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Fish product development and market trials of fish and fish products in Kenya: a case study of Kirinyaga and Meru Counties

D N Kyule, E Yongo*, M A Opiyo, K Obiero, J M Munguti and H Charo-Karisa*****

Kenya Marine and Fisheries Research Institute, Sagana, Kenya
domsjos@yahoo.com
** Kenya Marine and Fisheries Research Institute, Kisumu, Kenya*
*** Kenya Marine and Fisheries Research Institute, Turkana station, P.O. Box 205- 30500, Lodwar, Kenya*
**** National Aquaculture Research Development and Training Centre, Kenya*

Abstract

Post harvest losses in fish are one of the major challenges to food security in sub-Saharan Africa. In Kenya, consumers in rural areas consume fresh fish due to limited and/or lack of knowledge on other alternative fish products. In an effort to contribute towards addressing the issue of limited alternatives on fish value added products and deterioration of fish quality, a study was conducted to develop,test and assess acceptability of the new products in two Kenyan markets. This was achieved first by training fish traders, youth and women on recipe, product development and value addition inventions of fish products. The diversified fish products developed were catfish samosas, catfish fingers, catfish balls, smoked catfish and whole deep fried catfish.

Majority of consumers (50%) preferred fish fingers and samosas compared to other products from both markets.Marketing trial results indicate that traders can makeprofit ranging from 25% to 100% from selling catfish samosas, fingers, smoked and whole deep fried catfish after excluding cost of production. Market trials results indicated that, fish and fish products are highly acceptable health products and both male and femaleconsumers preferred the diversified fish products. All the products bought by the buyers were reported to be delicious in taste(91.7%) and (75.6%) from both Kerugoya and Meru markets respectively. This study has also provided some important information regarding acceptance of developed diversified fish products and this can be useful for researchers and entrepreneurs in developing marketing of aquaculturepro duce.

Keywords: *catfish, food security, post harvest losses, profit, training, value addition*

Introduction

Fish and fishery products are highly nutritious and contain high percentages of animal protein

with several other nutrients such as vitamins A, B, E and K and they are good sources of some minerals like calcium, phosphorus and iron (Dalin et al2013). Fish consumption in Kenya is at 5kg/capita/year (Rothuis et al2011) and is still lower than world average of 18.4 kg/capita/year in 2009 (FAO2012). This is expected to rise with thedemand of fish increasing with population growth (CIA2013). Because fish is a highly perishable product,the development and improvement of fish handling techniques that can be developed for fish harvesting, handling, processing and storage can never be over-emphasized especially at a time when aquaculture development is fast gathering momentum (Akinneye et al2007). Appropriate processing and handling of fish will therefore enable maximal production of value-added products which is the basis of processing profitability (Davies and Davies 2009) and reduce post harvest losses.

Traditional methods used for preservation and value addition, includes sun drying, salting and smoking (Dalin et al 2013).In the process of preservation, massive post harvest losses to traders and farmers is witnessed which sometimes are as high as 100%, occurring at different stages of the marketing chain (Joseph 1991). After catching and death, the micro flora may begin to change due to the differing environmental conditions. Usually fish are stored on ice, which will clearly reduce temperature but most farmers are not able to use ice because of lack of electrical based facilities for ice production to be used in fish preservation.

In Kenya, consumers in both rural and urban areas prefer fresh fish and those who live near the major water bodies and rivers consume many forms of fish which are either in fresh form or have undergone some form of processing; mainly sun dried, smoked or fried for preservation and extension of the shelf life of the products (K Obiero et al 2014). Moreover, the current delivery systems have limited the quality and quantity of the products that they consume necessitating development of technologies that will result into a wide range of value added products from high cost traditionally smoked whole and chilled fillets. In an effort to contribute towards addressing the issue of limited alternatives on fish products and deteriorations of fish quality, a study was conducted to develop and test new products in the markets with the involvement of fish traders, women and the youth and also to asses acceptability of the products at Kerugoya and Meru markets in Kirinyagaand Meru counties respectively.

Materials and methods

Study area

The study was conducted in Kerugoya and Meru markets in the Kirinyaga and Meru counties in Kenya. For this process to be achieved, product development was carried out at the fish trader's cafés from Meru and Kerugoya markets respectively.

Sampling procedure and sample size

A total of sixteen trainees=traders participated in the survey. The trainees were engaged in the procedures of developing the various products (catfish samosas, fingers, balls, smoked catfish and deep fried catfish, whose ingredients and methods of preparation are summarized in table 1 below). A fish recipe booklet developed by research scientists and research assistants from Kenya Marine and Fisheries Research Institute (KMFRI) Sagana was used for the training. Whole catfish and its fillet were utilized for the product development.The products were marketed from the trader cafes.During the survey period, 54 catfish samosas, 62 fingers, 19

balls, 30 smoked catfish and 36 deep fried catfish were developed in Meru while 54 catfish samosas, 35 fingers, 7 balls, 3 smoked catfish and 10 deep fried catfish were developed in Kerugoya.

