NUTRITIONAL VALUE AND FUNCTIONAL PROPERTIES OF POND SNAIL (Lymnaea stagnalis)

*Yusuf, A.A.[1] and Oseni,O.A[2].
[1] Department of Chemistry, University of Agriculture, PMB 2240. Abeokuta, Nigeria
[2] Department of Science Technology, Moshood Abiola Polytechnic, Abeokuta, Nigeria
(*Author for correspondence; E-mail. yusufaa2000@yahoo.com)

ABSTRACT
The proximate composition, toxic substances, functional properties, and mineral elements of both the shell and meat of fresh *Lymnaea stagnalis* were determined. The moisture contents of the sample were 38.62g/100g; and 30.06g/100g DM for both the shell and the meat respectively. Crude protein for the meat was 25.60g/100g DM while that of shell was not detectable (ND), the crude fat, and ash content for both the meat and the shell sample were 2.75g/100g DM, 0.95g/100g DM,3.41g/100g DM and 52.41g/100g DM respectively. Emulsion and absorption capacity were 6ml/g for the meat and 0.20ml/g for the shell, the oil absorption capacity of 10% was also determined for the shell and the meat. Mineral element composition determination showed that *Lymnaea stagnalis* meat is richer in sodium and potassium than the shell while the shell is richer in Calcium, Nickel, Magnesium, Cadmium, Iron, Copper, and Lead than the meat. Total oxalate was 420mg/100g DM for the meat and 350mg/100g DM for the shell; hydrocyanic acid was 180mg/200g DM for the meat and 121mg/100g DM for the shell; while tannic acid was 520mg/100g DM for the meat 480mg/100g DM for the shell.

Keywords: Nutrients, functional properties, pond snail.

INTRODUCTION
The conventional source of the animal protein for the West African populace come largely from livestock in form of poultry, beef, mutton and pork (Adeyeye, 1996).The rapid growth of human population, together with the ever increasing standard of living have also placed great pressure on the existing sources of animal protein, thereby making it expensive. It is therefore necessary to explore non-conventional protein sources such as snails in order to increase the animal protein supply

Umoh and Bassir (1977) and Mba (1980) highlighted a good number of lesser known animal foods such as *Egreria radiation* (clam), *Pachyme lania hyronensis* (periwinkle) and *Vivapara quadrata* (land snail) whose consumption were limited to a small population owing to lack of adequate information about their nutritional potential.

It has been revealed by Imevbore and Ademosun (1988) that land snail meat contains as high as 88.3% of protein. Adeyeye (1996) reported 20.76%, 14.52% and 17.51% of rotein in *Archachatina marginata, Archatina species, and Limicolania* spp respectively. *Lymnaea stagnalis* (pond nail) popularly called "Igbin Oluweri" by Yoruba tribe of Western Nigeria, is a species of snail and belongs to the class gastropoda and the phylum mollusca. It is used as food by the "Oluweri", (pond or river worshippers) and for traditional medicine in the rain forest region of Nigeria. It is available all year round in ponds. The shel is rough and hard. There is little or no research work on the nutritional value of pond snail. It is the focus of this work, therefore, to assess the nutritive value, functional properties and mineral composition of pond snail meat and its shells.

MATERIALS AND METHOD
Sample Preparation

Live samples of *Lymnaea stagnalis* were bought from the "Kuto" Market in Abeokuta, Ogun State, Nigeria. The shells were carefully removed so that weights of edible meat, haemolymph, intestine as well as the shell could be obtained. The meat and shell were dried to constant weight in an oven at 60°C. The percentages of the meat, haemolymph, intestine and shell to the total weight were determined. These were used to estimate the wastes and meat yields of the sample.

Dried samples were then milled into fine powder to pass through a 300-mesh sieve and stored for the analysis.

Chemical Analysis

Proximate composition of *Lymnaea stagnalis* was determined by the standard methods of AOAC as described by Horwitz (1980) A known mass of the dry powdered sample was ashed at 600°C in a muffle furnace for 4hrs. The ash was dissolved in 6MHCI solution and the resulting solution was made to a definite volume and used for the determination of mineral elements.

Sodium and potassium were determined with a flame photometer (Jenway PF7 Flame photometer, Essex, U.K) while other mineral elements were determined using an Atomic Absorption. Spectrophotometer (Pye unicam, U.K, model SP 9). Total oxalate was determined by the method of Dye (1956); hydrocyanic acid was determined by the alkaline titration method (Horwitz, 1980) while tannic acid was determined by following the colorimetric method of Burns (1971).Least gelation concentrations were determined by the Coffman and Garcia (1977). The water and oil absorption characteristics of the meat and shell were determined by Beuchat (1977). Emulson Capacity was measured by the method of Beuchat *et.al.* (1975).

