

Review Article

Health Benefits of Fish Consumption and Its Contribution to Poverty Alleviation and Food Security in Ethiopia: A Review

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Abstract: Food insecurity and malnutrition remains a public health threat in developing countries including Ethiopia, as millions of people continue to suffer from these problems. Therefore, fish consumption is one of the most important sources of micro and macronutrients for human health and overcome food insecurity and malnutrition problems. Ethiopia is endowed with lakes, reservoirs and rivers, which could be the potential resources for fisheries production and consumption. However, their exploitation and contribution to food security and poverty alleviation in the country was scarce. Therefore, this review was designed to provide the current information concerning the health benefits of fish consumption and its contribution to poverty alleviation and food security issues in Ethiopia. Peer-reviewed articles, gray literature, key reports from national and international organizations, research findings in developed and developing countries were used to collect information for this work. Fish is a source of protein, polyunsaturated fatty acids, minerals and vitamins, which could prevent non-communicable diseases. However, access to road infrastructure, pond management level, water sources, fish feed status, location of ponds and consumption habits were factors affecting fish production and consumption. Other factors which could affect fish production were climate change and variability, low fish supply, lack of awareness, lack of support, lack of facilities, low profit, and distance from market place. Therefore, a strategic partnership and collaboration of all responsible bodies should determine the long term impacts of fisheries production and consumption patterns on the poverty alleviation, food and nutrition security in the country.

Keywords: Fish Consumption, Nutrition, Poverty Reduction, Food Security, Ethiopia

1. Introduction

Through the Sustainable Development Goals [45], the world has committed to ending all forms of food and nutrition insecurity. Yet, malnutrition and food insecurity remains one of the most visible dimensions of poverty in developing countries. One in every four people is estimated to be undernourished in Sub-Saharan Africa (SSA) [16]. More than two billion people worldwide, in particular in developing countries, are estimated to be deficient in vitamin A and minerals like iron and zinc [23]. The prevalence of vitamin A deficiency in young children and iron deficiency in women in SSA are also the highest across the globe [19, 26].

Micronutrient deficiencies occurring at particular stages of human life (pregnancy, breast-feeding, childhood) can severely affect health and development, leading in some cases to irreversible effects. Therefore, fish can potentially contribute to reducing these micronutrient deficiencies. However, fish is under recognized and undervalued source of micronutrients, which could play a more significant role in addressing these global challenges [35].

Providing adequate food for a rapidly increasing human population is one of the greatest challenges this day in the world. To be more specific, seafood bases play an important role in filling the nutritional requirements of human beings [17]. Fish and seafood products represent a very healthy food,

low in saturated fats and offer an excellent source of protein, which are essential for our health. It contains several essential amino acids, highly unsaturated fatty acids, high level of iron, calcium and iodine, and vitamin A [33]. Besides, fish meat has been stated to improve intelligence, treat skin conditions, improve brain development, migraine and decrease risk of heart diseases, cancer, obesity and diabetics [17, 23].

Globally, the production of fish is approximately 154 million tons/year in 2012 and their consumption is 18.5 kg/capita/year [15]. Further study done in 2014 also reported that fisheries and aquaculture produced 167.2 million metric tons, amounting to 20 kg/capita/year, or 17% of animal protein consumed by the global population [33]. However, the contributions of fisheries to food security and poverty alleviation could be undermined by threats such as overfishing, climate change, pollution, and use of water sources [33].

Fish products provide about 17% of global animal proteins and omega 3 fatty acids, vitamins A, B and D, minerals like zinc, iodine, selenium, calcium and iron. They also provide essential micronutrients which are necessary to end malnutrition and reduce the burden of non-communicable diseases [33]. The world protein contribution of fish is also similar to that of poultry but greater than that of pig meat, bovine meat, mutton, goat, and eggs [34].

