

DEVELOPMENT OF VALUE-ADDED PRODUCTS FROM ANCHOVIES IN GHANA

by

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Abstract

Studies on development of value-added products from the Ghanaian anchovies (*Engraulis encrasicolus* syn. *Anchoa guineensis*) were carried out. Products developed with recipes formulated included, anchovy balls, golden fried anchovies, breaded anchovies (coujon of anchovies), anchovy burger, coated fried anchovies, fried anchovies and anchovies boiled in seawater and dried. Sensory evaluation and marketing trials of the products showed that they were generally well accepted. However, consumers indicated a higher preference for the anchovy burgers, balls and coujon of anchovies.

1. INTRODUCTION

The Ghanaian anchovy *Engraulis encrasicolus* syn. *Anchoa guineensis* (Fig. 1) is genetically identical to the European anchovy. The local vernacular names are Amobi, Abobi and Amoni.

In 1992 the catch in Ghana totalled about 86 000t, in 1993 it was 82 000t. In the artisanal fishery industry in Ghana, through which most of the catches are made, anchovies are not chilled and also not gutted. Autolysis of the viscera releases enzymes and bacteria which invade the flesh and the thin belly wall burst open in a matter of hours after catch.

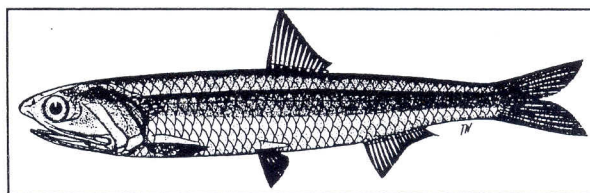


Figure 1. Anchovy (*Engraulis encrasicolus*)

In the Mediterranean area, anchovy is a highly valued species and several value-added products and preparations are made including salted ripened anchovy fillets, marinated anchovies and breaded anchovies. In Zanzibar and in Southeast Asian countries, anchovies of different species are boiled in seawater or brine and dried. Other products include fermented anchovies, paste and sauce (Lee 1990, Phithakpol 1989).

Along the coastal beaches of Ghana, large quantities of anchovies are processed into two main products, both with low added value. These are beach dried or rack dried anchovies and smoked anchovies. The beach dried anchovies are mainly used as a protein source in animal feeds in particular for poultry. The smoked anchovies are produced for human consumption although sometimes they may also be used for animal feeds.

Although in other countries much progress has been made in utilising anchovies to provide nutritionally and commercially valuable products for human consumption, in Ghana there is scope for improved and expanded use.

This study was aimed at developing value-added products from anchovies which would increase the food use and provide added economic value to the species which in turn would have an impact on the incomes within the artisanal fisheries, in particular, those of traditional women fish processors.

2. MATERIALS AND METHODS

Quantities of fresh anchovies were purchased twice in a month during the study period of 9 months from the landing beach at Tema. The anchovies were held in ice and at different periods a number of food products were developed from the anchovies. These were: anchovy balls, golden fried anchovies, breaded anchovies (coujon of anchovies), anchovy burger, coated fried anchovies, fried anchovies and anchovies boiled in seawater and dried. Other materials used as ingredients for the food preparations were purchased locally at the markets in Accra.

Development of value-added products

Raw materials used were whole fresh anchovies. Filleting was not feasible because of their small size.

Proximate and chemical analysis of developed products

Protein was determined by the method of Pearson (1970). Moisture, fat and ash were determined by the standard methods of AOAC (1990). Phosphorus was determined by the photometric method number 965.12 of AOAC (1990). Calcium was determined titrimetrically by method 917.02 of AOAC (1990) and iron was determined by the spectrophotometric method of AOAC (1990).

Sensory and marketing trials of developed products

Sixteen untrained panelists of the Food Research Institute but were familiar with the products were asked to evaluate the products organoleptically. Characteristics assessed were appearance, odour, taste and over-all acceptability. A 9-point hedonic scale was used for scoring from 9 (Like extremely) to 1 (Dislike extremely). Scores were statistically analysed.

Marketing trials were conducted at some restaurants in Accra. This was in a form of an informal sensory evaluation of the products by consumers. The consumers were also asked if they would buy the products if put up for sale and to recommend retail prices (RRP) for each product. These prices were compared to computed retail prices (CRP) for each product, which were obtained by taking into account the direct cost of production, labour, commission for agents and a profitability margin of 20% to the producer.

3. RESULTS AND DISCUSSIONS

3.1 Value-added products

After a series of trials with the fresh anchovies (Figure 2) and varying the amounts of ingredients the following recipes were formulated for the products. Figures 3 to 9 give pictorial descriptions of the developed products.

