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Mini Review

Vitamin A Deficiency in Bangladesh and Ongoing Interventions to Address

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Abstract

Although Bangladesh has made significant progress in reducing under-nutrition and is trying to achieve the targets for the nutrition-related Sustainable Development Goals (SDGs), the prevalence of micronutrient (MN) deficiencies remains high and constitutes a major public health problem. Several strategies have been implemented over the past decades in response to the high prevalence of MN deficiencies. Following a multi-sectoral approach, programs and interventions in various sectors are increasingly aimed at improving nutrition. Several approaches that complement each other are employed to address the complex problem of MN malnutrition. In addition to actively promoting exclusive breastfeeding of infants during the first six months of life to achieve optimal growth, development and health in infants, other approaches that mitigate against MN deficiencies in young children and women of reproductive age include supplementation, food fortification, dietary diversification and biofortification. The country's successful vitamin A (VA) supplementation program has reduced VA deficiency (VAD), however, 20.5% of pre-school age children are still VA deficient. Fortification of edible oil with VA in Bangladesh has indicated that 95% of the total packaged (30-35% of the total production) edible oil in Bangladesh is adequately fortified. Only 41% of bulk (65 - 70% of total) production edible oil is fortified with VA. This result indicates that maximum share of the total edible oil consumed in country is still not fortified, consequently, prevalence of VAD has not improved as expected. The diversity of diet is not accessible and affordable for most of the population in Bangladesh especially, the most vulnerable. There thus, the need for some other complementary approaches which are easily accessible and affordable to low-income population remains. One such intervention, which has proven effective in reducing VAD is promotion of biofortified Orange fleshed Sweet Potato (OFSP) among vulnerable population to improve VA status (VAS) led by International Potato Centre (CIP). Biofortification is an approach to cost effectively address MN deficiency and allows low-income households to meet their micronutrient needs through their own food production. It is particularly beneficial to most vulnerable groups - especially children, pregnant and breastfeeding women, and poor rural and urban households. Biofortified OFSP is now an important root crop having great possibility of adoption as regular diet for the population to improve their VAS especially for the most vulnerable.

Keywords: *Vitamin A Deficiency; Bangladesh*

Bangladesh has achieved a significant improvement over the last two decades in poverty reduction and human development - the ultra-poor constitute 17.6% of the Bangladeshi population [1] - and in health and nutrition. However, the country continues to experience a high burden of under-nutrition (stunting 36%, wasting 14%, underweight 33%) among children under 5 [2]. Notably, children from the lowest wealth quintile are twice as likely to be stunted as children from the highest wealth quintile (55% and 26% respectively; 2nd National Plan of Action for Nutrition, 13 August 2017). Close to half of Bangladesh's children are not exclusively breastfed in the first six

months, 18% of children receive complementary foods too early, and nearly 40% too late [2]. In addition, 55% of women nationally lack dietary diversity and 43% of adolescent mothers with children under 5 are shorter than those without children (28%), reflecting the effects of under-nutrition, early marriage, and early pregnancy. Diets in Bangladesh lack critical micronutrients, such as vitamin A (20.5%), iron, iodine and zinc. The prevalence of zinc deficiency is 45% among preschool age children [3].

These deficiencies can lead to premature and preventable death, cognitive developmental delays, visual impairment and blindness, and constrained work performance - all of which result in slower economic growth and widespread, intergenerational poverty. The fundamental, underlying cause of these deficiencies is diets that are overly reliant on staple foods and lacking in the diversity of foods needed to meet nutrient requirements. While efforts are needed to diversify diets, staple foods do and will continue to provide majority of the calories consumed and increasing the nutrient value of such foods can therefore contribute to ensuring that all people have the nutrients they need to survive and thrive.

Several approaches that complement each other are employed to address the complex problem of micronutrient malnutrition. In addition to actively promoting exclusive breastfeeding of infants for the first six months of life to achieve optimal growth, development and health in infants, other approaches that mitigate against micronutrient deficiencies in young children and women of reproductive age include supplementation, food fortification, dietary diversification and biofortification [4].

