



Enhancing Fish Food Consumption Among Rural and Semi Urban Residents through Effective Demonstration of Fish Cooking Method in Fish Potential Areas of the Tigray Region, Northern Ethiopia

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Authors' contributions

This work was carried out in collaboration between both authors. Author GB wrote the research proposal, led data collection, analyzed the data and wrote the manuscript. Author HZ wrote and edited the proposal and manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Fish is the main sources of protein 20% to world population. In addition to its high nutritive value fish has low cholesterol level compared to red meat and is easily digestible due to its high soft tissue. Despite the importance and availability of fish meat nearly to the newly contracted Tekeze hydroelectric power dam and in the region as a whole they have limited fish meat consumption behavior. The aim of the study was to demonstration fish food preparation method for

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rural community and restaurant owners in the fish potential areas of the region. The study wereda (Abi-Adi and Tanqua Abergelle) were selected purposively based on nearly availability of fish resources. In the second stage eight potential Tabia was selected purposively based on easily access to fish. In third stage 81 (60female& 21male) participant were selected purposively based on their interest on method demonstration. The participants were selected in collaboration with health extension worker and development agent. The participant farmers (65) and restaurant owners were trained the procedures of fish based recipe preparation method namely fish deep-fried whole tilapia, deep fried fish fillet, fish steak (Tibsi), and soup for own consumption and sell in restaurant. The primary data were collected by using check list from 41 randomly selected participants. The study employed frequency and narrative analysis. Due to the demonstration intervention and other NGOs effort, the nearby farmers start eating fish at home. Additionally, the number of restaurants who prepared fish based recipe as alternative food choose increased. Keeping the nutritive importance of fish meat the participant farmers preferred fish in its taste (92.65%), color (95.12%), smell (75.61%), and easily understandable method of preparation (85.36%). However, fish consumption is challenged by Shortage of capital. Lack of proper handling material, and Shortage of fish meat access in fair price in the rural settings (48.78%). Therefore, supply of medium sized cooling box is needed to safely transport from fish market to residence home and price of fish for local consumer should considered the economic status of the rural farmers.

Keywords: Fish meat; human food; user's perception; tigray region.

1. INTRODUCTION

Fish provides more than 4.5 billion consumers with at least 15 % of their average per capita intake of animal protein [1]. Consuming fish promotes glucose homeostasis, supports thyroid homeostasis, makes it easier to maintain a healthy body weight, lessens the severity of age-related blood pressure increases, and preserves muscle mass in the elderly [2]. According to [1,3] scientific evidence confirmed the beneficial effects of fish consumption on human health, including cognitive development, mental health, immune system, prevention of anemia and cardiovascular disease.

Consumption of fish is one of the paramount importances in human diet in various aspects. Being particularly valuable and having specific, unique nutritive values, fish occupy a special position in a human diet [4]. In this context, a number of health benefits are attributed to the omega-3 long-chain polyunsaturated fatty acids (LCPUFA) present in fish [5]. The protein profile of fish contains up to 22 of the essential amino acids in a well-balanced ration [6,7]. In addition to this, fish has a low cholesterol level compared to red meat and is easily digestible due to its high soft tissue. As it has high nutritional value, fish is highly recommended as a dietary component for both the young and the old [8]. It has been noted that populations who consume large amounts of oily fish in their diet tend to have lower rates of coronary heart disease (CHD) and sudden

cardiac death (SCD) [9]. A decreased frequency of asymptomatic carotid atherosclerosis was linked to high habitual fish eating [10]. Fish consumption increased by double in ten years, from 1.8 million MT in 2002 to 3.6 million MT in 2012, according to IFPRI [11]. People are not exposed to fishing, farming, or eating fish, even in times of food scarcity and inadequate protein in our diets. Though precise figures are not available, it appears that most Ethiopians prefer to consume beef over fish, even though the latter is fewer nutrients dense and more expensive.

