevalence among children by gender, age, wealth index quintile or region, however child birth weight was strongly correlated with the prevalence of overweight in children under 5 (P<0.001). Nearly 13% of children under 5 were born with high birth weight (≥ 4000g), with a significantly higher prevalence among boys (15.9%) compared to girls (9.5%) (P<0.001). "The prevalence of overweight was higher (19.9%) among children with high birth weight, compared to those born with normal weight (11%) or low birth weight (2.7%) (P<0.001) (Figure 27).

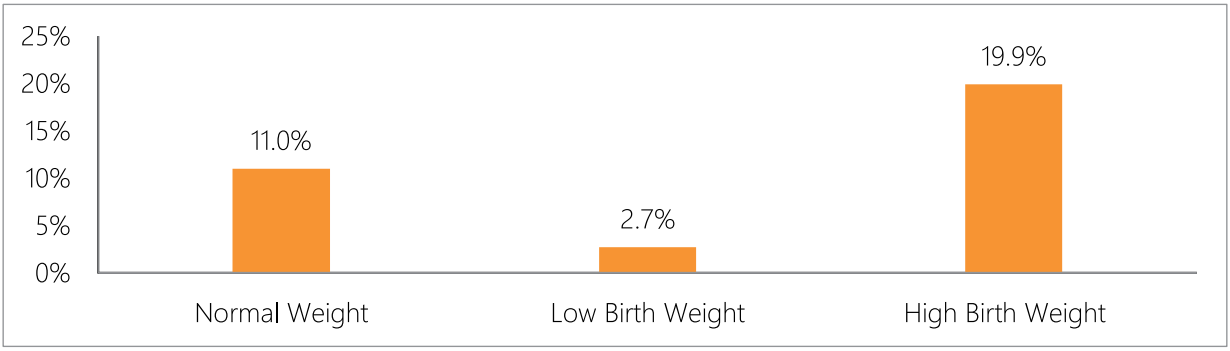

Figure 27. Prevalence of overweight in children under 5 by birth weight category

Maternal nutrition status was strongly correlated with high birth weight. Of children born to currently overweight or obese mothers, 17% had high birth weight compared to only 8% of those born to mothers with normal weight (P<0.01) (Figure 28). Maternal nutrition status was also significantly associated with child overweight with the highest prevalence of overweight among children whose mothers were themselves overweight or obese (P<0.05).

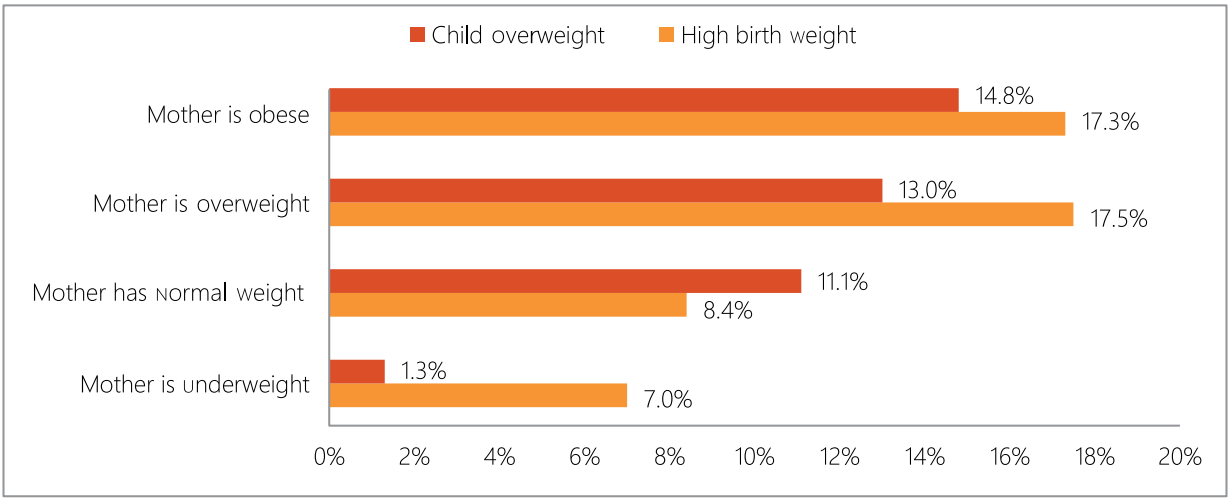

Figure 28. Prevalence of high birth weight and child overweight by mother's current weight status

Recent evidence indicates that early childhood undernutrition is associated with an increased risk of overweight and obesity in adulthood due to altered metabolism during infancy and childhood[26]. In the NNS V, stunted children had a significantly higher prevalence of overweight (20.5%) compared to children with normal height (11.0%) (P<0.01) (Figure 29).

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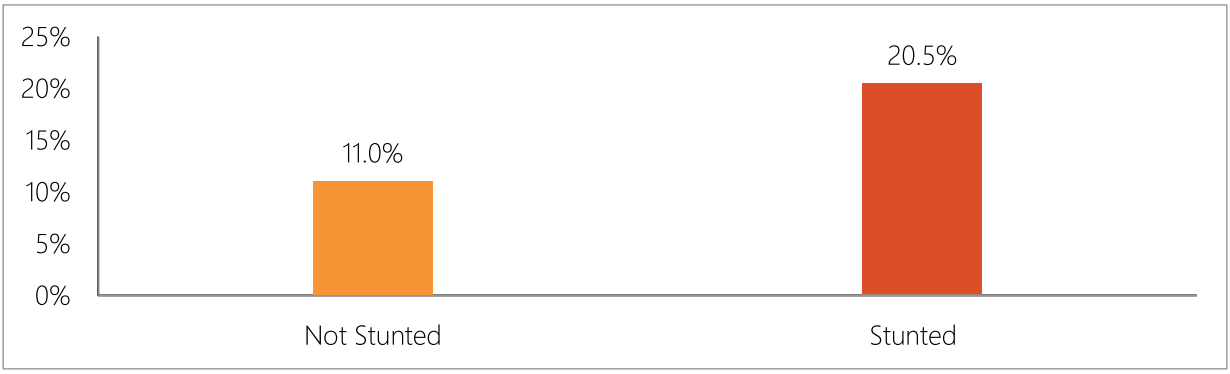

