Carcass and organoleptic characteristics of *Archachatina marginata*, *Achatina achatina* and *Achatina fulica* of snail

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Abstract
A total of ninety matured snails with thirty snails from Archachatina marginata (AM), Achatina achatina (AA) and Achatina fulica (AF) were evaluated for their carcass and organoleptic properties in a completely randomized design. The snails were kept for fourteen days and fed pawpaw leaves and fruits for the period. The snails were 'killed' by breaking the shell towards the apex. The shell, viscera and the foot were separated. The feet were washed with aluminium sulphate and samples for chemical and organoleptic studies were taken from the washed feet. The result obtained showed that the chemical composition of the three breeds of snail were not significantly different (P>0.05) from each other. AM had the highest dressing percent while AF had the lowest value. The cooking loss and the water holding capacity (WHC) differ significantly among the breeds of snails used in this study while there was no noticeable statistical difference (P>0.05) in the shear force values among the three breeds. The taste panel result showed that the mean score for colour, juiciness and taste for AM and AA were higher (P<0.05) than the score for AF. AF was adjusted superior in texture to the other two breeds. The flavour and the overall acceptability ratings were similar (p>0.05) in the three breeds.

Key words: Carcass, organoleptic, breeds, snail and water holding capacity.

Introduction
In West Africa, different species of snails are eaten both in the rural and urban areas. *Archachatina marginata* (Igbin Apinu), *Achatina achatina* (Ilakose) and *Achtina fulica* (Esan) are the most common land snails in South Western Nigeria (Amusan *et al.*, 1999).

Snails are good utilizers of waste and by-products and good converter of plant protein to animal protein. They are also able to utilize a wide range of food items but feed mainly on green leaves, fruits and decayed organic matter. Coupled with the above characteristics, snails are easy to rear, they require less attention, space, capital and carry less risk. They have the potential for huge returns on investment with extreme low level of input and require little technical expertise.

Snail is a species of micro-livestock that has gained worldwide reputation as far back as Paleolithic period because of its usefulness to man (Elmslie, 1982). It is consumed as food, useful in medicine and also used for ornamental purposes by rural and urban dwellers (Awesu, 1980). Snail meat is tasty, tender and nutritious. Its tenderness and fine texture makes it the most suitable meat for all ages. Fresh or processed, snail commands high income from foreign exchange (Enebe, 2000).

Although, many people are becoming interested in snail meat worldwide and a number of literatures are available on the biology and feeding habits of snails there are however not enough information on the carcass characteristics and eating qualities of snail meat.

The focus of this study therefore is to evaluate the carcass and organoleptic characteristics of three breeds of snail commonly eaten in south- western Nigeria.

Materials and Methods
The breeds of snail used were *Archachatina marginata* (AM), *Achatina achatina* (AA) and *Achatina fulica* (AF). The snails were purchased from an open market in Ibadan metropolis, Oyo State, Nigeria. A total of ninety (90) snails with thirty snails from each breed were used for the study in a completely randomized design. The snails were kept for fourteen days and fed pawpaw leaves and fruits for the period. At the end of the fourteen days, the snails were starved overnight to remove any feed remnants in their alimentary canal. The snails were weighed to get the live weight after which they were "killed" by breaking the shell towards the apex with a small iron rod. The

shell, visceral and the foot were separated and weighed. The feet were washed with aluminium sulphate (Alum) to remove the slime. After washing, samples were removed for chemical, carcass and organoleptic studies.

Chemical analysis: This was determined using the methods described by A. O. A. C. (1990). The parameters determined were crude protein, moisture, ash, ether extract and the nitrogen free extracts.

Cooking loss: Samples for cooking losses were taken from the foot mass and weighed before broiling. Broiling was done in a gas oven at a temperature of 177 °C with temperature stabilization for 5 minutes prior to the start of broiling. The steaks were broiled for 20 minutes on each side to medium doneness and then cooled to room temperature to determine cooking loss.

$$\text{Cooking loss} = \frac{\text{Weight of raw sample} - \text{weight of cooked}}{\text{Weight of raw sample}} \times 100$$

Shear force: Cores of 0.25cm in diameter were removed with the aid of hand coring device from samples used for cooking loss evaluations. The coring was done parallel to the orientation of muscle fibre and each core was sheared at three locations with Warner Bratzler shear force instrument.