Ethiopia is endowed with over 7,400 km² of lakes and reservoirs and 7,000 km of rivers. The total annual fish production of the country's major inland water bodies was estimated to be 51,481 metric tons per annum on the basis of maximum sustainable yield [17]. Their exploitation and consequently their contribution to food security and growth in the country are minimal despite the technologies capable of resolving the problem of livestock and fisheries production [17].

The Ethiopian fishery sector contributes only 0.02% to its Gross Domestic Product (GDP) [22]. Sustainable fishery management is crucial to food security, poverty alleviation and economic growth. Ethiopia earned about USD 14,000,000 from its capture fishery while a total of 40, 000 livelihoods were positively benefitted by the fishery sector in the year 2010. The per capita fish supply is around 200g, significantly below the mean 2.6 kg/capita/year for the East African sub regions [17].

Even though, fish is a vital source of food, employment, recreation, trade and economic wellbeing for people throughout the world, several reasons were attributed to low fish production and consumption [9]. These issues may include over fishing, illegal fishermen, irrigation and shore cultivation, improper management, poor feed quality and feeding habit and outbreak of diseases.

Currently, in Ethiopia, the contribution of fish production and consumption to poverty alleviation, food and nutrition security as well as factors associated to it is yet to be fully assessed. Therefore, this review was initiated to identify this gap and provide the updated information regarding the health benefits of fish consumption and its role in poverty alleviation and food security issues in the country.

2. Methods

In this review, peer-reviewed articles, gray literature, and key reports from national and international organizations were used. The research findings at the global level as well as in particular countries and regions, including both developed and developing countries were also used to

3. Literature Review and Discussion

3.1. Nutrients in Fish

Fish and aquatic animals in general do contain a high level of protein with good amino-acid profile, similar to that of the meat of land animals [17]. It is an important source of energy and protein better than many terrestrial types of meat [32]. The flesh of a fish is also readily digestible and immediately utilizable by the human body, which makes it suitable for complementing the high carbohydrate diets. Compared with land animals, aquatic animals have a high percentage of edible flesh, and there is little wastage.

Fish plays a unique role in providing a range of micronutrients and essential fatty acids, especially long chain polyunsaturated fatty acids, which cannot be easily substituted by other food commodities [8];[19]. These micronutrients can lead to a variety of health benefits, including positive maternal health and pregnancy outcomes, increased early childhood physical and cognitive development [33].

Protein profile of fish contains up to 22 of the essential amino acids in a well-balanced ration [17], low cholesterol level compared to red meat and is easily digestible due to its high soft tissue. As its high nutritional value, fish is highly recommended as a dietary component for both the young and the old. Fish has significant potential to contribute to the goal of reducing food and nutrition insecurity in Africa. However, fish consumption preferences are affected by the consumer's geographic, social and cultural characteristics, food consumption patterns, personal health status, education level, attitude, age, and economic status [24].

A proximate analysis done in India revealed that the protein, carbohydrate, lipid and ash contents were high in *Thunnus albacares* (13.69%), *Parupeneus bifasciatus* (6.12%), *Hyporhamphus dussumieri* (6.97%) and *T. albacares* (1.65%), respectively [31]. The finding of this study further showed that major amino acids were lysine, leucine and methionine, registering 2.84-4.56%, 2.67-4.18% and 2.64-3.91%, respectively.

Table 1. Nutritional value of fish.

Nutritional value of fish per 100 g		
Nutrient	Quantities	Unit
Protein	18.2	G
Iron	0.82	Mg
Calcium	9.0	Mg
Iodine	0.1	Mg
Potassium	321	Mg
Vitamin A	0.02	Mg
Vitamin B6	0.1	Mg
Polyunsaturated fatty acids		
Other minerals, vitamins,		

Source: [31].