Figure 29. Prevalence of child overweight by child's stunting status

RECOMMENDATIONS FOR POLICY AND PROGRAMMATIC MODIFICATION

Overweight and obesity is arguably the greatest public health concerns in Mongolia. The prevalence of overweight and obesity are high in adults, school children, and young children and has increased dramatically within the last decade. Addressing and preventing the high and growing prevalence of overweight and obesity in Mongolian adults and children are vitally important to not only the health of the country's people, but the Mongolian economy as obesity is linked to increased medical costs, reduced productivity, and reductions in educational attainment and achievement27. For example, obesity is a leading cause of cardiovascular disease which, alone, constitutes 55% of all hospitalizations in Mongolia and is responsible for 37% of all deaths in the country[28].

The reduction of overweight and obesity in Mongolia requires a multiprong strategy to address the lifecycle factors contributing to excess weight gain. Mongolians have unique eating patterns with predominantly high-energy diets from meat, dairy products, and grains, especially among traditional herders in rural areas who generally lack a diverse diet. These food consumption practices are linked to a high risk of overweight and obesity, but are traditionally balanced by a high level of physical activity. Mongolia's rapid economic growth and urbanization in recent years have produced a dietary transition towards consumption of unhealthy, Western-influenced "junk" foods and reduced physical activity for both children and adults in urban and rural areas. WHO recommended government policies designed to make "junk" foods less desirable include taxation of high-energy low-nutrient foods such as sugar-sweetened beverages and mandatory advertising restrictions for promoting junk foods to children[28]. The use of "sugar taxes" can reduce the consumption of empty calorie soft drinks and sugary drinks while providing much needed funding for obesity prevention programmes. Mandatory advertising restrictions of junk foods to children are an effective tool to reduce children's exposure to unhealthy food messages and reduce consumer demand for junk foods.

While making "junk" foods less desirable is an important component of reducing the obesity epidemic in Mongolia, government policies are also needed to increase production, availability and affordability of healthy foods and to increase opportunities for physical activity. The school environment provides a focused opportunity to introduce healthy lifestyles to children under a controlled environment to address rapidly growing prevalence of overweight and obesity in young school children. Nutrition guidelines for school canteens, mandatory physical education with provision of school-based sports, and integrated education on healthy lifestyles, as recommended by the WHO, are all key components of addressing child obesity[29].

The prevention of overweight and obesity in Mongolia requires a lifecycle approach with a focus on good prenatal, infant, child, adolescent, and adult nutrition. During antenatal care, increased attention is required for monitoring maternal weight gain to prevent high birth weight and providing counselling to

27 Hammond RA, Levine R. The economic impact of obesity in the United States. Diabetes, metabolic syndrome and obesity: targets and therapy. 2010; 3: 285-295. doi:10.2147/DMSOTT.S7384.

28 S.Ariuntuya, Kh.Narantuya, S.Davaajargal, T.Enkhjargal, & T.Unurtsetseg. (2011). Health Indicator Mongolia 2011. Government of Mongolia

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parents on the risks associated with overweight in their children. Support for exclusive breastfeeding and appropriate child feeding are also vital for starting healthy eating habits for children and preventing the onset of obesity from a young age.

Overweight and obesity are reaching alarming levels in all regions and socioeconomic groups of Mongolia and require urgent action. The country is now faced with a double burden of malnutrition, an increasing prevalence of overweight and obesity and its related illnesses coexisting with a high prevalence of undernutrition in the form of micronutrient deficiencies, which places a huge burden on the health system.

A reduction in overweight and obesity in the Mongolian population can be achieved through a comprehensive strategy that focuses on increasing public awareness, improving dietary quality through available, affordable, and accessible healthy foods, and national, regional, and local actions to increase physical activity in all population groups. Preventing and treating excess weight gain in children is critical to averting overweight and obesity and their serious health consequences later in life.

Key recommendations to reduce the prevalence of overweight in children under 5 years of age and school-aged children in Mongolia

- Implement government policies to make unhealthy "junk" foods less desirable
  - Introduce a tax on high-energy low-nutrient foods such as sugar-sweetened beverages
  - Implement mandatory advertising restrictions for marketing and selling of "junk" foods to children
- Introduce government policies to increase the production, availability, and affordability of healthy foods and increase physical activity with a focus on the school environment
  - Mandatory nutrition guidelines for school canteens
  - Mandatory physical education with provision of school-based sports
  - Integrate education on healthy lifestyles into school curriculum
- Implement a lifecycle approach to the prevention of overweight and obesity
  - Increase attention to monitoring maternal weight gain through antenatal care (ANC) to prevent high birth weight
  - Provide counselling to parents on the risks associated with excess weight in children
  - Support exclusive breastfeeding and appropriate child feeding to prevent overweight from a young age and instil healthy eating habits for children

Household Food Security Status

WHAT IS FOOD SECURITY?

