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The Characteristics of Cracker Fish and Beef Products
Processed Under Sudanese Condition

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Abstract

Purpose: The study was designed to evaluate the processing of fish and beef crackers under Sudanese conditions.

Methodology: 2kg *Tetraodon fahaka* fish meat, 2kg beef top side cut, corn flour, and spices were purchased from local market, and then prepared for processed cracker. The processing formula consist of 50% Meat or fish with 50% corn flour.

Findings: The products were significantly different chemically in lipid content 19% for fish and 14 % for beef cracker and similar in moisture, protein, and ash%. (WAI) water absorption index, (WSI) water Solubility index determined without different between products. Linear expansion and oil absorption were differently 15.6, 10.7, 19.7, and 2.1for fish and beef cracker respectively. Sensory characteristics were determined included colour, falavor, Crispness, overall acceptability. The panelists prefer cracker fish in overall acceptability.

Unique contribution to theory, practice and policy: Cracker fish products are traditional food in Asia; it's made of fish and sea food which increases the nutritional value, and is taken between meals. Most of the snacks available in the market are mainly based on cereals, which are high in calorie and low in protein content. For this reason, snacks like fish or beef crackers with high protein content was thought to be developed for nutritional enrichment. Cracker fish and beef were processed in Sudan had acceptable chance to increases the nutritional value for children which like crispness. Cracker it can be useful in IDP camp for displaced human in Darfur province.

Keywords: *Cracker, Characteristics, Processing, Fish, Beef*

1.0 INTRODUCTION

Fish crackers is one of the popular snack food in Southeast Asian countries including Malaysia. Crackers are a popular snack among young and old people, can be consumed at any time and any place. In fact, crackers are frequently served as a side dish with rice or other delicacies such as wonton noodles, rice cake, and *batagor* (Sufiat *et al*., 2022). They are made of fish flesh together with starch flour, water and seasoning which then shaped into round, oblique, Stick or longitudinal forms and gelatinized by boiling or steaming (Huda *et al*., 2009; Taewee, 2011).The cool dough is sliced and dried for certain times before being fried to be eaten as fresh and puffed Crackers. In Malaysia, there are many producers from the cottage industry especially in these three major States, Terengganu, Kelantan and Pahang. There are more than 100 small scale producers along the streets in Terengganu that each of them producing different taste and look of the crackers. Other characteristics that differ among the fish cracker producers are an uneven expansion and shapes, different sizes and color. This is happen due to the different ratio of ingredients used by the producers. Therefore, it is important to ensure that the crackers suits the best characteristics of good quality crackers in terms of their sufficient expansion from puffing, crispiness, low moisture content and less oil absorption (Taewee, 2011). Fish at large are divided into two main groups which are marine and freshwater fishes. In the fish introduction of new types of fish based products in tune with the changing market trends is need of the day. Present market trends demand for healthy ready-to-cook and ready-to-eat convenient products for present day time starved consumer (Paradkar ,2007, Esmat *et al.*, 2020, Broto *et al.,* 2020)

1.1 Statement of the Problem

Starch based snack foods that are popular among all age groups, do not normally contain adequate quality protein and minerals. Fish crackers can now replace these unhealthy snack foods available in the market by providing utilizable protein and minerals. Starch serves as a functional ingredient that contributes to the expansion of the product. The expansion is directly related to the crispiness, which determines the acceptability of fish cracker (Yu SY, 1991b, and Yu SY,1991a).

1.3 Objectives of the Study

The general objective of the study to evaluate processing cracker from beef and fish under Sudanese conditions and determine the characteristics or acceptability of beef cracker compare with fish.

1.2 LITERATURE REVIEW

One such important traditional fish-based snack food is the crackers known by different names in many countries of Asia. In India they are called wafers or crackers and in Malaysia they are called 'Keropok'. Ingredients for making fish crackers are starch or flour, seasoning (pepper, garlic, salt, sugar and monosodium glutamate); and the protein ingredient that gives its

distinction to the name of the cracker. Starch or flour is a principal ingredient for making fish cracker (Huda, 2009 and Taewee , 2011) Amylose-amylopectin ratio in starch has a strong effect on the expansion of starch-based snack Matz (1984) &Wang (1997). Fish cracker made from various flours, which had a different amylose-amylopectin ratio, were compared in their expansion (Mohamed *et al*.,1989). It was found that linear expansion of cracker correlated positively to the amylopectin content in flour. Types of starch have different compositions and functional properties (Subarica *et al*., 2012). Starch composition was shown to influence cracker expansion. Protein in flour seems to inhibit cracker expansion (Kyaw *et al*., 1999).

