Overview of Wheat Diversity and Human Health in Afghanistan

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Abstract

More than three billion people especially from developing countries are the victims of micronutrient deficiencies also known as hidden hunger. This is attributed mainly to the scarcity of essential micronutrients like iron, zinc and vitamin-Severe Acute Malnutrition (SAM) is a common condition among Asian children. It affects about 20 million children globally and about one million of them die annually. About 0.6 million children suffer from SAM in Afghanistan.

Wheat is staple food item for Afghanistan's 35 million people. Though, Afghans rank among the highest consumers of wheat in the world, however, cereals as such are known to be a poor source of micronutrients like iron and zinc, especially when soils are deficient in these minerals. Around 1.2 million children younger than 5 years and 550,000 pregnant or lactating mothers are at high risk of severe malnutrition in Afghanistan. In addition, more than half of Afghan pre-school children are chronically malnourished and the rates of acute malnutrition in children are between 6 and 10%, to as high as 16%. Iodine and iron deficiency are estimated at 70%, and over half of children are anemic. Conditions like diarrhea, scurvy, and stunting are also prevalent. 40.9% of Afghan children suffer from stunting and 20.5% of them are underweight because of malnutrition. (www.nutritionintl.org)'s report claimed that 40 to 60% of 6 to 24 month old children are at risk of disrupted brain development because of iron deficiency. Also, that 2600 young Afghan women die every year during pregnancy and child birth because of iron deficiency. Research has confirmed that there exists genetic variability to enhance micronutrient content in wheat grain.

CIMMYT has been working to enhance the iron and zinc content in wheat grains to offer an affordable solution to tackle malnutrition among wheat eating communities. CIMMYT is breeding for enhanced Zn and Fe in wheat grain and have focused on transferring genes governing increased Zn and Fe from *Triticum spelta*, landraces, *T. dicoccon* × *Ae. tauschii*-derived synthetics, and other high Zn and Fe sources to high-yielding elite wheat backgrounds using a limited back-cross approach. Research has revealed that the range of values for Fe concentration in grain among hexaploid wheat, *T. dicoccum* and landraces grown under field conditions was from 25 to 56 mg/kg, with a mean of 35 mg/kg. Bread wheat was found to have zinc in the range of 26 to 32 mg/kg, however its relatives were shown to carry up to 142 mg/kg of zinc. Researchers have succeeded in developing varieties having zinc up to 39 mg/Kg, and iron up to 43 mg/kg. Varieties with higher zinc and iron contents have already been released in India (Zinc Shakti and HPBW 01) and Pakistan (Zincol). Though the two micronutrients show a very high genotype environment interaction but they also display correlation meaning that lines showing high zinc also show high iron and vice versa. Introduction and release of such varieties in Afghanistan hold promise to bring health and to Afghan people in general and to Afghan women and children in particular.

Background

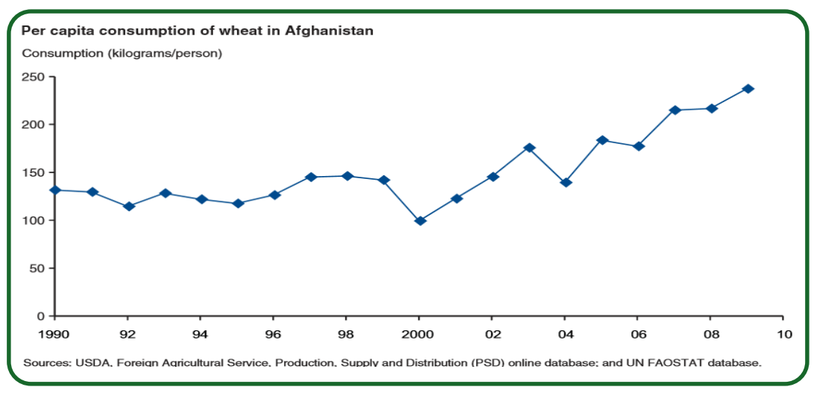


Fig. 1. Consumption of wheat in Afghanistan from 1990 to 2010.