Food security is "the condition in which all people at all times have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life"[30]. Food security requires sufficient supply of food, physical and economic access to food, and proper utilization of food through safe preparation methods, equitable food consumption in the household, and good health status to properly absorb nutrients from food to meet physiological requirements[31]. In order for a household to be food secure, all members of the household must not only have sufficient quantity of food to meet their caloric requirements, but also the types of food they prefer to consume. Multiple political, economic, social, cultural, and environmental factors affect food security, with seasonal food shortages common during the "lean" season when harvest crops are depleted and desirable foods like fruits, vegetables, meat, and dairy products are not readily available. The lack of food security, due to inadequate access to sufficient calories and to a variety of nutrient-dense foods, is a leading cause of global malnutrition.

HOW WAS FOOD SECURITY MEASURED IN THE NNS V?

There are various factors affecting household food security that vary by region and season. Standard indicators have been developed to assess household food security across countries and within countries. The most commonly used measure is the Household Food Insecurity Access Scale (HFIAS)[32] which is used to assess prevalence of household food insecurity based on a household's access to sufficient quantity of food and the types of foods household members prefer to consume. The HFIAS is a particularly useful measure for identifying vulnerable households for targeted interventions and for assessing changes in prevalence of household food insecurity over time. The HFIAS is comprised of 9 yes/no questions that assess the occurrence of specific events that move from less serious to more serious, representing an increased level of severity of food insecurity. Each question includes a follow-up frequency question to determine how often the event occurred during the previous 30 days, with frequency categorized as rarely (1 or 2 times), sometimes (3 to 10 times), or often (more than 10 times). Responses to these questions are used to calculate an HFIAS score for each household. Based on the score, a household's food security status is categorized as food secure, mildly food insecure, moderately food insecure, or severely food insecure with prevalence estimates calculated for each level of severity. A higher score indicates more food insecurity and a low score indicates less food insecurity in the household.

The HFIAS questions (Table 6) are grouped based on anxiety or uncertainty about household food supply and the household's access to sufficient quality and quantity of food. The physical consequences or behaviors taken by household members to adapt to a lack of food quality and quantity, such as eating non-preferred foods or having smaller meals, are also examined.

Table 6. Household Food Insecurity Access Scale questions

Anxiety and uncertainty about the household food supply
Did you worry that your household would not have enough food?
Insufficient quality of food and its consequences
Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?
Did you or any household member have to eat a limited variety of foods because of a lack of resources?
Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?

30 FAO. 2002. The State of Food Insecurity in the World 2001.

31 https://publichealthreviews.biomedcentral.com/articles/10.1186/s40985-017-0056-5

32 Coates, Jennifer, Anne Swindale and Paula Bilinsky. 2007. Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide (v. 3). Washington, D.C.: FHI 360/FANTA.

Insufficient quantity of food and its consequences
Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
Did you or any household member have to eat fewer meals in a day because there was not enough food?
Was there ever no food to eat of any kind in your household because of a lack of resources to get food?
Did you or any household member go to sleep at night hungry because there was not enough food?
Did you or any household member go a whole day and night without eating anything because there was not enough food?

RESPONSES TO HFIAS QUESTIONS

In this section, responses to the 9 HFIAS questions in the NNS V survey are presented and discussed. Results are presented according to the three domains of anxiety about food availability, insufficient quality of food, and insufficient quantity of food in the household.Worry and anxiety about food availability

Anxiety or worry about not having enough food to eat was reported in both food secure and food insecure households, although it was most prevalent (69.0%) in severely food insecure households (Figure 30).

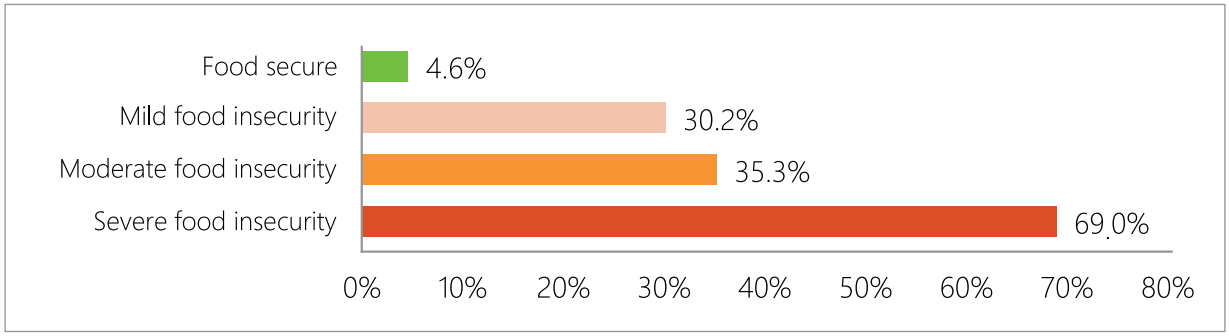

Figure 30. Percentage of households with anxiety about not having enough food, by food security status

INSUFFICIENT QUALITY OF FOOD AND ITS CONSEQUENCES

The following three questions explored quality of the household food supply through focusing on food variety and consumption of preferred foods. In more than half of mildly, moderately, and severely food insecure households, at least one household member was not able to eat their preferred foods due to a lack of household resources (Figure 31).