A semi structured questionnaire with both closed and open ended questions was used as the

survey instrument for the fish buyers. A total of 109 respondents/buyerswere interviewed from Kerugoya market, with 201 respondents from Meru market. The respondents were interviewed on attributes/taste, gender, price and number of products bought.

Table 1. General summary of ingredients and preparation procedures for the different products

1. Fish samosa filling

Ingredients- Minced fish, finely chopped onion, ginger garlic paste, chili powder teaspoon ,black pepper powder, garam

Method

1. Heat oil in a frying pan.

2. Add onions and salt, stir until brown.

3. Add the minced fish.

4. Let it cook until dry.

5.Add ginger, chili, black pepper, garam masala.

6.Cook for 10 minutes stirring regularly

7. Remove from the fire and let it cool

Samosa pastry and cones :

Ingredients : Plain wheat flour, cold water, salt

Method

1. Mix flour and salt into a bowl.

2. Make a well into the centre and add enough water to make firm dough.

3. Knead the dough on a floured surface until smooth and roll into a ball.

4. Cover in plastic wrap and leave to cool for 30 minutes.

5. Divide the pastry into 12 equal pieces.

6. Roll each piece into a ball and

2. Fish fingers

Ingredients -catfish, fillet, whole meal bread crumbs, Finely grated lemon, 2 eggs lightly beaten, salt and pepper

Method

1. In a bowl, beat the egg, water, and salt, and pepper to taste. In a separate bowl, mix the bread crumbs.

2. Rinse the fish and cut it into 4-by 2-inch sticks.

3. Lightly coat the fish with the egg wash, then the bread crumbs.

4. Heat the oil in a large pan over medium-high heat.

5. Add the fish and cook until golden, about 3 minutes each side.

6. Remove the fish from the pan and set on a paper-towel-lined dish.

3. Fish balls

Ingredients -minced catfish, diced potatoes, diced carrots ,white pepper ginger, peeled garlic, vegetable oil, eggs, bread crumbs, wheat flour, salt and pepper, onions

Method

1. Separately salt and boil the potatoes until tender.

2. Mash the potatoes to a fine paste.

3. Mix the potatoes and the cooked minced catfish in a bowl.

4.Deep fried catfish

Ingredients- Whole catfish, vegetable oil, wheat flour, salt

Method

1. Place the fish on a cutting board (at a 45° angle).

2. Cut the fish belly and remove all the contents rinsing thoroughly in warm water.

3. Cut the fish into 3 equal pieces.

4. Make 2 shallow incisions on each piece on both sides.

5. Season the fish with salt and lightly coat with flour.

6. Heat oil in a deep frying pan until ready.

7. Place the fish in the pan and heat in oil till it turns golden brown on both sides.

5. Smoked catfish

Ingredients- Whole catfish gutted**,** **s**moking kiln**,** charcoal**,** saw dust, mixed spices, salt, hooks

Method:

1.Arrange and hook the fish inside the smoking kiln

2. Light up the charcoal and saw dust.

Tightly close the smoking kiln and make sure no heat and smoke escapes.

3. Periodically, charcoal and sawdust can be added, for instance every hour, the fish is ready after 3 hours but this depends on the amount of heat applied.

roll out into a circle of 15 cm	
	4. Take about a teaspoon full
7. Divide this circle into two equal semicircles with a knife.	amount and roll in your hands to form the ball.
8.Fold like a cone.	5.Toss in the flour, beaten egg and bread crumbs to evenly coat the
9.Fill with the cooked fish and seal it and deep fry	outside
	6. Deep fry until golden brown.

Data collection and analyses procedures

The collected data were entered, sorted and analyzed.Descriptive statistics consisting of frequencies, means, standard deviation,percentages and modes were computed for different data categories to facilitate comparisons. Inferential statistics was done using Chi-square (c^2) test of goodness of fit. Data were analyzed using the Statistical Package for Social Sciences (SPSS version 20.0 for windows). All data analyzed were considered significant at 0.05 level of significance.

Results

Percentage composition of the product types for Kerugoya and Meru markets

The diversified fish products developed from both counties included catfish samosas, fingers, fish balls, smoked catfish and deep fried catfish. Of all the value added products, samosas were popular and comprised an average percentage of 38.2%, while fish fingerscomprised an average of 31.5% from the two markets. Fish balls were the least popular and less preferred among the value added products from both Kerugoya and Meru markets as illustrated in figure 1 below.