2.0 MATERIALS AND METHODS

2.1 Experiment

 The experiment was conducted at the food processing hall, Faculty of Agricultural Technology and Fish Sciences, Al-Neelain University. ingredients for processing cracker *Tetraodon fahaka* fish, Beef meat, Corn Flour, Nutmeg, piper cubeba, Salt, Sugar, Black pepper, garlic, dry onions, fenugreek, Sesame, Cinnamon were purchased from local market.
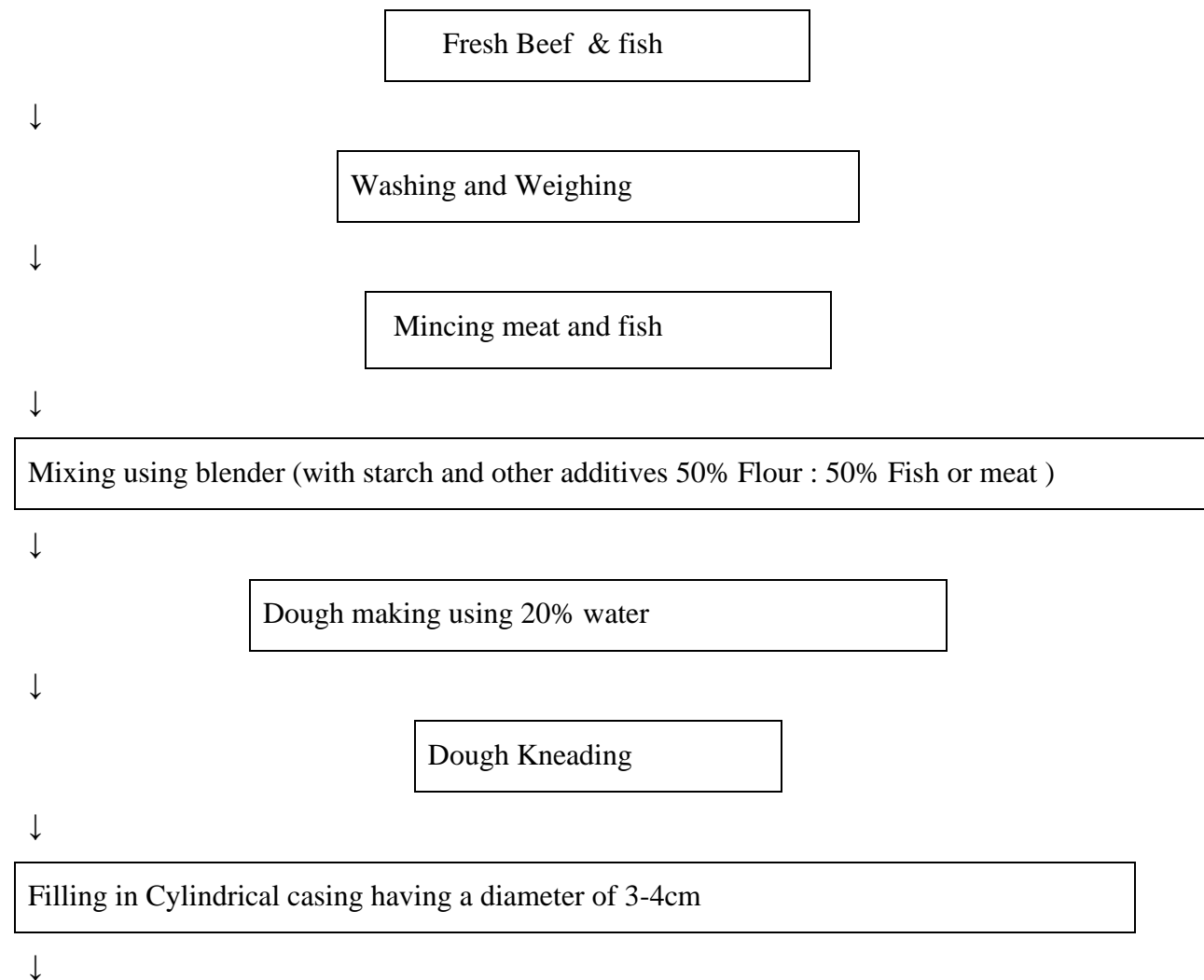
2.1.1 Processing Fish and Beef crackers