Figure 1

The greatest cost-benefit effect comes from giving supplementary vitamin A to children under two years old as the damage caused by micronutrient deficiency in the early years of life is irreversible. This is why the first 1000 days of a child's life (from conception to two years of age), is referred to nutritionally and promoted as a unique 'window of opportunity' by the United Nation's Scaling Up Nutrition (SUN) initiative. In the case of vitamin A, a mega dose of retinol (100,000 International Unit) is given to the children under the age of five years every six months (or twice in a year) in most of the developing countries where vitamin A deficiency (VAD) is a public health problem. These mega doses of vitamin A are meant to boost the liver stores of vitamin A in these children, then can be slowly released into the body for normal metabolism. Many Government and International organizations use vitamin A supplementation (VAS) for addressing vitamin VAD because it is very effective, not only for reducing VAD but also child morbidity and mortality. Bangladesh is one of the most

successful countries using VAS since long and has achieved a significant success in this. Since 1973, the Bangladesh Government has been implementing the national vitamin A supplementation program and in 2013 the bi-annual national vitamin A campaign had a reported coverage of 98% [5].

While the country's successful vitamin A supplementation program has made an impressive dent in reducing Vitamin A deficiency (VAD), 20.5% of pre-school age children are still deficient in this nutrient. VAD is the leading cause of preventable childhood blindness (xerophthalmia) and increases the risk of death from infectious morbidity caused by common childhood illnesses such as diarrhoea. It causes one out of every four child deaths in regions, countries and communities where the deficiency is prevalent. VAD also increases the risk of maternal death.

Fortification of vegetable oil with vitamin A is a well-known intervention as well has provided a glimmer of hope for Bangladesh in combatting vitamin A deficiency. Ninety-nine percent of the population consumes vegetable oil on a daily basis and there is little variation in its consumption due to socioeconomic status therefore, large-scale impact can be achieved.

Bangladesh's involvement in food fortification dates back to almost 30 years ago when fortification feasibility studies were carried out for wheat flour. A move towards fortification of foods with vitamin A started in 2006 when the Bangladesh Standards and Testing Institute (BSTI), part of the Ministry of Industry, established fortification standards for the country.

Figure 2

Edible oil was first fortified in 2012 and within six months, some of the refineries in the country had begun producing fortified vegetable oil and a logo for oil fortification was established from the Ministry of Industries, Government of Bangladesh. In 2013, the Fortification of Edible Oil with Vitamin A Law was passed making it mandatory to fortify edible oil with vitamin A in country and even imported edible oil should be also fortified with vitamin A except crude oil. Efforts are still in place today to strengthen and scale-up what was already successfully started in the country, to create an enabling environment, raise awareness of the benefits of vegetable oil fortification with vitamin A and to improve the quality of fortified oil and expand fortified vegetable oil production to reach the majority of the Bangladeshi population.

Based on the result of market assessments in 2017-18 conducted by ICDDR'B and GAIN, 95% of the total packaged (30 - 35% of the total production) edible oil in Bangladesh is adequately fortified but only 41% of bulk (65 - 70% of total) production edible oil is fortified with vitamin A. This result showing us that maximum share of the total edible oil consumed in country is still not fortified, consequently, prevalence of vitamin A deficiency has not been improved as expected.

Another intervention which has been continuing since last decade to prevent VAD is promotion of Biofortified Orange fleshed Sweet Potato (OFSP) among vulnerable population to improve vitamin A status led by International Potato Centre (CIP). Biofortification Biofortification is recognized as an effective and sustainable process by which the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding or modern biotechnology. The process is used as an approach to address micronutrient deficiency and allows low-income households to meet their micronutrient needs through their own food production. It is particularly beneficial to most vulnerable groups - especially children, pregnant and breastfeeding women, and poor rural and urban households.

Conventional selective breeding techniques have been used to produce OFSP that provides high level of vitamin A, zinc and iron. The production and distribution of biofortified OFSP can significantly contribute to reducing the global public health problem of vitamin A, zinc and iron deficiencies, particularly in high risk population. Biofortified orange-fleshed sweet potato is now an important tuber crop having great possibility to be adopted as regular diet for the population to improve their vitamin A status especially for the most vulnerable. Apart from cheap source of energy, the OFSP tubers are rich in starch, vitamins and minerals especially vitamin A in the form of β-carotene.