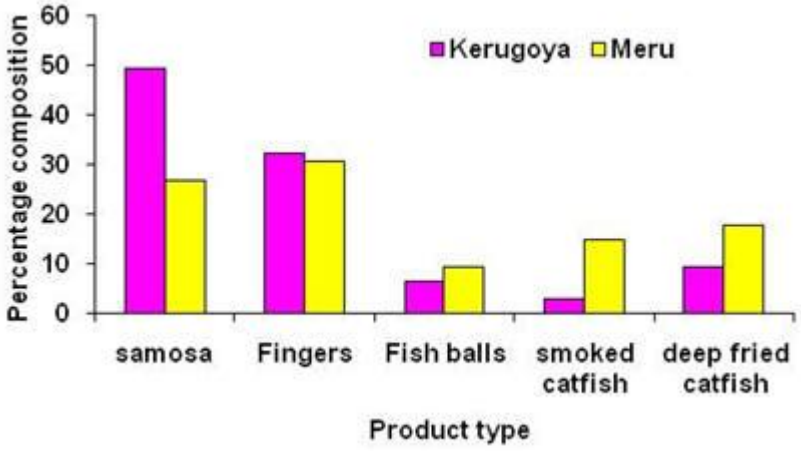

Figure 1. Percentages of the different product types

Consumption of product type by gender in Meru and Kerugoya markets

All respondents from Kerugoya and Meru markets purchased and consumed the diversified fish

products subjected to the market. Interestingly, most females consumed more fish samosas in Meru market (31%) compared to Kerugoya where males consumed more samosas (36%). Fish fingers were averagely consumed by both gender in Meru (31%) compared to Kerugoya market (15%). Moreover, fish balls were consumed mostly by women (16%) in Meru compared to their counterparts in Kerugoya (5%). Smoked catfish was preferred by majority of males in Meru (23%) but this was unpopular in Kerugoya by either gender as shown in figure 2 below. Further analysis by chi- square has shown that gender did not have an influence on choice of products in Kerugoya market. For instance, there was no significant difference(χ^2 =6.995; df=4; p=0.136) between gender and choice of product. On the other hand, gender had an influence on choice of product in Meru market, and there was a significance difference (χ^2 =18.676; df=4; p=0.001) between gender and choice of product type.

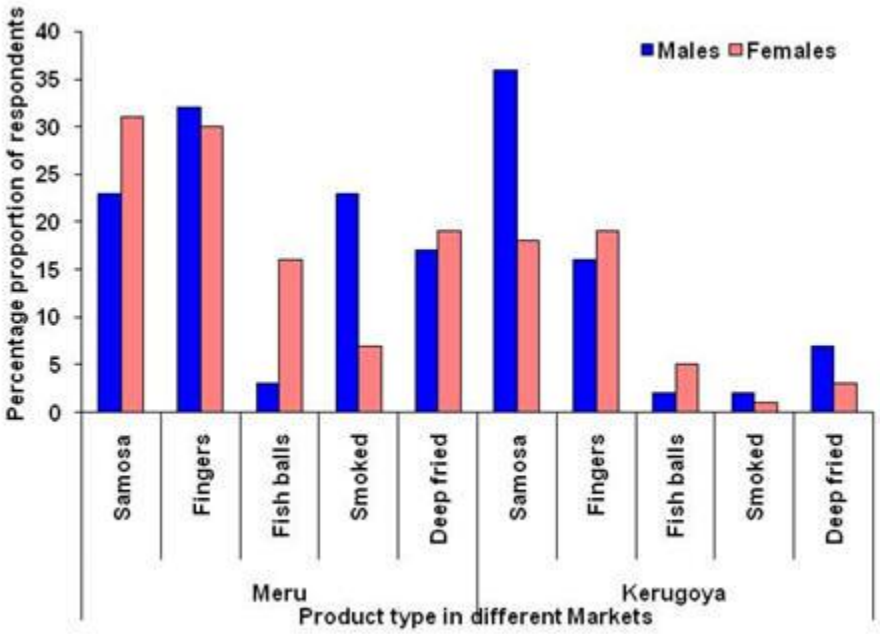

Figure 2. Percentage proportion of respondents for both males and females

Taste attribute for the buyers of the different products

Most of the buyers (91.7%) and (75.6%) in both Kerugoya and Meru markets respectivelyfound the developed products delicious (Figure 3) with a few responding not delicious and minority not knowing the attribute.

