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PROCESSING AND PRESERVATION OF SNAIL MEAT IN BENIN CITY, NIGERIA

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ABSTRACT

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This study was designed to identify the various methods of processing and preservation of snail meat in Benin City. Three methods of processing snail (breaking the snail shell, soaking in salt water and boiling in salt water) and two methods of preservation (smoking and oven drying) were used to prepare snail samples for this study. Two types of structured questionnaire were also administered; one for snail sellers and the other for consumers. The data were subjected to inferential and descriptive statistics as well as *t*-tests at 5% level of significance. The results showed that of the 50 sellers interviewed, 29%, 66% and 5% got their snails from the forest, village market and from private farms respectively. About 21%, 6.7% and 7.4% preserved their snails by freezing, salting and drying methods respectively. About 65% prefer to store their snails alive. Interviews from 50 consumers showed that about 56%, 30% and 14% preferred the big, medium and small snail sizes respectively. In terms of taste, 10% rated smoke dried meat as poor and 90% as good to excellent, 25% rated oven dried snail meat as poor and 75% rated it as good to excellent. In terms of aroma, 25% rated smoke dried meat as poor and 75% as good or excellent while 50% rated oven dried snail meat as poor and 50% as good or excellent. Significant differences ($P > 0.05$) were observed between the processing methods and the texture, taste and flavour of snail samples but no significant difference ($P < 0.05$) was observed for aroma. It seems that the best and simplest way of processing snail meat is through boiling in salty water. Smoke drying method was more preferable in terms of taste, aroma, flavor and texture but oven drying was more preferable in terms of colour.

Keywords: Processing, Snail meat, Preservation, Benin City

INTRODUCTION

Protein malnutrition is a major challenge to most developing countries especially in Africa. This has informed the need for man to explore the use of other sources in the wild in order to meet his body requirements (Ebabhamiegbho *et al.*, 2013). In Nigeria, it is now accepted that the use of mini-livestock such as snails, rodents and other small livestock in the wild can substantially improve the living conditions of people in urban and rural areas by acting as a valuable source of protein supplement to diet as well as generating additional income (Anon, 1992; Ezeama *et al.*, 2007). Snails are usually herbivores with a complex hermaphroditic reproductive system (Akinnusi, 1998). They are high in protein, low in fat and a source of iron, magnesium, calcium and zinc (Orisawuyi, 1989; Ademolu *et al.*, 2004; Cobbinah *et al.*, 2008; Babalola and Akinsoyinu, 2009; Adeola *et al.*, 2010). Investigation by Akinnusi (1998) revealed that snail meat contains 70% of water while its dry matter is high in essential amino acids such as lysine, leucine, arginine, tryptophan and 30% minerals. Snail is also a source of calcium ortho phosphate, a chemical substrate for curing kidney diseases (Imevbore and Ademosun, 1988). A recent study has also shown that the glandular substances from edible snails cause agglutination of certain bacteria; this could be of value against a variety of ailments including whooping cough (Cobbinah *et al.*, 2008). There is a growing interest in the production and marketing of non-traditional snail meat. Products from snail meat belong to foodstuffs with high nutritional value. Proximate analysis of wild snails (*Helix pomatia L.*) showed that they are rich in major minerals, protein and low in lipids (Özogul and Olgunoglu, 2005). Thus, snail meat gains an advantage over others (Yildirim *et al.*, 2004).

Snail meat is a popular food widely distributed in Nigeria especially in the Niger Delta and Upper Cross River Basins (Arene *et al.*, 1999). It is also a major source of income to the people (Ezeama, 2000). However, spoilage sets in after 48 hours of harvest while shrinking accelerates the spoilage rate as the meat cannot be kept in acceptable conditions after approximately 12 hours. This is why the preservation of the meat has become a major concern to both processors and consumers. A major traditional method of preserving sea foods is a combination of smoke drying with sun drying which reduces the microbial load, thus increasing shelf life. Some works have combined potassium sorbate treatment and dry curing in reducing the microbial population of freshwater snail and clam meat to extend shelf life (Ekanem *et al.*, 1994). However, the source(s), processing and preservation of snail meat in Benin City is yet to be investigated and documented. The objective of this paper therefore was to identify the simplest and best methods of processing and preserving snail meat in Benin City, the major sources of snail meat in the area in question as well as the consumers' preferences to the processing method adopted.

MATERIALS AND METHODS

Collection of samples

Thirty (30) matured African Giant snails of the species *Archachatina marginata* and *Archachatina archachatina* were purchased from local markets in Benin City, Nigeria. The snails were bought from market women who got their snails directly from the forest. The two species were preferred for this study because of their large size.