The fish was washed with chilled chlorinated water of 2 ppm and flesh was separated from the bones manually after heading, gutting, scaling and cleaning. 1kg beef top side cut prepared for processing. Fish and beef cracker was prepared as per flow chart shown in Fig. 1. The mince obtained was mixed with Corn Flower starch the meat or fish-to-starch ratio of 50:50 (%) including 1% sodium bicarbonate, 2% salt, 2% seasoning and 200 ml water added to the mixture. The ingredients were mixed mechanically using blender until a smooth paste was obtained. The semi-solid paste was then molded into a sausage casing having a diameter of 3 to 5 cm and 25 to 30 cm length. The sausage was steamed for 60 minutes. The steamed pastes were cooled in cold water to minimize shrinkage and chilled for 24 hrs in a refrigerator at 4±1 °C. The cooked and chilled sausage was cut manually into slices about 3 to 4 mm thick and dried in an oven at 60° for 12 hours until a moisture content was around $10 \pm 2\%$. The dry slice of beef and fish cracker was fried in cooking oil approximately at 180° for 10 sec. The fried crackers were evaluated for different quality analysis.

Table 1: Ingredients used for preparation of fish and beef cracker.

Combination-1 C-1	Combination-1 C-2

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50%Corn Flour (including 2% salt and other Ingredients like sodium Bicarbonate 1% and 2% seasoning) 50% fish Meat	50%Corn Flour (including 2% salt and other Ingredients like sodium Bicarbonate 1% and 2% seasoning) 50% Beef Meat

Fresh Beef & fish

↓

Washing and Weighing

↓

Mincing meat and fish

↓

Mixing using blender (with starch and other additives 50% Flour : 50% Fish or meat)

↓

Dough making using 20% water

↓

Dough Kneading

↓

Filling in Cylindrical casing having a diameter of 3-4cm

↓

Steaming of sausage for 60min

↓

Cooling in refrigerated condition for 24 hrs. Then slicing in to 3-4 mm thickness diameter.

↓

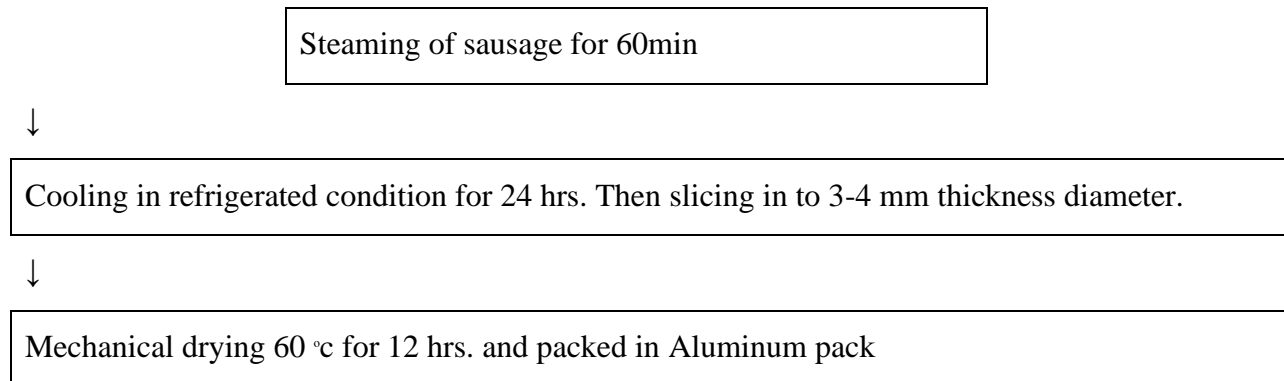| Mechanical drying 60 ℃ for 12 hrs. and packed in Aluminum pack |
| --- |

Fig 1: Flow chart for processing beef and fish cracker

2.1.2 Fish and beef cracker chemical composition

Moisture, crude protein, and Ash content were determined according to (AOAC, 2005). Water content was determined by drying samples at 105 ± 2 ℃ until a constant weight was obtained. Wet samples were used for determination of crude fat, protein and mineral contents. Crude fat was measured by solvent extraction method in a soxhlet system where n-hexane was used as solvent. Crude protein content was calculated by using nitrogen content obtained by Kjeldahl method. A conversion factor of 6.25 was used for calculation of protein content. Total mineral content was determined by incinerating samples at 550 ± 10 ℃ for 5 hours. The weight of the residual ash, expressed as a percentage of the wet sample weight, was taken as the total inorganic residue.