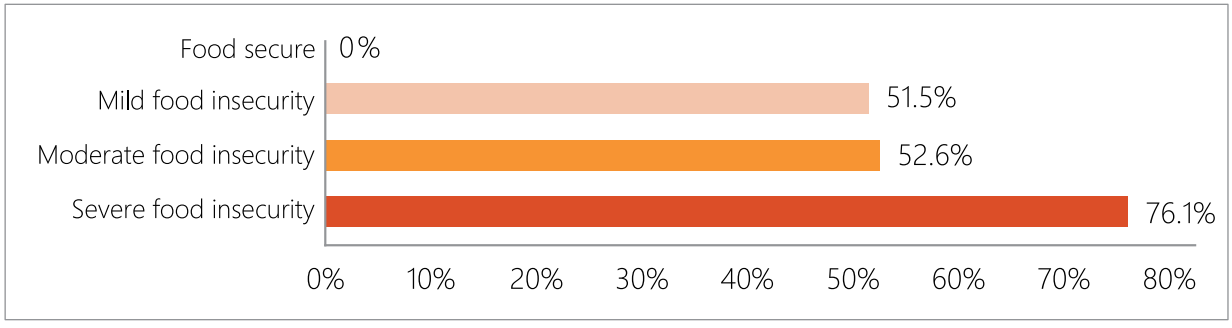

Figure 31. Percentage of households with any members not able to eat prefered foods, by food security status

Situations where a household member had to eat a limited variety of foods due to the household's lack of access to other foods occurred in over 86% of moderately and severely food insecure households and 62% of mildly food insecure households (Figure 32).

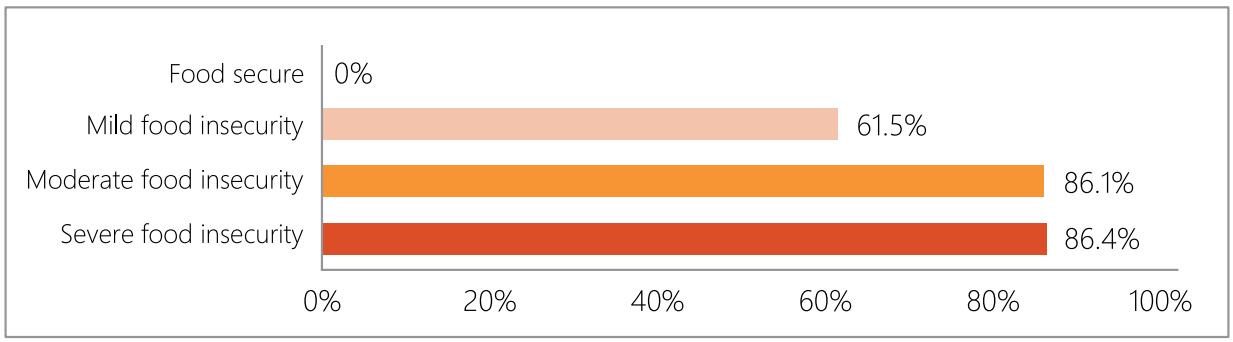

Figure 32. Percentage of households with any members that have to eat a limited variety of foods, by food security status

The last question relating to the household's access to sufficient quality of foods examined whether a household member had to eat undesired foods out of necessity due to a lack of household resources to obtain other foods. This was most prevalent (40.9%) in severely food insecure households (Figure 33).

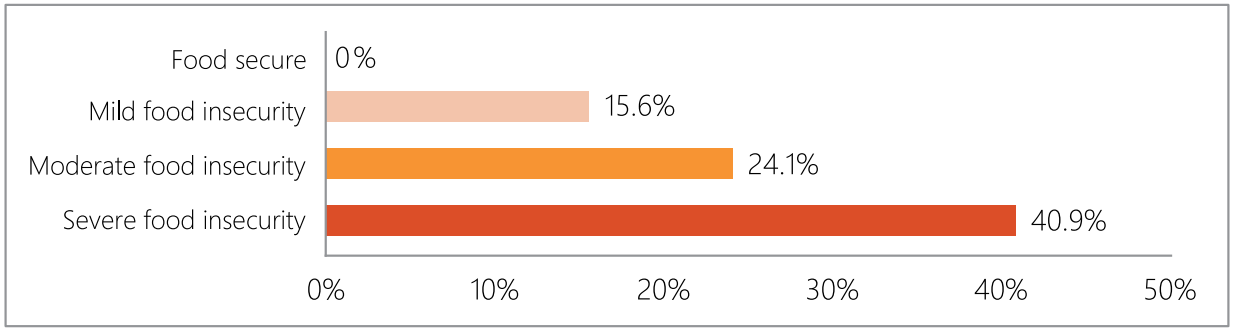

Figure 33. Percentage of household with any members that have to eat undesired foods, by food security status

INSUFFICIENT QUANTITY OF FOOD AND ITS CONSEQUENCES

The remaining four HFIAS questions examined whether the household had access to a sufficient quantity of food. In 43.5% of severely food insecure households, a household member had to eat smaller meals due to a lack of food availability. This coping mechanism was less prevalent in households with moderate food insecurity and did not occur in mildly food insecure or food secure households (Figure 34).

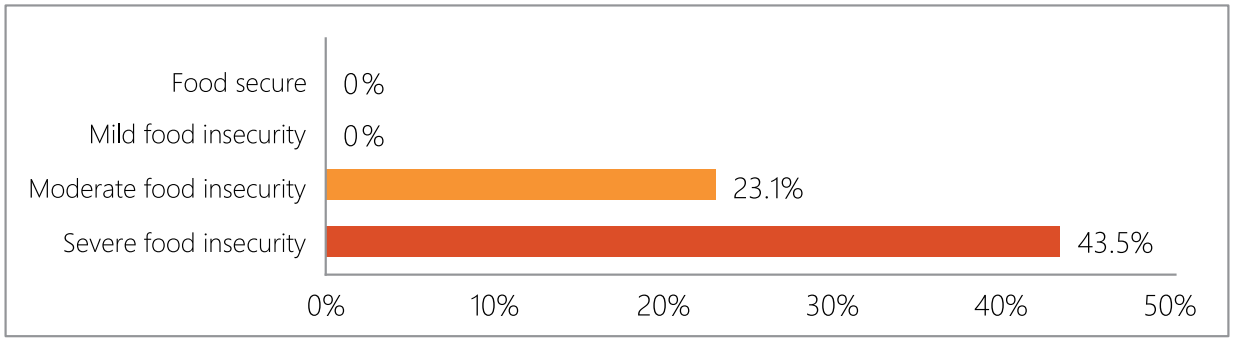

Figure 34. Percentage of households with any members that have to eat smaller meals, by food security status

Consuming fewer daily meals was also a way household members adapted to low food availability. In 56.9% of severely food insecure households, a household member had to consume fewer meals in a day than usual. This occurred in 31.4% of households with moderate food insecurity and was not prevalent in mildly food insecure or food secure households (Figure 35).