Study site

The experiment was carried out in Benin City which has a land area of about 19,035km² (Beaks and Genomics, 1999). Two (2) types of structured questionnaires were administered to obtain information from sellers and consumers in the study area. A total of one hundred (100) questionnaires were distributed to 50 sellers and 50 consumers in Egor and Oredo Local government Areas (LGAs).

Processing methods

Three different methods were examined, each having 10 snails

Breaking of Shell: Shells of 10 snails were broken and snail meat was extracted. The meat was then washed with clean water and potassium to remove slime and pieces of broken shells.

Soaking with Salt: 10 snails were submerged in 10 litres of water containing 0.2% salt. After 4 hours of soaking, they were washed thoroughly under running water and then boiled for 8-10 minutes. The water was drained and the snails were transferred into cold water. The snail meat was extracted thereafter.

Boiling with Salt: 10 snails were washed with clean water and dropped into 0.2% boiling salt water. The snails were cooked for about 15-20 minutes until the snail meat was easily removed from the shell. The water was then drained and the snails were washed.

Preservation methods

Two preservation methods were employed, each consisting of 15 processed snail meat samples. They include the smoked and oven dried methods. Salt was added not only as a preservative but also for flavor. Smoking kiln and electric oven were used for preservation.

Evaluation of smoked and oven dried snail meat

A panel of 50 persons was set up to evaluate the sensory qualities of the smoked and oven dried snails. The samples were graded based on taste (Ta), colour (Co), texture (Te), flavor (Fl) and aroma (Ar). The hedonic 9-point scale was used to describe the score of attributes of the smoked or dried snail meat which included: 1=very bad, 2=bad, 3=satisfactory, 4=good, 5-6=very good and 7-9=excellent.

Statistical analysis

Data obtained from this study were analysed using t-tests to show significant differences between parameters and consumers' perception of the samples prepared at 5% level. Inferential and descriptive statistics were also used to analyze the data. Data analysis was done using SPSS software (version 10.0).

RESULT AND DISCUSSIONS

The results of the sources of snails sold to consumers, effects of the processing and preservation methods of snail meat on consumer preferences as well as panel rating were as shown in following tables (1-9). Table 1 shows the primary sources of snails in the two LGAs considered. The results indicate that the forest and village markets put together constitute the major sources of snails sold in urban areas (95.1%) compared to private snail farms located in either rural or urban areas (5%). This finding agrees with Cobbinah *et al.* (2008) that snails are gathered in the wild and sold along main roads or urban centres. These locations are naturally cool, thus serving as favourable breeding environments for different mini-livestock species. The results of snail sizes preferred by consumers which were expressed as percentages (%) are shown in Table 2. The sizes obtained from Oredo and Egor Local government Areas ranged from less than 50mm (small) to at least 120mm (large). The figures suggest that local consumers prefer medium and large-size snails (85.9%) as against small ones (14.2%). This finding is in agreement with Cobbinah *et al.* (2008) who reported that consumer preferences dictate the optimum size and consequently, age of snail harvested for the market. From the results obtained, it is also probable that more large-sized snails were readily available at Egor Local Government Area compared to Oredo Local Government Area.

The results of the various methods by which sellers preserve snails after purchase from local markets in the two Local Government areas studied are also reported (Table 3). In terms of preservation, majority of sellers in both Local Government Areas of the state preferred their snails to be stored alive (59.3% in Egor and 70.6% in Oredo) and the least preferred methods being salting and drying. This removes the need for expensive storage facilities as may be required for other forms of livestock processing. These responses suggest that the snails purchased by consumers either meant for immediate or later consumption. They are either left on the floor or kept in cool places. It should be noted that snails can be stored for a period of 6-8 weeks in a box or crate (Cobbinah *et al.*, 2008). The results also showed clearly that although salting is not a major method of preservation in the LGAs

used in this study, the addition of salt may, along with smoking, have increased the shelf-life of processed snails. The effects of salting in lowering microbial activity and increasing yield has been earlier studied and shown to yield positive results (Ebabhamiegbho *et al.*, 2011)

Table 4 shows results of the differences in taste (TA) of processed snail meat according to size as obtained from the two Local Government Areas of the state. It is shown clearly that the consumers have higher preference for larger snail sizes. Table 5 shows consumer preferences of smoke-dried and oven-dried snail meat obtained from the two LGAs in this study using the 9-point hedonic scale. Consumers gave oven-dried snail meat a higher good rating (75.0%) over smoke-dried meat (65.0%). This may be due to the nature of the wood used in the smoke-drying process. According to Reeb and Milota (1999), the use of odourous wood for domestic or industrial purposes contains extractive compounds which can reduce the sensory characteristics of the meat (flavour, colour, aroma and taste). The nature and moisture content of wood used for smoke-drying of meat should therefore be investigated as this was not done in this study. In all, both types of processed meat had equal excellent ratings and were generally accepted. This confirms that both smoke-drying and oven-drying techniques were efficient in improving meat quality and overall acceptance by consumers (van Berkel *et al.*, 2004, FAO, 2001).