Anchovy balls	
Fresh anchovies	55-58%
Bread crumbs	42-44%
Onions	2%
Garlic	1%
Ground ginger	1%
Cayenne pepper	1%
Lemon juice	2%
Salt	

Anchovy balls

A number of trials were made and the most promising process was adopted with the approximate recipe as follows (see box):

Whole fresh anchovies were degutted and the heads were also removed. These were then washed quickly in cold water to reduce the fast rate of water dripping from the anchovies. The raw anchovies were minced in a *Moulinex* food processor to smooth paste. Ground ginger, onions and garlic were added and the mixture blended for about 4

minutes. Bread crumbs, ground Cayenne pepper, lemon juice and salt were added and further blended to an even mixture. Small bite size balls were moulded from the complete mixture and deeply fried at 120°C for 10 minutes or till golden brown.

It was thought that steaming the raw anchovies before blending could prevent the excessive drip loss and facilitate the mincing process. However, the taste of products were significantly affected and were not liked. Again the binding capacity of the fish was reduced and it was not easy to make good moulds out of this.

Puff anchovies	
Fresh anchovies	55-58%
Wheat flour	40-45%
Ground garlic	5-6%
Eggs medium size	3
Ground onions	10-11%
White pepper	5-6%
Milk and water	300 ml
Salt	
Oil for deep frying	1 litre

Golden fried anchovies (puff anchovies)

The following recipe was adopted after a number of trials (see box):

Heads and guts were removed from fresh anchovies and washed well to get rid of all the entrails. A marinade of salt and ground onions was prepared with the anchovies for at least 30 minutes. Wheat flour, eggs, milk and water were mixed into a batter. The marinated anchovies were coated in pairs in the thick batter and deep fried till golden brown.

This product could also be attractive and would find a good patronage at fast foods spots and restaurants.

Anchovy burger	
Fresh anchovies	60-65%
Ground onions	10-5%
Chopped garlic	2-5%
White bread crumbs	25-30%
Salt	
Oil for shallow frying	

Anchovy burger

In the trials, the best recipe adopted is presented as follows (see box):

Fresh anchovies with heads and entrails removed were minced and seasoned with salt, ground onions and garlic. White fresh bread crumbs were added to the minced anchovies and moulded into burgers. These were shallow fried on both sides till golden brown and used as burgers with burger loaf, lettuce leaves, onion rings, fresh tomato slices, cucumber slices and salad dressings as other ingredients.

Burgers, especially made from beef are known to be popular products and a product from anchovies if acceptable could add a bit of variety to the range of burgers available to the consumer.

Coujon of anchovies	
Fresh anchovies	60-65%
White bread crumbs	30-35%
Eggs medium size	3
Lemon juice	1 litre
Salt	
Wheat flour	
Oil for deep frying	1 litre

Coujon of anchovies

In developing the product, the final recipe which appeared to be most preferable had the following ingredients (see box):

Fresh degutted anchovies were seasoned with salt and lemon juice for at least 30 minutes. These were coated with white flour and introduced into a mixture of white bread crumbs and beaten eggs. The anchovies were deep fried till golden brown.

The developed product 'coujon of anchovies' could also be another attractive and economically viable product on the market.