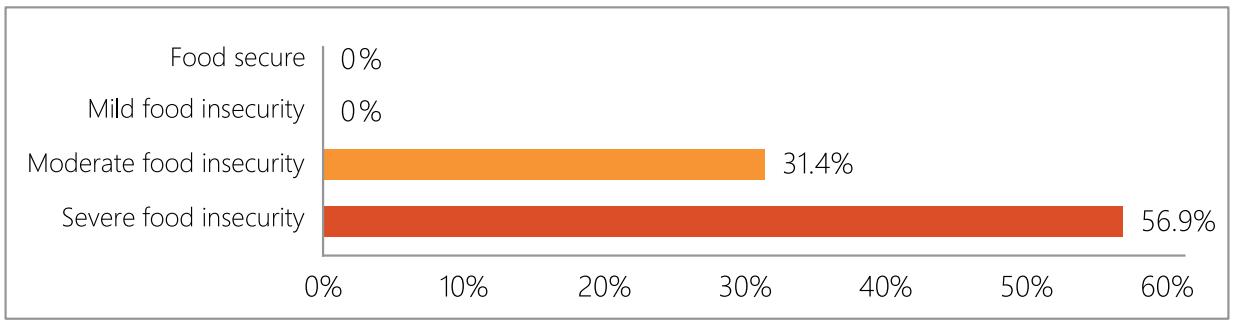

Figure 35. Percentage of households with any members have to eat fewer meals, by food security status

The last three HFIAS questions examined severe food deprivation in households and were only applicable to households classified as having severe food insecurity. Of major concern is that in 84.2% of severely food insecure households, there was at least one day in the past month when there was no food to eat of any kind in the household and in 43.3% of severely food insecure households there was at least one day in the past month when a household member had to go to sleep hungry. In 15.4% of severely food insecure households, the most extreme situation of a household member having to go a whole day and night without eating occurred due to a lack of food availability (Figure 36).

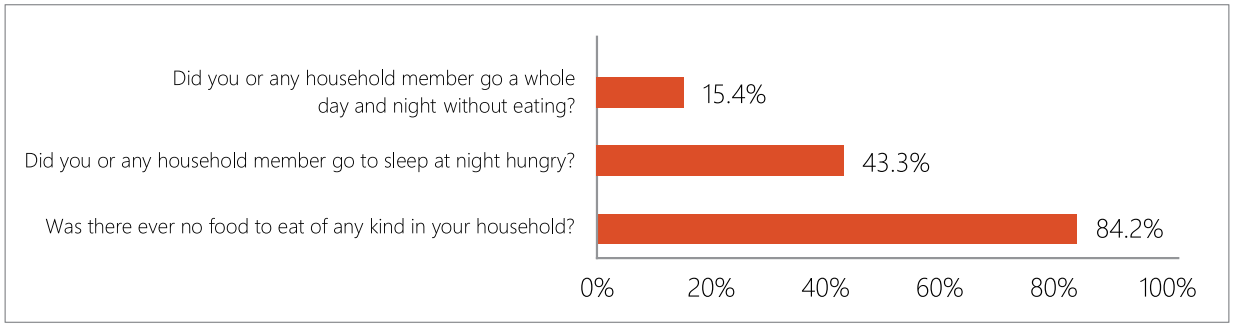

Figure 36. Percentage of households with severe food insecurity, by food deprivation status

HOUSEHOLD FOOD SECURITY IN MONGOLIA

The NNS V revealed household food insecurity is high in Mongolia (Figure 37). Overall, 65% of households had some level of food insecurity, with 14% having mild food insecurity with some level of anxiety and worry about the household food supply, 28% having moderate food insecurity with inability to eat preferred foods, and 23% having severe food insecurity where the quantity of food available was insufficient to meet household needs.

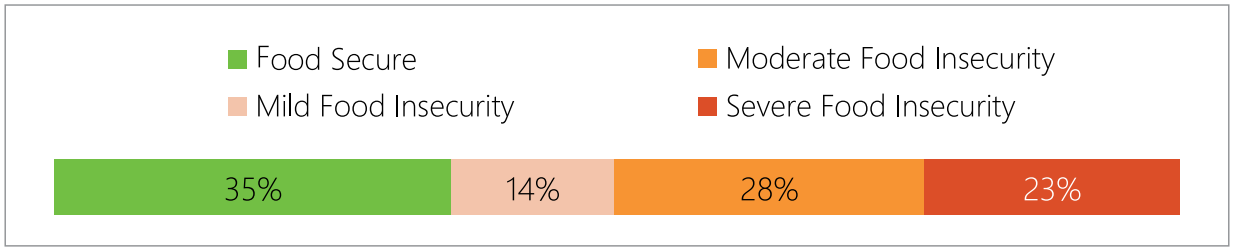

Figure 37. Household food security status as measured by the household food insufficiency access scale

Household food insecurity was prevalent in all regions, but was highest among households in Khangai (80%) and Ulaanbaatar (68%), with Ulaanbaatar having the largest prevalence (27%) of severely food insecure households. Poorest households had the highest level of food insecurity (75%), although food insecurity was high in all wealth index quintiles and 56% of even the wealthiest households had some

level of food insecurity (Figure 38). However, the majority of food insecurity in the wealthiest households was attributed to household anxiety about food shortages and food quality, while 1 in 3 of the poorest households reported insufficient food quantity. The findings of the HFIAS indicate that household food insecurity is a concern in all regions and income groups with households unable to procure the types of foods they prefer even if they have the economic means to do so. High severe household food insecurity indicates that the poorest households in Khangai and Ulaanbaatar do not have access to sufficient food to meet their dietary requirements.