The primary goal of the Abergelle Agricultural Research Center is to conduct research on improving fish production and productivity. This is achieved through identifying the breeding season, evaluating the physiochemical characteristics of the water bodies, introducing fingerlings to the water bodies, identifying the main obstacles and opportunities, and evaluating the fish value chain. Based on earlier research, more than 1065.63 tons of fish meat annually, which open up new employment opportunity for 350 fisheries after the Tekeze reservoir is built [12]. In addition, those who reside near fish-producing bodies of water are the forerunners in the evolution of fish eating in the future; their welfare is surely advantageous to the nation's future as well. Furthermore, the abundant fish resources are subject to spillage due to poor fish harvesting infrastructure. The smallholder farmers lack expertise in fish cooking techniques and have a weak inclination towards fish-based

dishes, even if there is an extreme scarcity of nutrient-dense food in the study area [13]. However, the majority of smallholders who reside in locations with potential for fishing consume fish meat infrequently, which may be a result of their ignorance about the value of fish meat and their lack of expertise in preparing fish meal for human consumption. As far as the author knowledge, no demonstration research on fish cooking techniques has been conducted in the study area. Hence keeping in mind all the merits mention in the above conducting research on the topic in the study area is crucial.

2. METHODS

2.1 Description of the Study Areas

The study was conducted in fish potential woredas of Tigray region namely Tanqua_Abergelle and Abi-Adi wereda. Both Tanqua-

Abergelle and Abiadi Wereda are located in the central zone of Tigray Regional State. The Tanqua-Abergelle and Abiadi Wereda are located about 120 and 90 km west of Mekelle, the capital city of the Tigray region, and at a distance of 900 and 878 km far away from Addis Ababa respectively, the capital city of Ethiopia. According to the current administrative division, Tanqau Abergelle wereda is subdivided into 19 rural kebele and 1 urban kebele administration, while AbiAdi wereda is classified in to four kebelles. Tanqua Abergelle is located at latitude N 13° 62' 87" and longitude E 38° 58' 50". AbiAdi wereda is located at latitude N 13° 14' 06" and longitude E 38° 98' 95". The Tanqua Abergelle wereda has a total population of 93430, of which 47636 are male and the rest 45794 are female [14]. AbiAdi wereda has an estimated population of 18,198, from the total populations 9053(49.2%) are males and 9145(50.8%) females [15].

Table 1. Explains the step by step preparation of raw fish products for cooking

Steps	List of preparation on how to			
	Prepare fillet from fish	Remove pin bone from fillet	Clean fish products	Descaled tilapia fish
step1	Place the tilapia on a clean cutting board	Place the fillet on a clean cutting board	Place the fish (fillet or descaled fish) on a bowl containing cold water	Rinse the Tilapia fish thoroughly under cold water for about 10 minutes
step2	Hold the fish with one hand and insert the tip of the fillet sharp knife at the base of the head	Identifying the pin bone	Add the lemon and grated ginger into the bowl	Hold the fish firmly with one hand and use a knife to scrape the scales from the tail towards the head. Rotate the fish as you go until all scales are removed.
step3	Cut along the spine and through the rib bones to the tail	Removing the pin bone	Gently rinse with cold water and rub with sliced lemon and grated ginger	Collect the removed scales and put in bucket
step4	Cut gently to separate one side filets from the fish	Put the pin bone in bucket	Allow to drain the cleaned fish for few	
step5	Flip the fillet out and begin cutting where the skin meets the flesh			
step6	To fillet the other side of the fish, turn the fish over and repeat step 2-5			
step7	Put the carcass in bucket			

Sample size and sampling Technique: 81 participants (farmers and restaurant owners) were selected using purposive sampling methods based on their interest; access to fish and their ability to influence others of these 75.31% were women. In addition to this seven DA's and ten extension experts were participated on the demonstration of these fish based food recipe preparation practices.

Materials used:The important materials needed to the preparation of fish products are Tilapia fish, cutting board, Sharp knife, cold water, Bowel, Slices of lemon, Soap and or detergents for cleaning , Soft Sponges, Fire wood, cup of grated Ginger and Bucket for carcasses. The

preparation of fish products for cooking is summarized in Table 1.

2.2 Ingredients Required for Fish-Based Recipe Preparation

Despite the variability and amount of ingredients needed for the preparation of fish-based recipe vary based on the interest of the consumer and economic condition of given house hold the commonly used ingredients are Large Cat fish fillet, Tilapia fish fillet, pepper, chopped onion, Cooking oil, water, garlic, carrots, Cereal flour (corn, wheat), salt, medium grated potato, garlic and carrots. The detail of cooking procedure is summarized under Table 2.