RESULTS AND DISCUSSION

The data relating to proximate composition is showed in Table 1. Values of protein, moisture, fat, and carbohydrate for *L. stagnalis* meat are generally higher than its shell. The ash content of *L. stagnalis* meat (3.41g/100g DM) also compared with that of *vivapara quadrata* meat (5.00g/100g DM) as reported by Mba (1980) but lower than that of *Limicolaria aurora* meat (11.76g/100g DM) as reported by Udoh *et al* (1995). The ash content of *L. stagnalis* shell is appreciably higher than that of its meat (Table 1). Since the ash content is a reflection of the amount of mineral content in the sample, it therefore, follows that the *L. stagnalis* shell contains more mineral than its meat.

The moisture content of *L. stagnalis* meat (38.62g/100g DM) is greater than its shell (30.06g/100g DM), but can be compared with that of *A. marginata* (38.32%), *Archatina* species (39.94%) and *Limicolaria* species (38.95%) (Adeyeye,1996).

The meat crude protein value of 25.60g/100g DM compares favorably with values reported by Udoh *et al* (1995): for *Limicolaria aurora* (25.70g/100g DM) and Mba (1980): for *vivapara quadrata* (31.70g/100g DM) and periwinkle *(Pachymelania byronesis)* (27.50g/100g DM). *Archatina* species 14.52% and *Limicolaria* species 17.51% (Adeyeye 1996) meat protein are lower than that of *L. stagnalis*. In this study, no crude protein was determined for *L. stagnalis* shell.

L. stagnalis meat is richer in carbohydrate (25.55g/100g DM) than its shell (7.55g/100g DM) and *Limicolaria aurora* meat (13.55g/100g DM) (Udoh *et al*;1995).

The mineral element composition of *L. stagnalis* meat and shell is shown in Table2. *L. stagnalis* shell contains higher mineral element content than its meat. Although *L. stagnalis* meat appears to be richer in potassium, and sodium. *L. stagnalis* meat contains lower sodium, copper, calcium, potassium and magnesium than *L.aurora* species meat (Udoh *et. al;* 1995); and higher potassium and magnesium than *A.marginata, Limicolaria and Archatina* species meat (Adeyeye, 1996).

The high calcium content of *L. stagnalis* meat may be due to its high contents in the shell. The lower value of sodium and higher level of potassium and calcium content of *L. stagnalis* meat suggest its consumption for hypertension patient. Apart from using the *L. stagnalis* meat for human consumption, its shell could also be a valuable source of nutrition to livestock, monogastric animals and other animals due to its high mineral content such as Calcium, Magnesium, Iron and Potassium (Table 2):

The results of water and oil absorption capacity are presented in Table 3. Water absorption capacity *L.stagnalis* meat (30.0%) is found to be more than that of its shell (2%). That is, *L. stagnalis* meat can retain water than its shell but the capacity of both *L.stagnalis* meat and shell to entrap the oil is found to be the same (10% each).

TABLE 1: Proximate composition of Lymnaea *stagnalis* meat and shell (g/100g)

Constituent	Meat	Shell
Moisture (wet weight)	38.62 ± 1.51	30.06 ± 4.01
Ash	3.41 ± 0.20	52.41 ± 1.12
Crude protein	25.60 ± 1.23	ND
Crude Fat	2.75 ± 0.5	0.95 ± 0.01
Crude Fiber	4.07 ± 0.3	9.08 ± 0.28
Carbohydrate	25.55 ± 1.30	7.55 ± 0.01

± SD, n = 3, ND: Not determined

TABLE 2: Mineral element composition of *Lymnaea stagnalis* meat and shell (mg/100g DM)

Mineral Element	Meat	Shell
Na	82.8 ± 0.10	81 ± 0.01
K	399 ± 1.21	117.6 ± 1.42
Ca	118.8 ± 0.25	166.0 ± 1.01
Ni	ND	0.53 ± 0.12
Mg	56.70 ± 1.07	144 ± 1.04
Cd	0.28 ± 0.2	0.47 ± 0.03
Fe	0.54 ± 0.07	15.40 ± 0.06
Cu	0.26 ± 0.05	1.0 ± 0.02
Pb	ND	0.03 ± 0.088

Mean ± SD, n = 3, ND: Not determined.