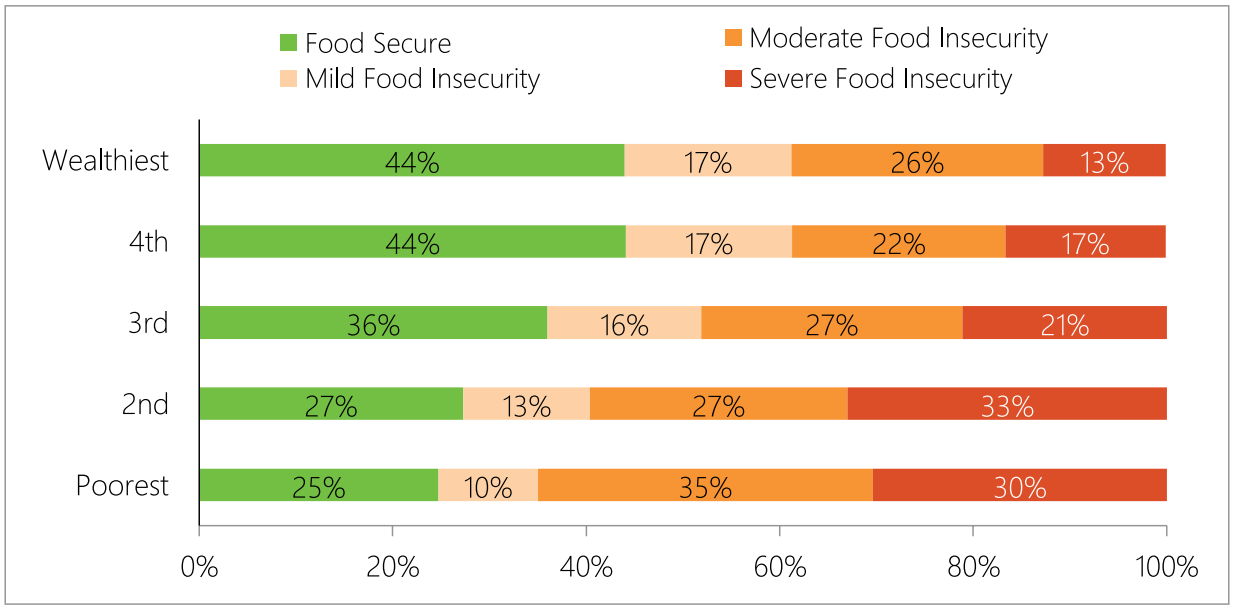

Figure 38. Household food security status by wealth index quintile

Food insecurity is a leading cause of undernutrition globally, with the NNS V confirming the association between household food insecurity and poor nutrition status in Mongolian children (Figure 39). There was a significantly higher prevalence of child stunting, wasting, and low birth weight among children under 5 years of age living in food insecure households compared to food secure households. Conversely, there was a higher prevalence of overweight among children in households that were food secure or had mild food insecurity.

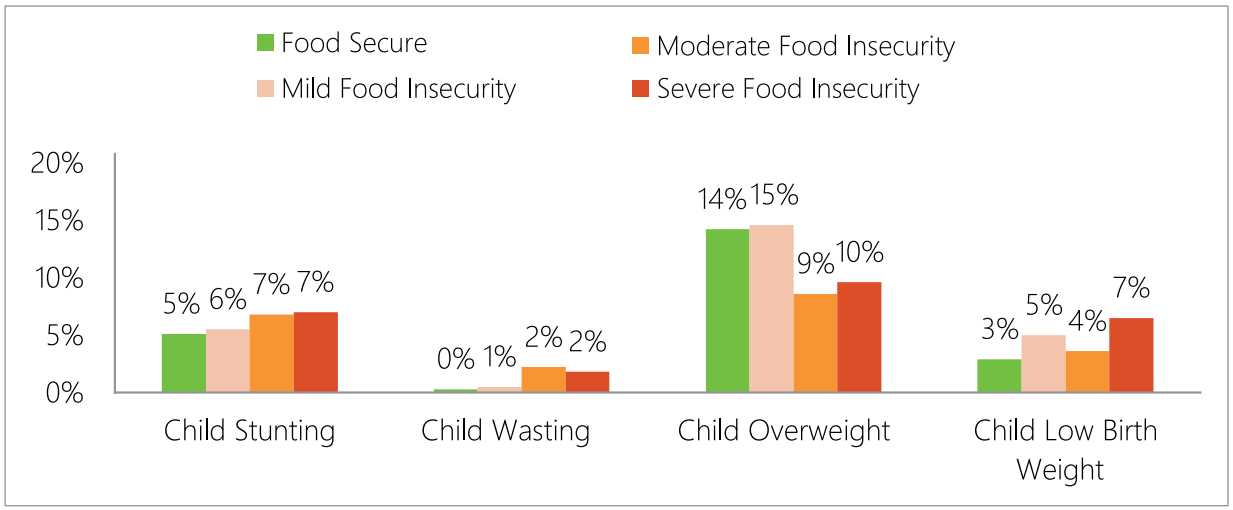

Figure 39. Child nutrition status by household food security status

The education level of mothers was significantly associated with food insecurity, with the lowest prevalence of food insecurity found in households where the mother had a higher education level (59%) compared

to 91% of households where the mother had primary or no education (P<0.001). Households where the mother had primary or no education were also more likely to be severely food insecure with nearly 1 in 2 (47%) of these households not having sufficient quantity of food in the previous 30 days compared to 15.3% of households where the mother had a higher education (P<0.001) .