2.1.3 Determination of linear expansion (LE %)

The percentage linear expansion was obtained after deep frying the dried crackers in oil at 180º. The un-puffed cracker was ruled with three lines across using a marker pen. Each line was measured before and after puffing.

According to the method (Chudasama *et al.,* 2019) used as follows:

Linear Expansion (%) =Length after puffing − Length before puffing ÷ Length before puffing×100

2.1.4 Determination of oil absorption (%)

The percentage oil absorption was calculated according to the standard method (Yu SY 1991a) below:

Oil Absorption (%) = Weight of cracker after frying − Weight of cracker before frying ÷Weight of cracker before frying × 100.

2.1.5 Water Absorption Index (WAI) and Water Solubility Index (WSI)

WAI and WSI were determined in triplicate following the method described by Yagci and Gogus (2009). Each ground cracker (3g) was dispersed in 30 ml of distilled water and stirred using a vortex mixer. This dispersion was allowed to stand for 30 min in a water bath at 30° C. Subsequently, the dispersion was centrifuged at 3000 rpm for 15 min using the centrifuge (Remi Instruments, Bombay, India). The supernatants were poured into a petridish and dried at 110 ℃ and weigh. WAI and WSI were calculated using following equations:

Dispersion was centrifuged at 3000 rpm for 15 min using the centrifuge the supernatants were poured into a petridish and dried at 110 ° and weigh. WAI and WSI were calculated using following equations:

WAI (g/g) =

Weight of hydrated residue ÷dry weight of the sample

WSI (%) =

 Weight of dissolved solids in supernatant ÷Dry weight of the sample × 100

3.1.5 Sensory analysis

Sensory evaluations were conducted using an eleven-member semi trained panel. Panelists were trained to evaluate the fish cracker for crispiness, texture, taste/flavor, odor and overall acceptability on a using 5-point hedonic scale according to standard procedure Cross and Overby 1988 as Like very much (5), Like moderately (4), Neither like nor dislike (3), Dislike moderately (2), Dislike very much (1). The limit of acceptability was 3 for all the samples.

3.2 Statistical analyses

Data obtained from all the tests were analyzed by using one-way analysis of variance (Anova) and followed by Duncan multiple range test of the Statistical Package for Social Science version 22.0 (SPSS inc., 2018 Chicago, Illinois, U.S.A). Statistical significance was indicated at the 95% confidence level. Values expressed are means of three determinations ± standard deviation.

3.0 Results and Discussion

Chemical composition of cracker fish and beef products were processed under Sudanese condition presented in table (2). There were not different in crude protein 17.5 and 19.2 for cracker fish and beef respectively beside moisture content with average 5% for each one, 5-4 % ash of cracker fish or beef without significantly different. On the other hand lipid % had differ means value between cracker of fish and beef 19% for cracker fish and 14% for beef, although beef meat had high percent of fat than fish meat, whereas lean meat were used in processing the products. The lipid % in cracker fish it might be refer to the frying processing step which its clear in the measured of oil absorption. Protein of cracker fish recorded 8-16.5% after processed mentioned by Modupe (2002) . The same author reported fat 19.8-21.4 ash 1.5-3 and moisture

% 3-4.1. In this study the results nearly to Chudasama *et al.,* (2019) were recorded 19.9 of protein 14.7 for lipid 5.13 for ash% and 3.19 % for moisture content.

Water absorption index WAI in dried fish and beef cracker was recorded as 5.2±0.05, and 5.2±0.15. However, water solubility index (WSI) showed no significant difference for these products. Analysis of WSI observed was 13.3 for all products. WAI and WSI are considered as indicators of the degree of starch gelatinization and its degradation. The higher content of soluble polysaccharides released from the starch polymer chains after gelatinization can effect on the increase of WSI and the decrease of WAI values Chudasama *et al.*, 2019.

Table 2:

Characteristics and chemical composition of cracker fish and beef.

item	Fish cracker	Beef cracker
protein	17.5±1.7	19.2±1.7
Moisture	5.o±1.0	5.0±3.0
Ash	5.0±1.0	4.o±0.0
Fat	19.0±1.0[a]	14.0±1.0[b]
WAI	5.2±.05	5.2±.15
WSI	13.3±0.0	13.3±0.0
Linear expansion	15.5±1.4bc	10.7±.25bc
Oil Absorption	19.7±12.6bb	2.1±.6bb

[ab]Means ±std. deviation in the same row bearing different superscripts are significantly different (P<0.05)

WAI: water Absorption index

WSI: water Solubility index

Linear expansion and oil Absorption were recorded 15.6, 10.7 19.7, and 2.1 for cracker fish and beef respectively nearly to Chudasama *et al.*, 2019 were recorded linear expansion and oil absorption of cracker fish with rice starch 18.7 and 6.2

Crispness, the most important sensory attribute of crackers, is directly related to linear expansion. A linear expansion greater than 77% is required for an acceptable level of crispness.