More than three billion people especially from developing countries are the victims of micronutrient deficiencies also known as hidden hunger.

SAM is a common condition among Asian children. About 0.6 million children suffer from SAM in Afghanistan.

1- Around 1.2 million children younger than 5 years and 550,000 pregnant or lactating mothers are at high risk of severe malnutrition in Afghanistan.

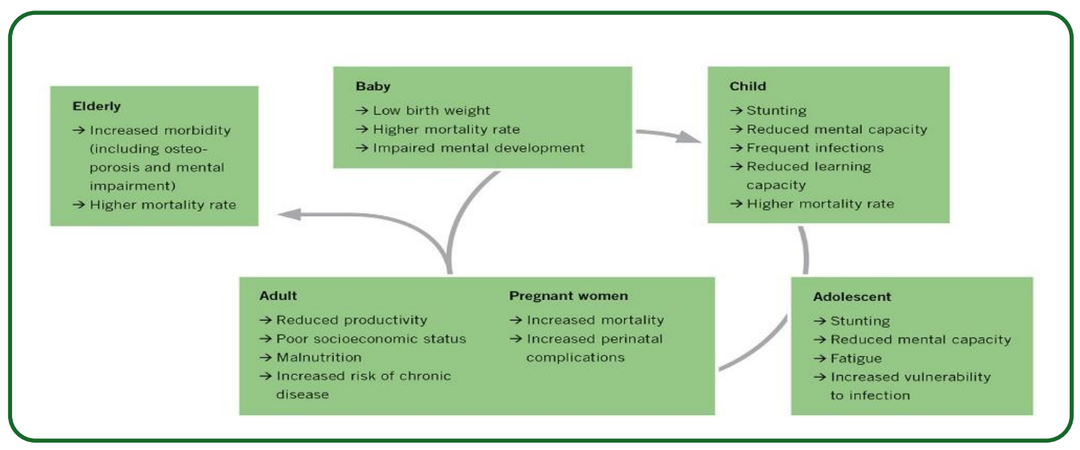


Fig. 2. Consequences of Micronutrient Deficiencies throughout the Life Cycle.

Present Status & Strategy

2- In addition, more than half of Afghan pre-school children are chronically malnourished and the rates of acute malnutrition in children are between 6 and 10%, to as high as 16%. Iodine and iron deficiency estimated at 70%, and over half of children are anemic.