Similar associations were observed between household food insecurity and maternal dietary diversity and child's minimum acceptable diet (Figure 40). In food secure households, children and mothers both consumed better quantity and quality of foods. Notably, however, the proportion of children receiving a minimum acceptable diet was under 50% at all food security levels, which indicates that children's diets are likely highly influenced by poor feeding practices not related to the food security of the household.

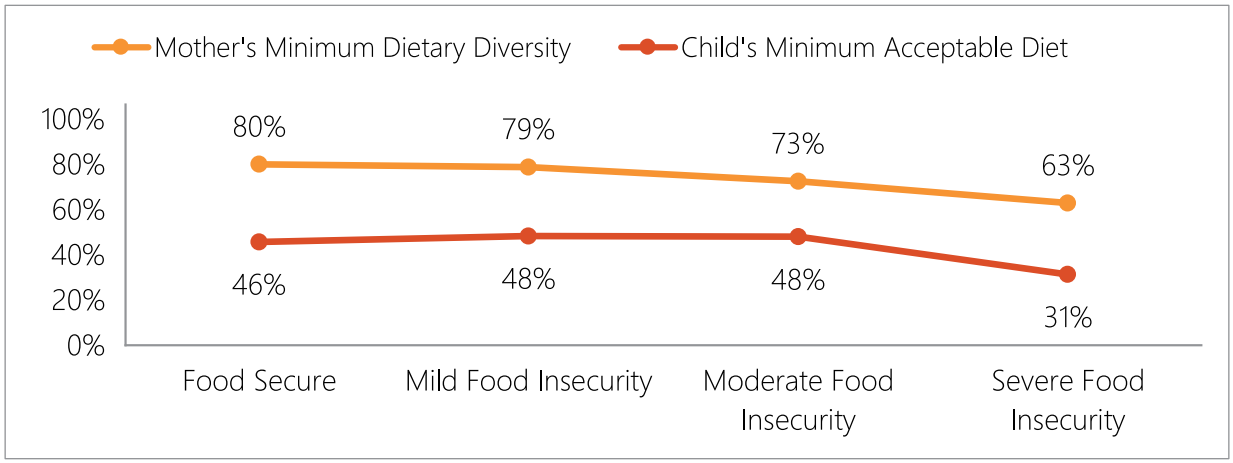

Figure 40. Mothers' dietary diversity and children's minimum acceptable diet by household food security status

This finding was confirmed by the 24-hour dietary recall for children in which consumption of nutrient-rich foods, such as dark green leafy vegetables, vitamin A-rich fruits and vegetables, eggs, animal liver, other vegetables, and milk and dairy products was low for all children 6-59 months of age regardless of their household's food security status (Table 7).

Table 7. Food consumption among children 6-59 months by household food security status

Food groups	Food secure	Mild or moderate food insecurity	Severe food insecurity
Grains and tubers	87.7%	87.5%	86.8%
Nuts and seeds	6.6%	8.3%	6.5%
Milk	46.6%	50.5%	41.4%
Yogurt	27.9%	27.7%	22.0%
Other dairy foods	40.1%	42.9%	32.5%
Meat (beef, lamb, goat, chicken, pork)	85.4%	85.2%	82.6%
Animal liver	5.7%	7.0%	10.5%
Eggs	11.8%	13.1%	11.4%
Dark green vegetables	4.8%	5.1%	3.9%
Other vegetables	39.2%	35.9%	30.6%
Vitamin A-rich fruits and vegetables	52.4%	50.7%	50.1%
Tea or coffee	74.2%	73.2%	82.5%

The association between food insecurity and low dietary quality was also confirmed in adults through the 24-hour dietary recalls of mothers (Table 8) and men 15-49 years of age (Table 9). While mothers in

households at all food security levels consumed grains and tubers, meat, and vegetables such as onion and drank tea or coffee, the consumption of nutrient-dense foods like vitamin A-rich fruits and vegetables, eggs, nuts and seeds, other fruits, as well as dairy products was highest in mothers from food secure households. Additionally, consumption of nutrient-poor high-calorie sugary foods such as cakes, cookies, and biscuits and sugary soft drinks and sweetened drinks was highest among mothers in food secure or mildly/moderately food insecure households, with mothers from severely food insecure households consuming fewer of these items.

Table 8. Food consumption among mothers by household food security status

Food groups	Food secure	Mild or moderate food insecurity	Severe food insecurity
Grains and tubers	99.7%	99.4%	100.0%
Nuts and seeds	26.3%	20.5%	15.6%
Dairy foods	92.2%	87.0%	77.3%
Meat (beef, lamb, goat, chicken, pork)	99.3%	99.2%	99.8%
Animal liver	9.7%	10.6%	14.1%
Eggs	27.4%	19.7%	15.8%
Dark green vegetables	52.6%	51.7%	44.3%
Other vegetables	87.2%	85.4%	84.0%
Vitamin A-rich fruits and vegetables	64.5%	63.9%	54.5%
Other fruits ***	50.8%	41.8%	30.6%
Sugary foods (cakes, cookies, biscuits)	80.1%	72.9%	61.9%
Sweetened drinks	57.3%	58.2%	43.6%
Tea or coffee	88.6%	89.8%	92.7%
Any alcohol	19.9%	20.5%	16.1%

Like mothers, nearly all men aged 15-49 years consumed grains and tubers, meat, other vegetables like onion and drank tea or coffee regardless of household food security status (Table 4). The consumption of nutrient-dense foods such as vitamin A-rich fruits and vegetables, dark green vegetables, and other fruits was lower than for mothers at all food security levels, although consumption of animal liver was higher among men than among both mothers and children. Interestingly, consumption of animal liver, an excellent source of vitamin A, iron, zinc, and B vitamins, was highest among mothers, men, and children from severely food insecure households and was lowest among mothers and children from food secure households. As was found for mothers, consumption of foods from most food groups was lowest among men in severely food insecure households.

