TECHNOLOGY TRANSFER & RESAERCH TRANSLATION DIRECTORATE

ETHIOPIAN PUBLIC HEALTH INSTITUTE

An Evidence-Based Technology Brief

Improving Nutritional Status through Consumption of Quality Protein Maize in Ethiopia.

Technology brief prepared by:

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QPM = Quality Protein Maize = Maize with improved protein quality through bio-fortification

- QPM is a promising strategy to combat under nutrition in developing countries
- QPM is not Genetically Modified maize

Addis Ababa
Ethiopia
July 25, 2016

Who is this technology brief for?

The industries, policymakers, and other stakeholders with an interest in the technology addressed by this technology brief**.**

Why was this technology brief prepared?

To inform deliberations about health technologies by summarizing the best available evidence about a technology of public health importance

What is an evidence-based technology brief?

Evidence-based technology briefs bring together global technology evidences to inform polciy makers about best avaialbile health technologies which have public health importance.

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Background

According to the 2014 min-demographic and health survey, 40 % of children under five in Ethiopia are stunted,25% are underweight and 9% are wasted (Central Statistical Agency[Ethiopia] 2014).The 2013 UNICEF report also shows that 40% of children in sub-Saharan Africa and 26% of children in the world are stunted or too short for their age, due to chronic malnutrition(UNICEF 2013).According to the World Health Organization report of 2016, the classification of severity of under-nutrition, prevalence of stunting ≥40 is considered as very high.

A high stunting level is detrimental for a child's growth & mental development. It limits a child's ability to ultimately succeed. This poses a high burden on a country's economic & social development: the economic burden of poor child nutrition in Ethiopia is estimated to be 4.7 billion USD per year, which is equivalent to 16.5% of the country'sGDP (African Union Commission et al. 2014)

Taking into consideration of the highest prevalence of under-nutrition in Ethiopia and its long term impact among children aged under-five, the federal ministry of health has planned to endunder-nutrition by 2030which is dubbed as the 'Seqota' Declaration. By 2020 the Federal Ministry of Health has planned to reduce stunting to 20%,under-weight to 15% and wasting to 4.9%(www.moh.gov.et.)

Majority of rural Ethiopians have limited access to high quality protein sources like eggs, meat, dairy products & legumes. Instead, there is wide consumption of local maize by rural communities, even for weaning food. The available local maize, which is widely consumed by rural communities is a poor source of balanced protein for human consumption, because it lacks adequate amounts of the essential amino-acids: lysine and tryptophan (CIMMYT ETHIOPIA 2013).

One way of dealing with this kind of problem of such magnitude is using local appropriate technologies such as wide consumption of Quality Protein Maize (Gunaratna et al. 2008)

Therefore, this technology brief aims at synthesizing evidences & highlighting the public health importance of QPM and its potential for reducing under-nutrition in children.

1. Local evidences

Food analysis and sensory evaluations of yellow quality protein maize was conducted at the food science& nutrition laboratory of EPHI. According to this study, QPM has more protein, iron, calcium and calories than the conventional maize types (Table 1). Sensory evaluation also showed that QPM was highly preferred for its taste and its baking quality in the production of softer and less fragile 'injera' & bread (Asrat et al. 2013).

Table 1. Nutrient content of QPM, conventional maize and teff, per 100 gm (Asrat et al. 2013)

Nutrient	White QPM	Yellow QPM	Conventional maize	Tef (Mixed)
Calories	373.81	368.60	356	363.90
Moisture %	10.83	10.85	12.40	11.02
Protein %	9.86	9.67	8.30	9.85
Fat (gm)%	4.85	4.20	4.60	2.62
Carbohydrate %	70.71	73.03	73.40	70.10
Fibre %	2.20	1.02	2.20	3.41
Ash %	1.55	1.23	1.30	2.93
Calcium (mg)	7.20	6.87	6.00	138.25
Iron (mg)	3.80	5.62	4.20	47.42
Lysine	4.00	-	-	-

2. International evidences

A meta-analysis study on consumption of QPM compared to conventional maize has shown an 8%(95% CI: 4-12%) increase in the rate of growth in height and a 9% (95 CI: 4-12%) increase in the rate of growth in weight in infants and young children with mild to moderate under nutrition in populations where maize is a significant part of the diet (Gunaratna et al. 2008)

Another systematic review indicated that consumption of QPM instead of conventional maize leads to a 12% (95% CI: 7-18%) increase in the rate of growth in weight and 9%(95% CI; 6-15%) increase in the rate of growth in height in infants and young children with mild to moderate under utrition from populations in which maize is the major staple food (Gunaratna et al. 2010).