Table 2. Refers to the cooking procedures of fish-based recipe preparation techniques

Steps	Cooking procedure for			
	Deep-fried whole tilapia	Deep fried fish fillet /Kotellat/	Fish steak (Tibsi)	Fish soup
Step1	Place the cleaned and pin bone removed fillet on cutting board	Set deep fryer on 375 °F	Preheat pan over oven to about 50°C	Add chopped onion into pan and stir for 2-3 min
Step2	Enlarging the fillet through bottle or metal and prepare seasoned flour by combining flour, salt and spices (pepper)	Cut 2 slits in both sides descaled tilapia fish	Add chopped onion and stir for 2-3 min	Add oil and stir for 2-3 min
Step3	Preheat oven to 400 °F	Once the fryer is ready, cook 2 fish at a time till golden brownby turning	Add cooking oil and then pepper, stir for 2-3	Add grated carrot and potatoes and stir for few minutes
Step4	Once the fryer is ready, cook 1-2 fish at a time till golden brown by turning the other side	Drain each whole fried fish using strainer for a few seconds	Add warm water (5 ml) stir for 2-3	Add warm water and cook until the potatoes are nearly cooked
Step5	Drain each fried filet for a few seconds and serve with salads and bread	Serve with salads and spiced paper	Add chopped catfish meat and stir for 2-3 min	Add chopped catfish meat and simmer for 2–3 minutes
Step6	Season the fish filets with salt and pepper and dredge in the seasoned flour		Add salt and garlic	Season to taste
Step7			Cool and serve with bread or injera	Serve, ladle the fish soup into soup bowls, serve immediately

2.3 Data Collection

The study uses primary and secondary data. The primary data was collected by using a semi-structured questionnaire, which includes questions on demographic characteristics, their understanding of the importance of fish food, and their perception of cooking procedures. The secondary data were collected through reviewing published and unpublished materials. The questionnaire was initially prepared in English and later translated into local languages during the interview. The data collection tool was pretested and accordingly modified. The data collection was carried out by a team of researchers. Data were collected from randomly selected 41 demonstration participants (15 restaurant owners and 26 farming community representatives) by employing interview technique.

2.4 Method of Data Analysis

The collected data were analyzed using descriptive statistics and narrative analysis. For the analysis purpose the study was used Stata version14.

3. RESULTS AND DISCUSSION

3.1 Demographic Character of the Participants

Sex: The participant's sex was composed of female headed households 61(75.31%) and male

headed households 20(24.69%). According to the culture of the study area majority of the reproductive role is assigned to women especially the food preparation and child care. The main reason for having 25% the participants' male is associated in decision making on what to consume at household level and evaluate the effectiveness of demonstration when it is gender inclusive.

Age: Age of the respondents is one of the demographic characteristics that influence technology adoption by users. The minimum and maximum age of the demonstration participants' were 22 and 65 years respectively. The mean age of the total respondents was 45.96 years with SD of 12.06.

Education level of the respondents: It is obvious that education increases the knowledge and skill of the people in a given society by diversifying source of information and easily understanding of existing situation. Therefore, the more educated a participant means the more aware in the importance of consuming fish based recipe at house hold and individual level. Additional education level of participants is emphasized to use leaflet and manual on fish cooking procedure. The result of the study indicates that majority (56.79%) and (43.21%) of the sampled participants were literate and illiterate respectively. The demographic characteristics of the participants are described in Table 3.

Table 3. Descriptive statics of the demonstration participants

List of demographic characteristics	Response level	
	No	%age
Sex		
• Female	61	75.31
• Male	20	24.69
Age		
• mean	45.94	
• Range	33	
Education level		
• illiterate	35	43.21
• grade 1-4	22	27.16
• grade 5-8	17	20.99
• >= 9	7	8.64

Sources: Computed from own survey, 2023

3.2 Participant’s Perception on Fish Based Recipe Cooking Procedure

The study's findings indicate that fish-based recipe preparation is preferred due to its simple trial process (85.36%), quick cooking (80.48%), and affordable price in fish based recipe (87.04%). The cost of fish meat ranges from 250 to 350 birr/kg, and the cost of cattle meat in the market ranges from 700 to 800 birr/kg, with additional expenses ranging from 128% to 180%. For this reason, the participants reportedly suggested that the best way to encourage the consumption of nutrient-dense food is by increasing the availability of fish at a fair and reasonable price. Furthermore, according to the respondents, the process of preparing fish products and cooking fish-based recipes is low-risk (87.80%) and gender neutral (90.24%), meaning that both men and women can do it equally. Table 4 below summarizes participant responses regarding how they perceived the process of preparing fish.