Men in food secure households had a higher consumption of sugary foods and sugar-sweetened drinks than men from food insecure households. However, even mothers and men from severely food insecure households consumed high amounts of sugary foods and sugar-sweetened drinks such as carbonated soda, sweet teas, and sugar-sweetened juices. These data indicate that food preferences are an important component of household diets even when food availability and affordability are limited.

Table 9. Food consumption among men by household food security status

Food groups	Food secure	Mild or moderate food insecurity	Severe food insecurity
Grains and tubers	99.8%	99.1%	99.1%
Nuts and seeds	23.8%	26.9%	14.5%
Dairy foods	86.1%	85.2%	73.4%
Meat (beef, lamb, goat, chicken, pork)	100.0%	100.0%	99.8%
Animal liver	13.8%	12.9%	14.4%
Eggs	22.8%	20.4%	14.5%
Dark green vegetables	10.8%	8.8%	3.6%
Other vegetables	91.1%	86.6%	89.0%
Vitamin A-rich fruits and vegetables	39.6%	39.1%	32.7%
Other fruits	32.9%	32.6%	21.3%
Sugary foods (cakes, cookies, biscuits)	62.3%	55.1%	49.4%
Sweetened drinks	65.8%	58.3%	56.1%
Tea or coffee	94.2%	95.8%	97.1%

RECOMMENDATIONS FOR POLICY AND PROGRAMMATIC MODIFICATION

The government of Mongolia implemented a national food security programme during 2009-2016 with the objective of providing accessible, nutritious, and safe foods to vulnerable populations. However, the NNS V revealed food insecurity remains high nationwide in households in all regions and wealth indexes. There is now an urgent need to collect in-depth information, through intersectoral collaboration to better understand factors affecting food security in Mongolian households.

Factors that should be investigated include:

- Intra-household food allocation practices to understand which members of the household are disproportionately affected by food insecurity;
- Child feeding practices in both food insecure and food secure households to better understand factors contributing to children's diets other than household food availability;
- Factors other than affordability that contribute to food insecurity to better understand the paradox of why some wealthy households are not protected from food insecurity, while some food insecure households have greater dietary diversity; and
- Situations of chronic versus temporary or seasonal food insecurity and characteristics of households on the threshold of food insecurity identified through a vulnerability assessment.

The high prevalence of food insecurity in Ulaanbaatar sheds light on the disadvantaged status of Ger communities who mainly migrate to Ulaanbaatar for employment opportunities. The high rate of seasonal unemployment and higher living costs increase vulnerability of these slum communities to temporary and chronic food insecurity. Addressing the food security needs of this population should be a priority. Targeted social protection measures and safety net schemes to help protect vulnerable populations from food insecurity, such as food vouchers and food or cash transfers, may be effective especially during seasonal food shortages. It is recommended that the food voucher programme in Mongolia prioritize households with children under 5 years of age, especially those in Ger communities in Ulaanbaatar. The food voucher programme is also an excellent platform for the delivery of essential micronutrients to vulnerable households through the inclusion of vouchers for multiple micronutrient powders for children 6-23 months of age and multi-micronutrient supplements for pregnant women.

Though the traditional nomadic pastoral system practiced by the majority of the population in rural areas tends to limit dietary diversity due to low production and availability of foods other than meat and dairy products, it creates food self-sufficiency for large-holder herders. However, climate and other shocks leave

poorer herders vulnerable to food insecurity. Efforts should focus on building resiliency of poor herders that hold few livestock. Continued improvements in road infrastructure as part of Mongolia's national development strategy will create better access for herders to soum and aimag markets. In addition, supporting family gardening in soum and aimag centres by providing market incentives, soft loans, and grants to farmers for cultivation of healthy foods such as fruits and vegetables is an effective way to increase dietary diversity and reduce food insecurity in rural communities in Mongolia.

Mongolia's unique geographic, ecological, economic, and cultural characteristics are important considerations for understanding the food insecurity problem in the country. To improve the food security of Mongolian households, an understanding of who is impacted by food insecurity and the causes is critical to informing targeted intersectoral interventions with the goals of increasing availability, access, and utilization of food.

Key recommendations to reduce the prevalence of household food insecurity in Mongolia

- Through intersectoral collaboration, collect in-depth information to better understand factors affecting food security in Mongolian households
  - Intra-household food allocation practices to learn which members of the household are disproportionately affected by food insecurity
  - Factors contributing to children's diets other than household food availability
- Strengthen social protection measures and safety net schemes to protect vulnerable populations from food insecurity
  - Expand the existing food voucher programme to prioritize households with children under 5 years of age, especially those in Ger communities in Ulaanbaatar
  - Integrate the delivery of essential micronutrients to participating households through the inclusion of vouchers for MMPs for children 6-23 months of age and multi-micronutrient supplements for pregnant women
- Build resiliency of poor herders and households that hold few livestock
  - Continue to improve road infrastructure to create better access to markets
  - Support family gardening by providing market incentives, soft loans and grants to farmers for the cultivation of healthy foods such as fruits and vegetables