Figure 2. Fresh anchovies

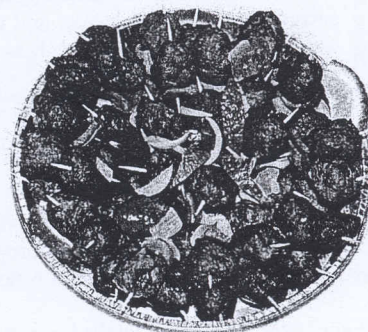


Figure 3. Anchovy balls

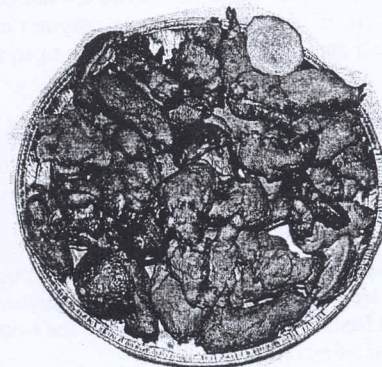


Figure 4. Puff anchovies

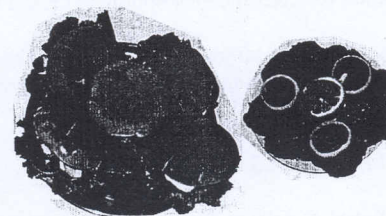


Figure 5. Anchovy burger

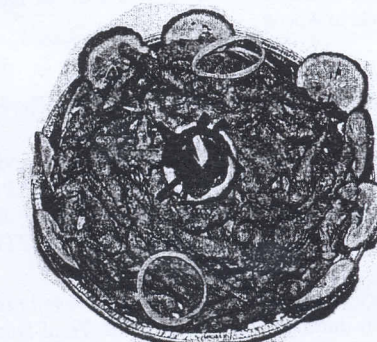


Figure 6. Coujon of anchovies

Coated fried anchovies	
Fresh anchovies	70-75%
Wheat flour	20-25%
Lemon juice	2%
Salt	
Oil for deep frying	1 litre

Salted fried anchovies	
Fresh Anchovies	
Salt	
Oil for frying	

Coated fried anchovies

In producing the coated fried anchovies, a simple recipe which could be easily adopted had the following ingredients (see box):

After seasoning fresh degutted anchovies, with salt and lemon juice for at least 10 minutes, these were then tossed in plain wheat flour. The anchovies were deep fried for 8 minutes. Coated fried anchovies could be used as a delicacy for cocktails and light refreshment spots.

Salted fried anchovies

As a very simple product, few ingredients were needed in the development of salted fried anchovies. These were (see box):

Whole fresh anchovies were salted to taste. The anchovies were spread out and allowed to air dry for about an hour. These were then deep fried till cooked or slightly browned.

This product could be simple and easily prepared for the local market. It could go with some of the traditional food products like *kenkey*, *banku* and soaked gari when it is usually served with hot pepper sauce.

Steamed and dried anchovies

The preparation of steamed anchovies involved only whole fresh anchovies and salt to taste. The anchovies were steamed for 5 to 8 minutes and quickly drained. These were then placed in a solar dryer for 2 - 4 hours to dry (Fig. 9). The dried products could be stored in polyethylene bags for a number of days.

Steamed and dried anchovies could be the most inexpensive and simplest product. The product could be used in traditional soups and stews as a fish protein source.

3.2 Proximate and chemical composition of developed products

The results of the proximate and chemical composition of the developed products are presented in Table 1. This could be useful for consumer information.

4. MARKETING

4.1 Sensory evaluation of developed products

Sensory evaluation results of the developed products are presented in Table 2 below. The mean scores showed that all the characteristics of the anchovy products were moderately liked. Overall acceptability mean scores indicated that the products were generally well accepted. However, the anchovy balls, burgers and coujon of anchovies appeared to be the most acceptable of all the products.

Although some panelists noticed mouth itching after taste in the coujon of anchovies and felt the product could be improved, the product was well accepted (Table 2).

Table 3 shows consumers' response to their willingness to purchase the products if offered for sale during the marketing trials and their recommended retail prices (RRP) as against the computed retail prices (CRP).

4.2 Marketing trials

As Table 3 indicates, virtually, all the consumers were quite willing to purchase the products if offered for sale. This response could be a positive indication for the feasibility of the production of the products as consumers may not be difficult to be found. The retail prices recommended by the consumers appear to agree reasonably with the computed retail prices as shown on Table 3.