Table 2: Summary of studies analyzing the impact of QPM on child growth

Study type	**Forms of intervention**	**Age group (month)**	**Weight change (%)**	**Height change (%)**	**p-value**	**References**
Meta-analysis	Diet	4-60	9	8	<0.0019	Gunaratna et.al (2008)
Meta-analysis	Diet, Seed	4-59	12	9	<0.0001	Gunaratnae t.al(2010)

Impact of QPM

QPM can improve the nutritional security of populations by providing two essential amino-acids; lysine and tryptophan, which must be obtained from a dietary source. QPM can provide a protein source for both human and animal consumption(CIMMYT ETHIOPIA 2013).

Clinical studies in Peru showed that children recovering from severe malnutrition by consuming quality protein maize had similar growth rates as children consuming modified cow's milk formula (Graham et al. 1990). Similarly, study done in Nicaraguan day center among mild or moderately malnourished children showed that, children consuming a QPM snack for 3.5 month had better growth in terms of height, weight, and height-for-age than children consuming conventional maize (Ortega et al. 2008).

Moreover, evidence from a meta-analysis on the effects of QPM on stunting has showed a big impact on the height and weight of children.Utilization of QPM could play a very important role

to ensure household nutrition security and reduce malnutrition among children (Emily & Sherry 2015).

Based on the available evidences above on the usefulness of QPM, it is of more advantageous over normal maize. Maize is a primary weaning food for babies and a staple food of the population in several rural areas in our country. Replacement of normal maize with QPM could benefit these people.

Applicability

QPM can be used for making porridge, biscuit, corn flour, cracked grain, absit: initial for injera preparation (Asratet 2013). On average, Ethiopians consume 44 Kg of conventional maize per year for their energy and protein requirements. More than 60% of total caloric intake comes from the consumption of common maize in our country (Akalu et al. 2010).

The availability of more than ten food industries in the country the expanding number of small scale enterprises, is another opportunity for the industrialization of use of QPM. Currently the food factories in our country are importing maize from the Republic of South Africa.

QPM can be also be used for school feeding and for emergency food aid. Moreover, the protein fractions in QPM are robust against many traditional food processing and cooking techniques (Gunaratna et al. 2008; Asrat et al. 2013).

Equity

QPM can reach remote areas where malnutrition rate are very high and provides at risk populations with a nutritional bonus(Emily and Sherry, 2015).It is low a cost protein source for the poor in our country.

Opportunities for QPM adoption

- Active research is going on improving QPM.
- QPM is also included in the agricultural extension packages of the ministry of agriculture in Ethiopia.
- The main maize growing & consuming regions in Ethiopia (Oromia, Amhara, and SNNP in descending order) have the suitable setting for adopting QPM: many children are at

risk for under-nutrition and have maize as an important part of their diet (CIMMYT-INTERNATIONAL 2014)

- The government's commitment in increasing the production of QPM and the plan to reduce malnutrition in 2020

Barriers for QPM adoption

- QPM genes can be easily lost through crosspollination, unless hybridized maize is purchased every year from agricultural research centers. This problem is more pronounced where QPM is planted in small patches surrounded by non-QPM maize (Anonymous 2001)
- Lack of market aggregation or absence of value chain for QPM
- Farming households do not readily adopt new varieties and when they do, children do not always consume adequate amounts(CIMMYT-INTERNATIONAL 2014)
- No subsidy for QPM seed by the government
- No regulatory mechanism in place to identify QPM seeds from the conventional maize.

Policy Contexts in Ethiopia

- The agricultural-led industrialization development policy in our country can create a conducive environment for large production of QPM.
- Ethiopia has already set the target of increasing QPM production area to 200.000 ha in three years (2015-2017) [CIMMYT- ETHIOPIA 2013].
- Federal Ministry of agriculture has produced a working guideline on the importance of QPM(CIMMYT- ETHIOPIA 2013) .
- Federal Ministry of health of Ethiopia is committed to reducethe prevalence of stunting to 26%, underweight to 13% & wasting to 4.9% in 2020 (www.moh.gov.et)

Next Steps

- The aim of this technology brief is to foster dialogue & judgments that are informed by the best available evidence
- Further actions will follow from deliberations that the technology brief is intended to inform. These might include:
    - Careful consideration on improving QPM consumption
    - Careful consideration in promotion of QPM use-through small and large scale enterprises

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