Water holding capacity: The water holding capacity was determined on intact muscle following the method of Suzuki *et al.* (1991). Approximately 0.5g of sample was weighed unto a 9cm Whatman No. 1 filter paper and pressed between two 10.2 x 10.2 cm plexi glass for 1 minute using a vice. The samples were oven dried at 100 °C for 24 hours for moisture content determination. The amount of water released from the sample was measured using a compensatory planimeter by measuring the area of the filter paper wetted relative to the area of pressed sample.

$$\text{WHC} = \frac{100 - (\text{Ar} - \text{Am}) \times 9.47}{\text{Wm} \times \text{Mo}} \times 100$$

Where

Ar = Area of water released from meat (cm^2)
Am = Area of meat sample (cm^2)
Mo = Moisture content of the meat (%)
Wm = Weight of the meat sample
9.47 = a constant.

Taste panel evaluation: Steaks for the organoleptic evaluations were cooked to an internal temperature of 70°C. The cooked snail samples were cut into equal sizes and served in odourless plastic plates. The snail meat samples were coded and each panelist was made to rate samples across the treatments for colour, texture, juiciness, taste, flavour and overall acceptability. A nine-member panel was used to evaluate the organoleptic characteristics of the samples. The members of the panel were post-graduate students with an average age of 28 years. Each sample was evaluated independent of the other on a 9-point hedonic scale.

Statistical analysis: All data generated were subjected to analysis of variance appropriate for the design and where statistical significance were observed, the means were compared using the Duncan's Multiple Range Test (Duncan, 1955). The SAS Computer Software Package (1999) was used for all statistical analysis.

Results and Discussion

The result of the chemical analysis of the three (3) breeds of snail used in this study is shown in Table 1. The moisture content (g/100g) ranged between 58.26 and 61.68 which gives a range of dry matter of 38.42 to 41 74 (g/100g). The values reported here were similar to the values of 35.36 to 43.22 percent (dry matter) reported by Omole *et al.* (2001).

Table 1: Proximate composition of snail meat (g/100g)

Parameters	*A.marginata*	*A. achatina*	*A.fulica*
Moisture	59.04	61.68	58.26
Crude protein	17.00	15.22	16.50
Ash	4.67	4.83	5.10
Ether extract	5.51	5.17	4.12
N.F.E	72.76	74.78	74.28

The crude protein values of 17.06, 15.22 and 16.50 were obtained from *A. marginata*, *A. achatina* and *A. fulica* respectively. There was no significant (P>0.05) difference in the mean crude protein values of the three breeds of snail. The highest ash content was reported in *A. fulica*, followed by *A. achatina* and *A. marginata*. However, these values were not significantly different from one another.
The percent ether extract obtained in this study were 5.51, 5.17 and 4.12 for *A. marginata*, *A. achatina* and *A. fulica* respectively. The result obtained were higher than the values of 1.01, 0.98 and 0.94 reported by Omole *et al.* (2001) for similar breeds of snail. The difference might be due to age, nutritional status and the physiological status of the snails. Although the fat contents were higher than that of Omole *et al.* (2001), the values are lower when compared to 17.23 for muscovy duck (Awosika, 2005), 19.5 for broiler (Adeshiyan, 2004) and 9.6 for mutton (FAO, 1968). The low fat content of snail meat makes it an ideal meat for people with cardiovascular diseases (Shogbola, 1986) and a good antidote for fat related diseases (Akinnusi, 1998).