3.2. Potential Role of Fish Consumption in Preventing Non-communicable Diseases

Fish consumption has various health, environmental, social advantages and nutritional that is essential to cognitive and physical development, especially in children, and are an important part of a healthy diet over other terrestrial animal meat [17]. The fatty acid content of fish is highly polyunsaturated and particularly those which are attributed to reduce blood cholesterol. There are also some indications that certain fatty acids in fish may provide protection against renal diseases. Fish is a primary source of essential nutrients for children's and pregnant women's, especially nutrients like, an omega 3 fatty acid that is critical for early brain development [27]. It is highly nutritious and so even small quantities can improve people's diet [10]. Increasing the per capita consumption of fish in any country has benefits of health [12]. Another study shows that regular consumption of fish provides health benefits, reducing the risk of depression, cardiovascular diseases, type II diabetes, and fatal coronary artery diseases [30]. Presence of marine food in a diet also stimulates fat loss. In addition to being a source of well-known omega 3 fatty acids and high-quality protein, fish and seafood contain other components beneficial to health, namely B12,

selenium, iodine, choline and taurine [21].

Developed and developing country perspectives on the links between fish and health differ considerably. In developed countries the major focus has been on fish safety and the health benefits of polyunsaturated fatty acids from fish and fish oil, which are thought to lower blood pressure and reduce risk of heart disease [11], and in developing countries, the focus has been on the role of fish in tackling under-nutrition, maternal and child health [17].

The key driving forces behind increased fish consumption are rapid population growth, rising incomes, urbanization, a growing appreciation of healthy and nutritious fish-based food, and innovations in processing and packaging technologies and distribution channels [39]. Besides, 12.3 million people in Africa work in the fisheries and aquaculture sector, with 6.1 million (50%) being employed as fishers, 5.3 million (42%) as processors and 0.9 million (8%) as fish farmers [38]. In terms of economic value, fish produces an estimated total of US\$24 billion annually, accounting for 1.26% of gross domestic product [38]. However, even if the continent has good potential to produce more, they perform below expectation as comparing with the existing potential.

Table 2. Capture and aquaculture production of fish status in Ethiopia and the rest of Easter African sub region in 2016.

Country	Capture Fisheries Production (Tons)	Aquaculture Production (Tons)	Total Domestic Fish Supply (Tons)	Aquaculture as a Share of Fish Production (%)
Sub-Saharan Africa	7,254,848	592,540	7,847,388	7.8
Egypt	335,613	1,370,660	1,706,273	81.73
Nigeria	734,731	306,727	1,041,458	30.62
Uganda	396,205	117,590	513,795	22.9
Tanzania	371,228	10,742	381,970	2.8
Kenya	165,135	18,658	183,793	11.3
Ethiopia	45,519	91	45,610	0.2
Rwanda	29,334	4,847	34,181	14.2
Burundi	20,120	1,326	21,446	6.2

Source: [36].

Beside on consumption status, again Eastern African Region exhibits remarkably low levels of fish consumption per capita (average of 5.1kgs/person/years) compared to the rest of Africa (10.1kg), and global level of 19.8kg (Table 2). From the below data (Table 3), only Uganda's per capita fish consumption of 12.5 kg was higher than the rest of Sub

Saharan Africa. However, the country of Ethiopia, have low fish, animal, and total protein intake across Eastern African countries. They only take 0.4kg/person/year and 0.1 g/person/day [36], [37], which is very far from the world and African average consumption level. It also contributes only 0.2 percent of the total annual protein consumption.

Table 3. The fish, animal, and total protein intake Ethiopia and some Eastern African countries in 2013, compared to Africa and the global status.

Country	Total Food Fish Supply (Tonnes)	Fish Consumption (kg/Person/Year)	Fish Protein (g/Person/Day)	Animal Protein (g/Person/Day)	Fish/Animal Protein (%)	Fish/Total Protein (%)
World	142,126,714	19.8	5.4	32.1	16.9	6.7
Africa	11,225,497	10.1	2.9	16	18.4	4.4
Uganda	469,773	12.5	3.7	12.4	30.1	-
Tanzania	352,304	7.2	2.3	10.4	22.5	4
Rwanda	52,910	4.5	1.5	5.8	25.1	2.5
Kenya	181,227	4.1	1.2	15.8	7.3	1.9
Burundi	20,145	2.0	0.6	2.2	28.1	1.7
Ethiopia	39,347	0.4	0.1	7.7	1.6	0.2

Source: [36, 37].