Figure 3

Earlier in Bangladesh, sweetpotato was perceived as food for poor but nowadays because of its vitamin A content, it is widely consumed by all quintiles of the population. One medium sized boiled OFSP root or a handful of pieces (around 125 grams) can meet a child's daily recommended intake of vitamin A. While the vitamin A needs of most adults can be met by consuming 200 - 300g of OFSP per day. This is particularly important in developing countries of Asia and Africa, where vitamin A deficiency is the leading causes of blindness, disease and premature death among children under five and pregnant women. Sweetpotato leaves and vines are also rich in vitamins and minerals and can be cooked as leafy vegetable with other vegetables or individually, they have nutritional benefits. Sweetpotato leaves

and vines are excellent sources of vitamins A, B (thiamine, niacin and pyridoxin) and C and contain comparatively high level of protein (around 3% of fresh weight basis), calcium and antioxidants [6].

International Potato Centre (CIP) through their sweetpotato programs in many countries in Africa and Asia has been promoting commercial processing of OFSP into nutritious puree as an ingredient in local food-processing industries, specifically the bakery sector. There exists a variety recipe for tasty foods to be cooked from OFSP roots and vines. Some food manufacturers are producing bakery items as well by using OFSP pulp with flours and the popularity and consumption both have been growing day by day. From agronomic perspective, sweetpotato can be grown in a wide range of agroecological zones and soil types and it's a very easy growing crop with good harvest output.

It is also well known that the effectiveness of food-based approaches to improving nutrition are closely dependent on the health status of individuals, care practices especially of infants and small children, and the environmental and management conditions of the production, preparation, consumption and bodily elimination of food. Directly or indirectly, these involve access to and quality of water, availability and use of sanitation facilities and hygiene practices (WASH). A growing evidence demonstrates links between poor WASH conditions, especially exposure to poor sanitation, and stunting (low height for age ratio) [7]. By ensuring proper sanitation and hygiene and safe drinking water, malnutrition and stunting can be reduced among children by preventing the prevalence of diarrhea and communicable diseases. According to World Health Organization, roughly 50% of all malnutrition (worldwide) is associated with repeated diarrhea or intestinal worm infections as a direct result of inadequate water, sanitation and hygiene. Handwashing with soap can reduce diarrhea by 42 to 47%, in the single most cost-efficient manner. Reductions in diarrhea disease through water, sanitation and hygiene interventions can prevent at least 860,000 child deaths a year caused by malnutrition. Improvements in sanitation, especially through eliminating open defecation, can reduce rural stunting from 4 to 37%. Parasitic infections caused by poor sanitation and hygiene can lead to anaemia and impact normal growth and cognitive development [8]. The International Potato Centre (CIP) together with its partners are implementing other nutrition-sensitive interventions, including WASH strategy, in Bangladesh to identify target entry points within the WASH supply chains to address the gaps in knowledge and practices among the market actors, including consumers. The intervention aims at identifying and addressing key underlying constraints which is creating marketing failures to provide improved and hygienic WASH products and services. The intervention's unique approach integrates social and behaviour change (SBC) and market development to catalyse sustainable improvements in WASH and nutrition. The intervention targets demand, supply, and the overall environment for WASH products and services to improve WASH and nutrition outcomes.

However, there are some challenges we need to address to promote orange fleshed sweetpotato in large scale. In Bangladesh CIP has been working to increase both production and consumption of OFSP in northern and southern region to improve nutritional status of our vulnerable population. We hope that in near future it becomes a popular food crop in our country for whole population and vitamin A deficiency will be eliminated from Bangladesh.

Conclusion

We can reduce undernutrition and improve food security by scaling up proven cost-effective interventions that have already benefitted women and children in many countries and communities around the world. To improve nutrition through agriculture we need to make agriculture nutrition-sensitive by including specific, clear nutrition goals and nutrition interventions which can be achieved through increased production and consumption of biofortified orange fleshed sweetpotato - an easy growing, climate smart and available food crop for both rural and urban population in Bangladesh.

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