The emulsion capacity (Table 3) of *L. stagnalis* meat (6.0ml/g) is higher than that of its shell (0.02ml/g) whereas foaming capacity of *L. stagnalis* shell (10%) is found to be very much higher than its meat, which cannot be determined (Table 3). This shows that *L. stagnalis* shell can trap more air than its meat. The least gelation capacity of *L.stagnalis* meat is found to be (2%) while there is no traceable amount of least gelation in its shell (Table 3). This observation could be attributed to the fact that *L.stagnalis* meat contains 53.4% of protein as against undetermined amount for its shell (Table 1).

Table 4 shows the levels of total oxalates, hydrocyanic acid, tannic acid and phytic acid anti-nutrients in *L. stagnalis* meat and shell. The lethal dose of oxalate to man has been reported as between 2 and 5g (Oke, 1969).

The 420mg/100g DM of oxalates in *L. stagnalis* meat and 350mg/100g DM in shell cannot all that cause serious problems to man. The reason is that commonly consuming cereals such as rice, maize and sorghum contain as much as 200mg/100g DM each (Oke, 1965) of oxalates.

Table 3: Functional Properties of *Lymnaea stagnalis* Meat and Shell (mean ± SD, n = 3)

Functional Properties	Meat	Shell
Emulsion capacity (ml/g)	6.00 ± 0.01	0.2 ± 0.01
Foaming capacity (%)	ND	10.00 ± 1.20
Least gelation capacity (%)	2.00 ± 0.03	ND
Water absorption (%)	30.00 ± 1.13	2.00 ± 0.04
Oil absorption capacity (%)	10.00 ± 1.06	10.00 ± 1.06

Mean ± SD, n = 3, ND: Not determined, DM: Dry matter content

ble 4: Levels of Anti-nutrients in *Lymnaea Stagnails* Meat and Shell (mg/100gDM).

nti-nutrients	Meat	Shell
otal Oxalates	420 ± 0.09	350 ± 0.06
ydrocyanic acid	180 ± 0.23	121 ± 0.14
annic acid	520 ± 0.31	480 ± 0.36
hytic acid	DM	DM

Mean ± SD, n=3, ND=Not determined

In conclusion, the benefits that can be derived by man and animal from *Lymnaea stagnalis* cannot be overlooked, their nutritive values compare favorably with other sources of conventional protein and minerals. It is expected that with more information being supplied to the consumer, and as more data become available on other topics on the pond snail, greater interest may be exploited to it; and there is no doubt, if pond snail is consumed in adequate quantities it would help to alleviate deficiency of protein. Also, home breeding of animals could contribute significantly to its supply all year round

REFERENCES

Adeyeye E.I. (1996): Waste Yield, Proximate and Mineral Composition of Three different Types of Land Snails Found in Nigeria. Inter. Jour. of Food Science and Nutrition 47, 111-116.

Beuchart L.R; Cherry, J. P. and Quinn (1975) Properties of peanut flour as affected by proteolysis .J. Agric. Fd. Chem. 23: 616.

Beuchart L. R. (1977). Functional and electrophoresis characteristic of sullinylated peanut flour proteins. J. Agric. Chem. 25. 258.

Burns, R. E. (1971). Method of estimation of tannin in grain sorghum. Agronomy J; 163, 511-519.

Coffman, C. W. and Garcia, V. V. (1977). Functional properties of amino acid content of a protein isolate from mung bean flour. J. Fd. Technol. 12: 473.

Dye, W. B. (1956). Chemical studies on halogeton flomeratus. Weeds, 4, 55-60.

Horwitz, W. (1980). Official Methods of analysis (13th Edition). Association of Official Analytical Chemists, Washington D.C., U.S.A.

Imevbore, E.A. and Ademosun, A.A. (1988). The Nutritive Value of the African Giant snail, *Archachatina marginata.* J. Anim. Production Res. 8(2), 76-87.

Mba, A.U. (1980). Chemical Composition of Some Local Sources of Protein Foods for Man. Nig. J. Nutrition Science 1(2), 142-7.

Oke, O. L. (1965). Chemical studies on some Nigerian cereals. Ceral Chem; 42, 299 -302.

Oke, O. L. (1969). Oxalic acid in plants and in nutrition. World Rev. Nutr; 10, 262-302.

Umoh, I.B. & Bassir, O. (1977). Lesser-Known Sources of Protein in Some Nigerian Peasant Diets. Food Chemistry; 2:315-321.

Udoh, A.P; Akpanyung, I. E. and Igiran (1995). Nutrients and anti-nutrients in small snails (Limicolaria aurora), Food chemistry 53:239-241.