3.3. Fish Implications for Food Security

The fisheries sector remains an important source of food, nutrition, income, and livelihoods for hundreds of millions of people around the world [51]. Food security and poverty reduction have been central to the world development agenda but the principal themes have evolved with the growing population, and changes in the world economy, technology, and state of the environment.

Food and nutrition security defined here as reliable access to food in sufficient quantity and quality to enjoy a healthy and active life, coupled with a sanitary environment, adequate health services and knowledgeable care is a key reflection and central determinant of broad social and economic welfare and dynamism [14]. From this definition, the four key dimensions of food and nutrition security are availability, access, utilization and stability [40]. In contrast, food insecurity is defined as a limited or uncertain availability of nutritionally adequate and safe foods or limited ability to acquire personally acceptable foods that meet cultural needs in a socially acceptable way [14].

Diet quantity and quality, food poverty and food shock indicators generated from food security and vulnerability analysis of Ethiopia in 2014 revealed that food insecurity is widespread and severe problem in Ethiopia [42]. Food insecurity influences nutritional and health status of household members by limiting the quantity and quality of dietary intake [41]. Studies in developed and developing countries revealed inconsistent evidence about the influence of household food insecurity on children nutritional status [43, 44]. Therefore, fisheries play important roles in providing food and income in many developing countries, either as a stand-alone activity or in association with crop agriculture and livestock rearing [1, 29].

According to a study done in Ethiopia, fish is an affordable animal source of protein and primary source of food and nutrition, creating growing demand for this staple [28]. However, the Ethiopian fishery is under several constraints due to different factors. Although the current global food system is producing enough food for the world's population, ensuring access to a sufficient quantity of food that is culturally acceptable, affordable, nutritious and healthy for active life for everyone on the planet presents more of a challenge [18].

Fisheries are regarded as an important sector in the effort to increase animal protein consumption and achieve food security for the growing population by providing revenue for food efficient countries to purchase food [17]. This sector's economic output provides important contributions to poverty and food security through three main, interlinked pathways: (1) nutritional benefits from the consumption of fish; (2) income to those employed in the sector and multiplier and spillover effects in fishery dependent regions; and (3) through generation of revenues from exports, taxation, license fees and from payment for access to resources by foreign fleets or foreign investment in aquaculture [11].

In many parts of Africa, small-scale fisheries and related activities provide income to rural communities where alternative employment opportunities are scarce or even non-existent [8]. In these situations small-scale fisheries, fish processing and trade provide people with an important, and sometimes crucial, form of safety net that helps protect them against the effects of agricultural product price volatility, macro-economic crises, structural reforms, harvest failures, political turmoil and other factors that threaten rural stability and food security [14].

3.4. Contribution of Fish to Alleviate Poverty and Hunger

Artisanal freshwater fish is one of the most important economic activities in Ethiopia [49]. Sustainable fisheries management and improvements in fishery sector is therefore crucial to poverty alleviation, food security and environment sustainability in Ethiopia [50]. The benefits gained from the development of fisheries are significant and play important roles in food supply, income generation and nutrition. The contribution of fishery activities to national economies is multifaceted. In addition to supplying food, the fishery sector contributes to gross domestic product provides livelihoods for fishers and processors, is a source of hard currency, and boosts government revenues through fisheries agreements and taxes [17]. However, the current production of fisheries in Ethiopia is still far below the estimated potential yield, which suggests the possibility for further expansion of the fishery.

Fish and other farmed aquatic foods are potentially of importance in two key respects with regard to poverty and hunger. First, fish is a nutrient dense food, rich in highly bioavailable quality (in terms of essential amino acids) protein, essential fatty acids and micronutrients [7], recommended as an essential part of a balanced diet [6]. The capture, culture and trading of fish also creates jobs, thereby generating incomes [5]. Recent estimates by the FAO are that between 27 and 57 million full time equivalent aquaculture related jobs, almost three-quarters of which are in production [5]. The value of global fish trade exceeds that of all other animal proteins combined contributing an estimated 0.5-2.5% of global [8].