Meat quality characteristics: The result of the meat quality characteristics and the dressing percentage are as shown in Table 2. The cooking loss of 31.00 ± 1.67, 30.86 ± 2.23 and 41.35 ± 1.91 percent were obtained for *A. marginata*, *A. achatina* and *A. fulica* respectively. The highest cooking loss was obtained from *A. fulica*, most probably due to the low water holding capacity (WHC) of this breed of snail (Table 2). The values for WHC were 69.57 ± 3.87, 74.79 ± 3.63 and 50.52 ± 2.52 percent for *A. marginata*, *A. achatina* and *A. fulica* respectively. There seems to be a direct relationship between the cooking loss and the WHC. The higher the WHC, the lower the cooking loss.

Table 2 Meat quality characteristics of 3 breeds of snail

Characteristics	*A. marginata*	*A. achatina*	*A. fulica*
Cooking loss (%)	31.00 ± 1.67^{b}	30.86 ± 2.23^{b}	41.35 ± 1.91^{a}
Shear force (kg/cm^3)	1.65 ± 0.11	1.60 ± 0.15	1.98 ± 0.25
Water holding capacity (%)	69.57 ± 3.87^{b}	74.79 ± 3.63^{a}	50.52 ± 2.52^{c}
Dressing percent (%)	38.98 ± 0.81^{a}	36.90 ± 1.08^{ab}	35.27 ± 1.03^{b}

Means on the same row with similar superscripts are not significantly different($p<0.05$)

The shear force values as determined by Warner Bratzler shear force machine gave the highest value of 1.98 ±0.25 kg/cm^3 to A. fulica, while the lowest value of 1.60 ± 0.15 kg/cm^3 was given by A. achatina. The shear force values were however not significantly (P > 0.05) different from each other. From all indications, the WHC exerts some influence on the shear force value with the highest

shear force recorded where the WHC was lowest and vice-versa.

The dressing percentage of 38.98 ± 0.81, 36.90 ± 1.08 and 35.27 ± 1.03 were obtained for A. marginata, A. achatina and A. fulica breeds respectively. The dressing percentages obtained in this study fell within the range of 34.51 and 39.11 obtained by Omole et al. (2001) for similar breeds of snail.

Taste panel evaluation: The results of the taste panel evaluation (Table 3) indicated that the colour, juiciness and taste of A. marginata and A. achatina were rated higher ($P > 0.05$) than for A. fulica. The panelist rated A. marginata and for A. achatina equal statistically ($P > 0.05$) in the three organoleptic characteristics mentioned above. The taste panelist however gave the highest texture rating to A. fulica with a value of 6.94 ± 0.32 as against values of 4.39 ± 0.41 and 3.89 ± 0.38 for A. marginata and A. achatina respectively.

The result of this study showed that there were no significant differences in the flavour and overall acceptability rating across the breeds.

Table 3: Organoleptic characteristics of snail meat as influenced by breed

Parameters	*A.marginata*	*A. achatina*	*A.fulica*
Colour	6.94 ± 0.27^{a}	6.39 ± 0.12^{a}	5.61 ± 0.29^{b}
Texture	14.39 ± 0.41^{b}	3.89 ± 0.38^{c}	6.94 ± 0.32^{a}
Juiceness	5.75 ± 0.85^{b}	6.83 ± 0.44^{a}	4.02 ± 0.18^{c}
Taste	7.12 ± 0.91^{a}	7.59 ± 0.71^{a}	6.18 ± 0.38^{b}
Flavour	4.89 ± 0.46	5.22 ± 0.45	4.17 ± 0.37
Overall acceptability	5.67 ± 0.43	5.78 ± 0.48	5.50 ± 0.28

Seasory attribute were measured on a 9 – point hedonic scale 9 is extremely desirable and 1: extremely undesirable

Conclusion

The result of this study showed that the proximate composition of the three breeds of snail were similar and all are high in crude protein and low in ether extract while the dry matter content were relatively high. The dressing percentage across the breeds were lower than most livestock, however, the WHC was high in *A. marginata* and *A. achatina* breeds. Although there were significant differences ($P<0.05$) in the taste panel ratings for colour, texture, juiciness and taste but the meat from the three breeds of snail were acceptable in equal magnitude ($P>0.05$) by the taste panelist.

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