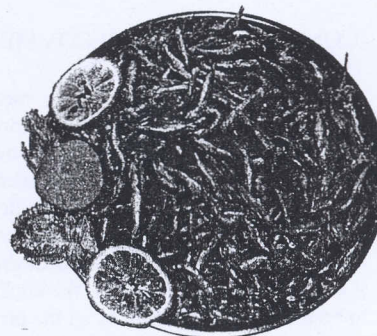


Figure 7. Coated fried anchovies

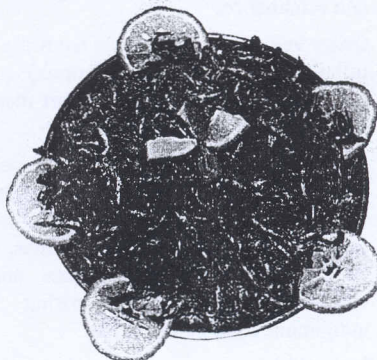


Figure 8. Salted fried anchovies

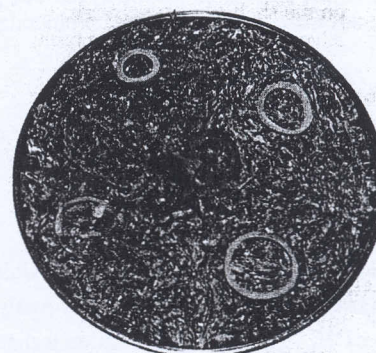


Figure 9. Boiled (steamed) - dried anchovies

Table 1. Proximate and chemical composition of developed products*

Product	Moisture (%)	Protein (Nx6.25) (%)	Fat (%)	Ash (%)	Calcium (mg/100g)	Iron (mg/100g)	Phosphorus (mg/100g)
Anchovy balls	55.1 ± 2.6	19.7 ± 4.8	21.9 ± 1.5	2.6 ± 0.9	201 ± 6	2.0 ± 0.8	254 ± 13
Coated fried anchovies	20.8 ± 1.7	26.8 ± 2.3	31.5 ± 1.7	3.3 ± 1.1	384 ± 3	2.1 ± 0.4	506 ± 10
Fried anchovies	21.7 ± 1.4	36.7 ± 1.9	46.4 ± 1.3	6.2 ± 1.3	694 ± 3	2.2 ± 0.7	550 ± 11
Steamed dried anchovies	17.6 ± 1.5	67.7 ± 1.7	3.7 ± 1.4	9.7 ± 1.2	164 ± 7	3.6 ± 0.9	588 ± 7
Coujon of anchovies	43.5 ± 1.7	38.9 ± 1.2	29.6 ± 0.9	2.0 ± 1.6	263 ± 3	1.0 ± 0.3	345 ± 5
Anchovy burger	58.3 ± 1.7	16.1 ± 1.9	21.3 ± 1.1	2.1 ± 1.2	236 ± 4	2.0 ± 1.1	241 ± 9
Puff of anchovies	47.1 ± 1.3	15.4 ± 1.5	28.5 ± 1.9	2.1 ± 1.6	128 ± 3	1.0 ± 0.5	264 ± 10

*Values are means of four determinations

5. CONCLUSIONS AND RECOMMENDATIONS

- By means of a trial and error method, recipes were formulated leading to the preparation of, anchovy balls, golden fried anchovies, breaded anchovies (coujon of anchovies), anchovy burger, coated fried anchovies, fried anchovies and anchovies boiled in seawater and dried. These products were generally well accepted and most consumers expressed their desire to purchase them if offered for sale. However, the anchovy balls appeared to be the most acceptable of all the products.
- The processing methods could be transferred to local processors if markets for the products could be identified and established.
- Other value-added products from the anchovies such as infant foods, crackers (keropok) and new extruded products for the local and export markets could also be studied.
- It is anticipated that in the development of these value-added products, starch and protein components would be obtained from indigenous food sources such as cassava, cereals and grain legumes. Consequently this could lead to the development and introduction of value-added products comprising fish proteins and indigenous food components.
- It would be necessary to develop appropriate packaging material for the products since the products could also be on the shelves of supermarkets. The packaging may also advertise anchovies, hence promoting its consumption.

6. ACKNOWLEDGMENTS

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7. REFERENCES

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Table 2. Mean* scores for sensory evaluation of products

Product	Appearance	Odour	Taste	Overall acceptability
Anchovy balls	7.8±1.4	7.6±1.2	7.6±0.3	7.8±1.1
Golden fried anchovies	7.8±1.7	7.0±0.9	7.0±1.7	7.1±1.4
Anchovy burger	6.5±1.7	7.0±1.3	7.4±1.5	7.3±1.9
Coujon of anchovies	7.4±1.8	7.0±1.3	7.4±1.5	7.3±1.9
Boiled dried anchovies	6.4±1.3	6.9±1.0	7.1±1.2	7.0±1.1
Coated fried anchovies	7.2±1.1	7.4±1.3	7.3±0.9	7.6±1.7
Salted fried anchovies	6.9±1.6	7.0±1.3	7.1±1.7	7.3±1.0

*Means for sensory scores are for 17 panelists

Table 3. Response of willingness of consumers to buy products on sale and retail prices

Product	No. of consumers	Yes	No	Undecided	RRP* (Cedis)	CRP* (Cedis)
Anchovy balls	17	17	-	-	350.00	300.00
Golden fried anchovies	17	13	4	-	300.00	500.00
Anchovy burger	17	13	3	1	400.00	350.00
Coujon of anchovies	17	13	4	-	400.00	400.00
Steamed dried anchovies	17	11	5	1	100.00	100.00
Coated fried anchovies	17	15	2	-	250.00	200.00
Salted fried anchovies	17	12	4	1	150.00	150.00

*RRP- Recommended retail prices (average) by 17 consumers

*CRP- Computed retail prices