Fish plays a vital role in domestic trade as well as in import and export market. The Ethiopian cross-border fish trade is currently not properly documented. The country imports significant amounts of fish from neighboring countries though some of these imports end up being exported to Sudan through the porous border with neighboring South Sudan. Although most fish traders do not have access to basic cold chains with ice and insulated containers, a few basic fish handling and preservation institutions which are equipped with electricity and freshwater supplies are available in the Ethiopian fisheries.

3.5. Factors Affecting Fish Production and Consumption

Although the worldwide consumption of fish and fish

products has greatly increased in the recent years, in many parts of Africa, post-harvest losses exceed 30% of the catch [8]. This has a double impact on food security by reducing income for producers and reducing the total quantity of fish available to consumers. Because of weak market infrastructure and facilities in rural areas, the majority of the fish, especially in inland fisheries is still marketed as dried and/or smoked products. The current problems of fisheries are impacts of water hyacinth, expansion of agriculture, urbanization, climate change, postharvest losses, improper fishing gears and poison plants, immature fishing and overfishing [2];[3].

Postharvest fish losses could be nutrient or economic losses render the commodity unavailable or nutritionally deficient for human utilization. Losses can be categorized into physical, quality and market force loss [48]. Traditional processing can cause depletion in nutrient availability and leading to nutritional loss.

According to a study done by [13], education, income and being family were the important factors affecting fish consumption habits. In addition, a study done in Turkey also showed that socio-economic and demographic factors affected fish consumption pattern [4].

Moreover, a study done in Kenya revealed that access to road infrastructure, pond management level, sources of water for fish farms, fish feed, status of fish ponds and location of ponds were factors associated to fish production [20]. A study conducted in Brazil found that factors such as participation in federal programs to transfer income, total area of water and production in ponds were the key factors in determining the likelihood of producer to sell fish [25].

Studies done in Norway and Russia also show that barriers to fish and seafood consumption were fish availability, price perception, self-efficacy, convenience and fish eating habits, health beliefs and sensory perception [9]. In addition, a study done in northern Ethiopia shows that the main fish production constraints in the areas were low fish supply, lack of awareness, lack of support, lack of facilities, low profit, and distance from market place [52]. Also, the study done in Gambella region, Ethiopia reported that the major factors contributing to a reduction in fish production were inefficient fishing gears, poor transportation, poor postharvest handling, low price and improper market place [53].

Climate change, variability and extreme weather events are also compounding threats to the sustainability of capture fisheries development in marine and freshwater environments. Impacts occur as a result of both gradual atmospheric warming and associated physical and chemical changes (salinity content, oxygen concentration and acidification) of the aquatic environment [47]. Initial assessments show that the impacts of climate change on fisheries will be felt most acutely in Africa and South Asia [46]. Fisheries sustainability is also affected by several drivers, the most important being weak governance, socioeconomic conditions, and ecosystem change [54]. Population growth, overfishing, climate change, and trade

are likely to alter the volume and distribution of the supply from capture fisheries, potentially to the detriment of sufficient and equitable global food provisioning [54].

4. Conclusion

This review concluded that fish production and consumption is highly linked with food and nutrition security. Fish provides macro and micro nutrients to prevent non-communicable diseases and end under-nutrition among vulnerable groups. The review also revealed that fish production and consumption were affected by consumers' social and cultural habits, economic status, eating behaviors, personal health status, age, and education level, fish management, sources of water and marketing problem, fish feed and status of fish ponds. Besides, this paper work identified that low fish supply, lack of awareness, lack of support, lack of facilities, low profit, and distance from market place were the main factors for fish production. Therefore, factors affecting fish production and consumption should be explored through innovation, technologies and conducting researches for improving fisheries based food and nutrition security. Further, all concerned bodies need to work with fisheries and aquaculture sector to ensure the food and nutritional security status in the country.

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