Fish recipes have higher acceptance by the participants (95.12%). Additionally, the participants prefer a fish-based recipe in its color (95.12%), scent (75.61%), and flavor (92.65%) if the fish product preparation and cooking procedure are implemented properly. even

though the fish based recipe has many positive aspects, the rural participants find it difficult to transport fish fillet from fishing site to their home because of its characteristics, lack of proper handling materials, and high environmental temperature. they also criticize the fillet's low availability (48.78%). The demonstration intervention helps people in rural and semi urban areas improve their fish-eating habits. The smart usage of fish can help in filling food and nutritional security for the rural population. Recent research findings demonstrate that different fish cooking procedures have varying nutrient content of the fish-based dish, primarily protein, magnesium, phosphorus, and calcium content [16,17]. The primary obstacles found during the demonstration are: inability to fish freely from the reservoir; inability to obtain fish meat at a reasonable price; and, despite the area's fish potential, farmers' interest in consuming fish is restricted by a lack of funds, an inability to obtain fish meat, and an inadequate supply of handling equipment. Enough incentives must be offered by the government and nongovernmental groups in order to support fish processing technologies and implement medium-sized cooling boxes. Table 5 provides an overview of the demonstration participants' preferences for fish-based recipes.

Table 4. The participants’ perception on fish based recipe cooking procedures

Characteristics	Farmers response level					
	Low		Medium		High	
	No	%	No	%	No	%
Divisible/easily trial able of the fish meal preparation	6	14.63	15	36.59	20	48.78
Time taken to cook fish meal	20	48.78	13	31.71	8	19.51
Low cost of fish based recipe preparation	5	12.20	22	53.66	14	34.15
Complexity in preparation	18	43.90	16	39.02	7	17.07
Labor intensiveness	16	39.02	16	39.02	9	21.95
Gender neutrality	4	9.76	16	39.02	21	51.22
Your understanding on cooking procedure	2	4.88	18	43.90	21	51.22
Risk of fish based recipe preparation	19	46.34	17	41.46	5	12.20

Sources: Computed from own survey, 2023

Table 5. The participants' preference analysis on fish based recipes

Characteristics	Farmers response level					
	Low		Medium		High	
	No	%	No	%	No	%
Your understanding level on the importance of fish food	5	12.50	10	24.39	26	63.41
Implementation complexity	4	9.76	16	39.02	21	51.22
Compatible with feeding system	6	14.63	23	56.10	12	29.27
Availability in your area	20	48.78	11	26.83	10	24.39
Compatibility existing practice	6	14.63	19	46.34	16	39.02
Color of the prepared fish food	2	4.88	14	34.15	25	60.98
Smell of the prepared fish food	7	17.07	17	41.46	17	41.46
Taste of the prepared fish food	3	7.32	15	36.59	23	56.10
Over all acceptance of fish based recipe	2	4.88	15	36.59	24	58.54

Sources: Computed from own survey, 2023



During practical training



Fig. 1. During testing fish tsebhi



Fig. 2. Pectoral representation of training on fish food preparation

4. CONCLUSION AND RECOMMENDATION

Getting nutritious food for the continuously increasing population is becoming very difficult. From the study we can conclude that, the participants preferred fish meat in its taste, color, smell, and reasonable price. Due to the demonstration intervention and other NGOs efforts, the nearby farmers started eating fish at home. Additionally, the number of restaurants

that prepared fish as an alternative food choice increased. However, fish consumption is common challenged by shortage of capital, lack of proper handling material, and shortage of fish meat access at a fair price. Therefore, the study recommended:

- Improving the access of medium-sized cooling boxes at a fair price is needed to safely transport fish meat from the fish market to the residence home.

- The price of fish for local consumers should consider the economic status of the rural farmers.
- Further research on integration of aquaculture with irrigation and evaluation of best cooking method in preserving the fish nutrient is highly needed.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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