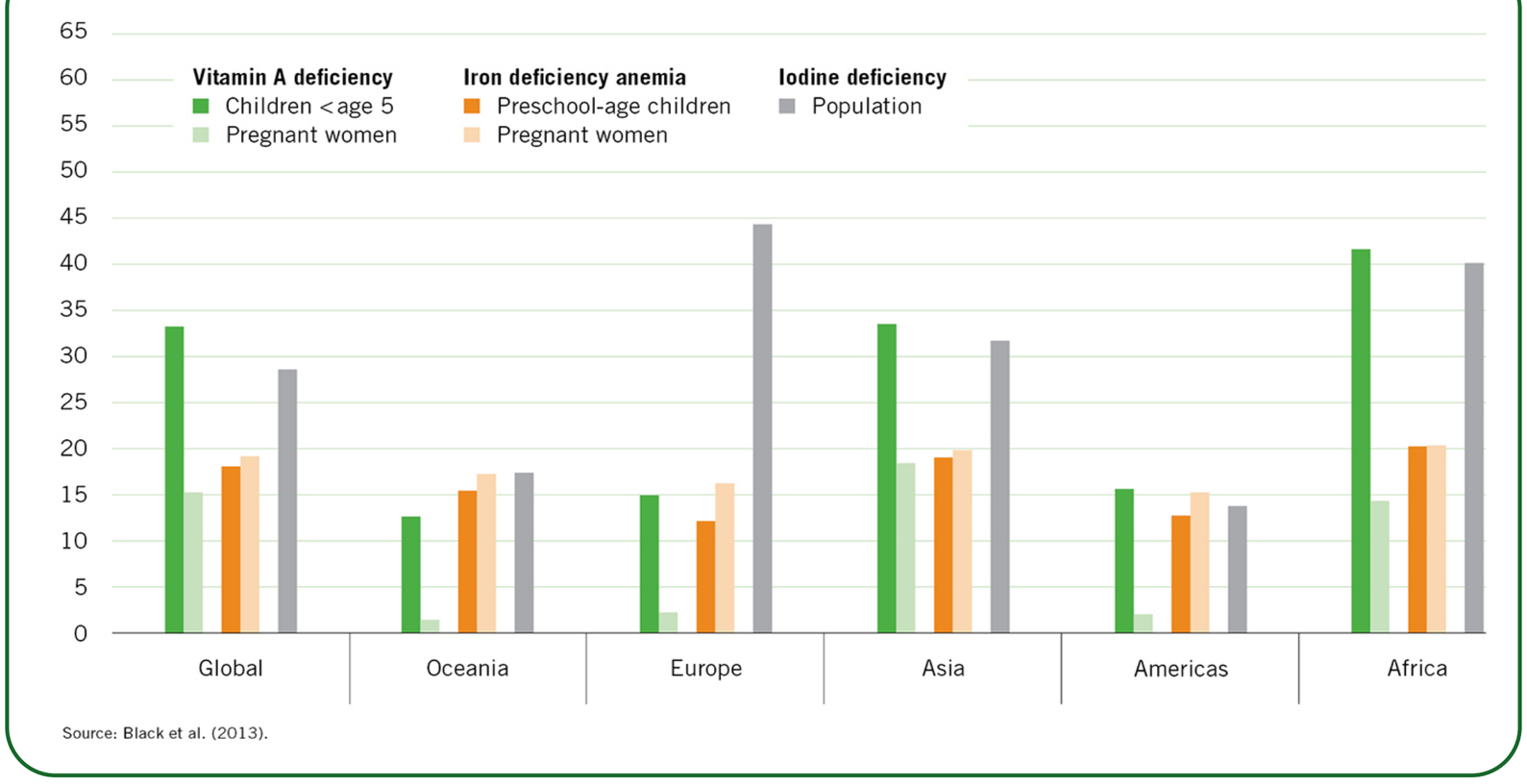
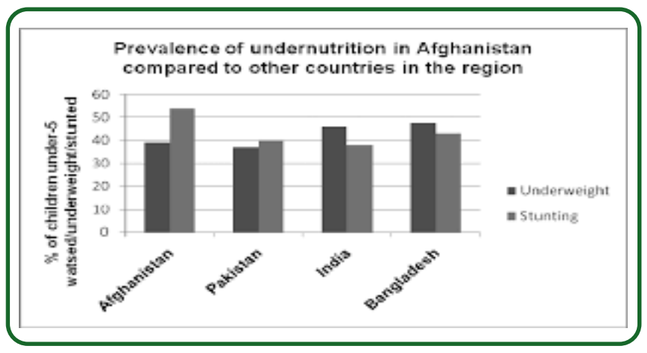


Fig. 3. Percentage of populations with selected micronutrients deficiencies.



3- Conditions like diarrhea, scurvy, and stunting are also prevalent.

4- According to a report, 40.9% of Afghan children suffer from stunting and 20.5% of them are underweight because of malnutrition.

Fig. 4. Prevalence of undernutrition in Afghanistan compared to other courtiers in the region.

5- A Nutrition International (www.nutritionintl.org) report claimed that 40 to 60% of 6 to 24 month old children are at risk of disrupted brain development because of iron deficiency. In addition, those 2600 young Afghan women die every year during pregnancy and childbirth because of iron deficiency..

Table. 1. Selected micronutrient deficiencies and their effects.