Tables 6 – 9 show results of sensory evaluation of smoke-dried and oven-dried snail meat in terms of texture, taste, aroma and flavour respectively. All sensory results obtained show that majority of consumers preferred smoke-dried snail meat as against the oven-dried parts. There were significant differences between the processing methods used (smoke-drying and oven-drying) and parameters like texture, taste and flavour ($P > 0.05$). No significant difference was observed between processing technique and aroma ($P < 0.05$). Smoke-drying is a processing technique that is both cheap and efficient in extending the shelf-life of various products. This may explain why it is a wide-spread processing technique in the LGAs studied. These results agree with the findings of van Berkel *et al.* (2004) that smoke particles impart positive effects on flavour, colour, taste and aroma of meat and fish products. It was also reported by Cobbinah *et al.* (2008) that most traditional smoked products are prepared by the smoke-drying process which takes about 12-18 hours depending on the product. The essence of the process is to reduce the moisture content, raise osmotic pressure and consequently increase the shelf-life of the snail meat. The significant effects measured may also be attributed to the use of salt during processing. The use of salt has been observed to increase yield and lowering microbial activities in meat in a recent study (Ebabhamiegbho *et al.*, 2011).

Table 1: Sources of the sold Snails (%) (n=100)

LGA	Forest	Village Market	Private Farm	Total
Egor	23.3	76.7	-	100.0
Oredo	35.0	55.0	10.0	100.0
Mean	29.2	65.9	5.0	100.0

Table 2: Preference of Various Sizes of Snails By Consumers (%)

LGA	Small (less than 50mm)	Medium (80-120mm)	Large (120mm and above)	Total
Egor	3.3	26.7	70.0	100.0
Oredo	25.0	25.0	50.0	100.0
Mean	14.2	25.9	60.0	100.0

Table 3: Preservation Method used by Consumers (%)

LGA	Freezing	Salting	Drying	Store Alive	Total
Egor	18.5	7.4	14.8	59.3	100.0
Oredo	23.5	5.9	---	70.6	100.0
Mean	21.0	6.7	7.4	65.0	100.0

Table 4: Differences in the Taste of Snails of Various Sizes

LGA	Small (less than 50mm)	Medium (80-120mm)	Large (120mm and above)	Total
Egor	10.0	30.0	60.0	100.0
Oredo	20.0	30.0	50.0	100.0
Mean	15.0	30.0	55.0	100.0

Table 5: Consumers Preference for Smoked and Oven-Dried Snail Meat (n=50)

Snail Meat	1-3 (Poor)	4-6 (Good)	7-9 (Excellent)	Total
Smoked	25.0	65.0	10.0	100.0
Oven-dried	15.0	75.0	10.0	100.0

Table 6: Texture Rating of Smoked and Oven-Dried Snail meat by Consumers (%)

Snail Meat	1-3 (Poor)	4-6 (Good)	7-9 (Excellent)	Total
Smoked	15.0	75.0	10.0	100.0
Oven-dried	20.0	75.0	5.0	100.0

Table 7: Taste Preference by Consumers (%)

Snail Meat	1-3 (Poor)	4-6 (Good)	7-9 (Excellent)	Total
Smoked	10.0	55.0	35.0	100.0
Oven-dried	25.0	70.0	5.0	100.0

Table 8: Aroma Preference by Consumers (%)

Snail Meat	1-3 (Poor)	4-6 (Good)	7-9 (Excellent)	Total
Smoked	25.0	50.0	25.0	100.0
Oven-dried	50.0	50.0	---	100.0

Table 9: Flavour Preference by Consumers (%)

Snail Meat	1-3 (Poor)	4-6 (Good)	7-9 (Excellent)	Total
Smoked	25.0	45.0	30.0	100.0
Oven-dried	25.0	60.0	15.0	100.0

CONCLUSION

The effects of two processing techniques on the sensory characteristics of snail meat were evaluated in this study. About ninety-six percent (96%) of snails sold to consumers were obtained from forest areas and village markets which are naturally favourable for snail breeding. About 65% of sellers prefer storing the snails alive and 60% of consumers prefer large-sized snails (120mm and above). Smoke-dried snail meat was generally preferred by consumers over oven-dried technique. The need to investigate the nature of wood used for smoke-drying is also emphasized.

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