The linear expansion ratings of the fried crackers increased with an increase in the amount of fish (table 2). In previous work on expansion using soybean/cassava, wheat flour/wheat starch, and tapioca/rice starch, an increase in the protein content of the blends caused a decrease in the linear expansion of the extrudates. However, in a study of soy, wheat, milk, and egg proteins, milk protein tended to increase expansion volume, whereas the other proteins decreased expansion Chinnaswamy and Hanna1993. This was related to the viscoelastic nature and the cross-linking ability of different proteins. As the degree of cross-linking increases, the amount of expansion during frying decreases. The increase in linear expansion with an increased proportion of fish may be associated with myofibrillar protein (particularly myosin) present in minced fish, which has the ability to form a gel (Modupe 2002).

Table 3:

Sensory evaluation characteristics of cracker fish and beef

Item	Fish cracker	Beef cracker
Color	4.2±1.4 [a]	3.1±1.7 [b]
Flavor	4.4±1.2 [b]	3.9±1.8 [b]
Crispness	4.3±1.6 [b]	3.4±2.0 [c]
Textures	4.0±2.0 [b]	3.8±1.6 [b]
Overall acceptability	5.±1.5 [a]	3.6±1.4 [b]

[ab]Means ±std. deviation in the same row bearing different superscripts are significantly different (P<0.05).

The taste panelists found no significant difference in flavor and texture between cracker fish and beef, on the other hand there were prefer colour, crispness, and overall acceptability of cracker fish fig (1), whereas the same formula of processing cracker that indicated for beef meat which had connective tissues, and become tough with frying.
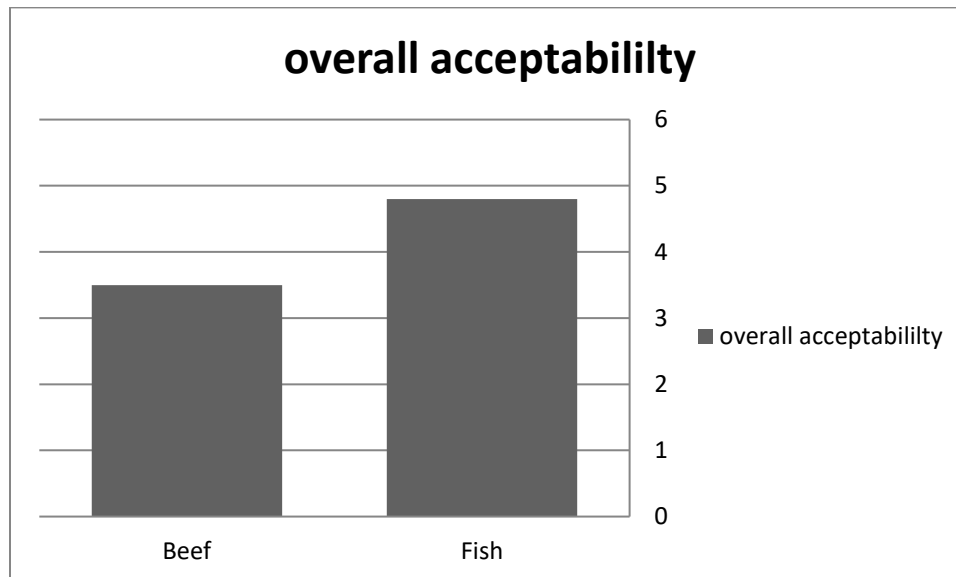
Fig1. The overall acceptability of panelist.

Conclusion:

Cracker fish and beef products were processed under Sudanese condition had good chance to successful as food industry in Sudan and other African countries, from the results of the study the characteristics of cracker fish and beef processed under Sudanese condition nearly to same with an Asian crackers. Nevertheless, cracker products which increased the nutritional value by using meat and fish in the products will become useful and improvement junk or snack food. However the sensory attributes of cracker were acceptable and favored especially cracker fish.

Recommendation:

More research to investigate crispness of beef cracker and developed all characteristics of cracker fish and beef. Development and entry this industry in Sudan which increased the nutritional value for children. Cracker it can be useful in IDP camp for displaced human in Darfur province and other place in the world.

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