Micronutrient deficiency	Effects include	Number of people affected
Iodine	Brain damage in newborns, reduced mental capacity, goiter	~1.8 billion
Iron	Anemia, impaired motor and cognitive development, increased risk of maternal mortality, premature births, low birthweight, low energy	~1.6 billion
Vitamin A	Severe visual impairment, blindness, increased risk of severe illness and death from common infections such as diarrhea and measles in preschool age children; (in pregnant women) night blindness, increased risk of death	190 million preschool age children; 19 million pregnant women
Zinc	Weakened immune system, more frequent infections, stunting	1.2 billion

Sources: Allen (2001); Andersson, Karumbunathan, and Zimmermann (2012); de Benoist et al. (2008); Micronutrient Initiative (2009); Wessels and Brown (2012); and WHO (2009; 2014a).

The Economic Toll

Vitamin and mineral deficiencies impose a significant burden on the affected persons and societies, both in terms of health costs and negative impacts in lost human capital and reduced economic productivity. Hidden hunger impairs physical growth and learning, limits productivity, and ultimately perpetuates poverty (Figure 5) in a continuous cycle. Countries where a large share of the population is affected by vitamin and mineral deficiencies cannot realize their economic potential (Stein and Qaim 2007; Stein 2013). Poor people disproportionately suffer from micronutrient deficiencies, and bear the long-term negative effects that constrain socioeconomic development (Darnton-Hill et al. 2005).

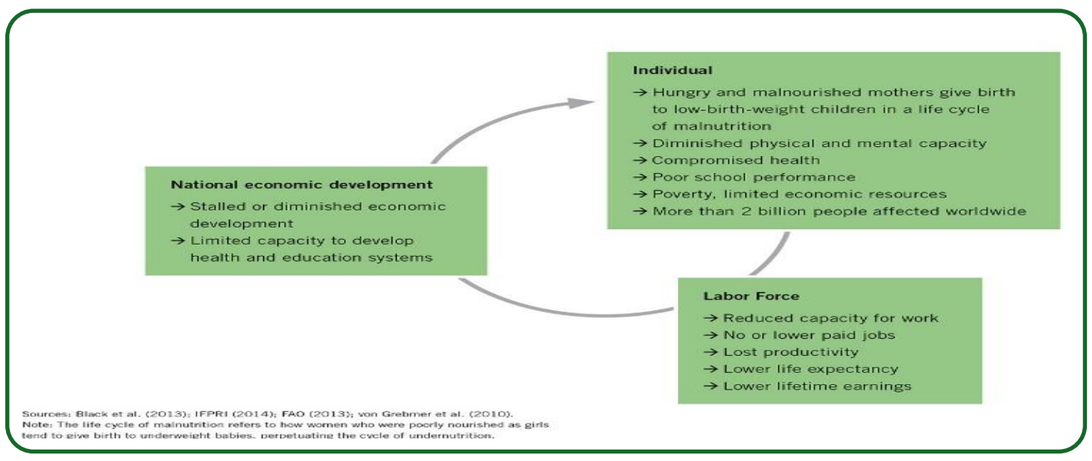


Fig. 5. Cycle of hidden hunger, poverty, and stalled development.

Looking a head

Conventional plant breeding involves parent lines with high vitamin or mineral levels that crossed over several generations to produce plants with the desired nutrient and agronomic traits. Transgenic approaches, in which genes are manipulated or new genes inserted, are advantageous when the nutrient not naturally found in a crop

1. Research has confirmed that there exists genetic variability to enhance micronutrient content in wheat grain.

2. Research has revealed that the range of values for Fe concentration in grain among hexaploid wheat, *Triticum dicoccum* and landraces grown under field conditions was from 25 to 56 mg/kg, with a mean of 35 mg/kg.

3. Bread wheat found to have zinc in the range of 26 to 32 mg/kg. however its relatives were shown to carry up to 142 mg/kg of zinc.

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