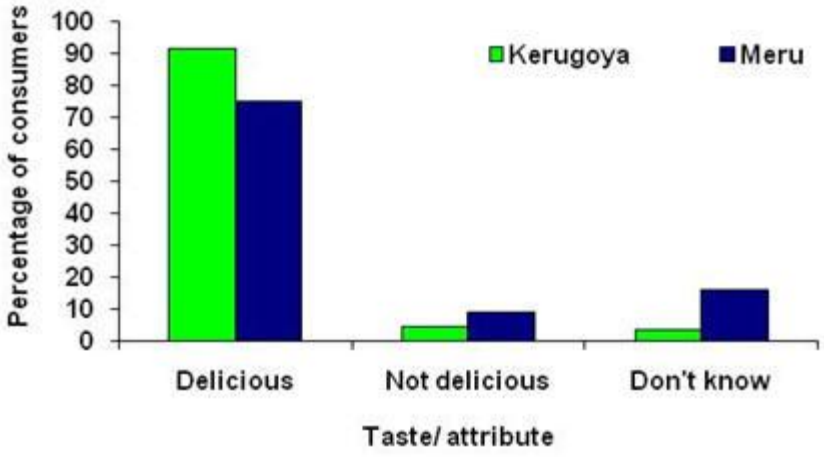

Figure 3. Percentage presentation of the taste attribute from buyers

Prices and percent profit for the various product types

Both catfish fingers and balls were sold at Ksh.30 whereas the samosas sold at Ksh.40. The smoked catfish and deep fried catfish were sold at Kshs. 100 and 200 respectively from both markets as shown in table 2 below. The prices were preset after considering cost of production by the traders and researchers.

Percentage profit ranged from 7% for fish balls, 25% samosas, 54% smoked catfish and 100% for both deep fried catfish and fingers as shown in table 2 below for both markets.

Table 2. Summary costing and percentage profit for all the products in Kshs

Product type	Cost of production/ piece	Selling price/ piece	Profit/ piece	Profit, %
Catfish samosas	32	40	8	25
Fish fingers	15	30	15	100
Fish balls	28	30	2	7
Deep fried catfish	50	100	50	100
Smoked catfish	130	200	70	54

Percentage (%) profit was calculated as; selling price-cost of production/ cost of production (100)Ksh. refers to Kenya shillings. 1 US$ = 85 Ksh.

Discussion

Value addition reducespost-harvest losses, increase the shelf life of that particular fish product and guarantee a sustainable supply of fish during off-season with increase in profit of the of fisher folk. The highest percentage scored by fish fingers and samosas as shown in figure 1 above could probably be due to the fact that the fish traders dropped developing fish balls, smoked and deep fried catfishand specialised with the two products during the study period due to their profitability(Davies and Davies 2009). This is partly implicated in the price and percentage profit margin as shown in table 2 above.Price per piece didn't affect the number of products bought significantly ($P>0.05$) which can be a measure of acceptability.

The attribute consideredfor acceptabilitywas taste, a positive determinant of acceptability as per studies by (Rosniyana2007). The attribute/taste was scored as delicious, not delicious and don't

know and few of the consumerswho didn't like the taste could do modificationthrough formulation, treatment and controlling the processing and manufacturing factors to meet their expectations in terms of taste according to (Rashilah et al 2010). The lack of significant difference in the number of products bought by either males or females in Kerugoya market is a clear indication that all the products were accepted and this probably is a simulation of what can happen in any other market segment and its behaviour when faced with a series of purchase choices according to Rashilah et al(2010).

Most of the consumers preferred samosas and fingers to other products probably due to their taste. The traders in the study areas have been specializing in deep fried catfish for their livelihoodwhich they claimed was a good business and they further reported an increase in profit and the number of consumers after introducing the diversified products into the market hence an increase in the number of people consuming fish and this conforms to the observations of (FAO 1996) that with awareness of fish nutritional values, peoplesconsumption may switch to fishery products if they can economically afford them.

The diversified products were developed from whole catfish and catfish fillet due to its reasonable price, good flesh quantity (meaty) and availability and are in line with findings by (Musaet al 2011) who investigated supply, marketing and distribution of fish species in a local market in Ogun state, Nigeria.Moreover, there is no doubt that those who place importance on attractiveness on a particular commodity are more likely to choose these fish products rather than whole fish from the on-shore markets or fish from aquaculture.

Conclusion

- Traders can make 100% profit above total cost by including catfish samosas and fingers in the products range.
- Fish and fish products were highly acceptable as food products and they were bought by both males and females in the market.
- All the products bought by the buyers were delicious in taste.
- This study provides some important information regarding acceptance of developed diversified fish products and can be useful for researchers and entrepreneurs in developing marketing of aquaculture produce and reduction of post-harvest losses.

Acknowledgement

The authors thank the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA) for providing support through funding this research work through the project "building public-private sector partnership to enhance productivity and competitiveness of Aquaculture-Grant No. **RC10 LFP-02.**" We highly acknowledgeKenya Marine and Fisheries Research Institute for providing maximum logistical support and technical staff who helped during study.

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Received 27 March 2014; Accepted 5 May 2014; Published 1 June 2014

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