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Determination Of Nutrients/Organic Compounds In The Foot And Slime Of Land Snail (Achatina Achantina)

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ABSTRACT:*Land snail (Achatina Achantina), whether cooked or roasted, the slime may still persist to the consumption stage. The aim of this work was to determine the concentrations of Na, K, Cu, Mg, Mn, Ca, Fe, Zn, P in the foot, visceral mass secretions, and foot secretions by flame atomic absorption spectroscopy and also to determine the concentrations of organic compounds in the slimes of the foot and visceral mass by using gas chromatography-mass spectroscopy. The concentrations of nutrients in mg/kg in the foot Secretion were (Sodium, 396.76; Potassium, 134.71; Calcium, 220.11; Magnesium, 219.15; Copper, 17.12; Zinc, 2.586; Manganese, 3.345; Iron, 12.75; Phosphorus, 6.431); visceral mass Secretion (Sodium, 670.89; Potassium, 70.34; Calcium, 180.04; Magnesium, 130.38; Copper, 28.83; Zinc, 2.99; Manganese, 1.723; Iron, 8.491; Phosphorus, 0.609); and foot (Sodium, 1,872.2; Potassium, 3,429.6; Calcium, 1,226.4; Magnesium, 1,080.5; Copper, 29.53; Zinc, 27.34; Manganese, 12.64; Iron, 89.21; Phosphorus, 13.32). The %composition of organic compounds in the secretions from the foot were: oxime-methoxy-phenyl, 12.88; cyclotrisiloxamehexamethyl, 57.95; pentadecane, 3.55; diethyl phthalate, 14.2; 10-methylnonadecane, 4.51; hexatriacontane, 4.70; 1,2-Benzene dicarboxylic acid, 2.21. The %composition of organic compounds in the secretions from the Visceral mass secretions were: oxime-methoxy-phenyl, 81.37; diethyl phthalate, 14.2; 10-methylnonadecane, 4.51. Methoxyphenyl-oximes and 10-methylnonadecane are known respectively to display antibiotics and antioxidant properties. Therefore, eating slimy snail may not have adverse effect on human health.*
KEYWORDS: *snail, visceral secretions, foot secretions, organic compounds, nutrients*

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I. INTRODUCTION

The land snails (Achatina Achantina) are non-conventional wildlife protein source in Nigeria and some parts of Africa. Snail meat is now becoming a highly relished delicacy (also known as “Congo meat”) in Nigeria. The snail contains nutrients important to man. Such nutrients include Ca, Mg, Na, K, P, Fe, Mn, Zn, and Cu (Adegbite et al., 2006, Berniyanti and Suwarno, 2007). The mucus that land snails secrete with the foot leaves a slime trail behind them which is often visible for some hours afterwards as a shiny "path" on the surface over which they have crawled. Snail slime is currently used in human cosmetics by companies such as Biocutis, Misshaus, Alternative Secrets and Réelle Skincare (Daniel, 2009, Naoshi et al., 2005).

The secretion of the snail supposedly has a double function when applied to human skin: on one hand it is claimed to stimulate the formation of collagen, elastin and dermal components that repair the signs of photoaging and, second, is claimed to minimize the damage generated by free radicals that are responsible for premature skin aging (Perez et al., 2012, Sodipe et al., 2013). The slime, besides containing nutrients, is also used in diverse ways. Snails have been recognized as a proteinaceous, high-quality nutritious food source (Vieira et al., 2004).Harti et. al., (2016) carried out a study on the effectiveness of snail slime and chitosan in wound healing. Their study reckoned that snail slime (Achatina fulica) has many functions, including wound or scratch and gingivitis healings, and skin care. The essential substances contained in the snail slime involve glycosaminoglycans and proteins. The proteins have important biological functions, including as a bacterial protein (enzyme). The result showed that snail slime and chitosan (2%) with the ratio of 1: 2 is effective in wound healing, the content of the anti-inflammatory factor in snail slime and antimicrobial.Falah and Saja,

(2017) reviewed selected essential trace elements and their vital roles in the human body. They opined that the trace elements are naturally occurring inorganic substance required in humans in amounts <100 mg/day. They are essential components of biological structures and have an important effect on and play a key role in a variety of the processes necessary for life throughout, and mediate vital biochemical reactions. The aim of this was to assess the content (nutrient and organic compounds) of snail secretions.

II. MATERIALS AND METHODS

Hydrochloric acid (HCl), nitric acid (HNO_3), dichloromethane, land snail (Achatina Achantina), flame AAS, GC-MS

Sampling/sample preparation for nutrients analysis via AAS

The snails were bought from Swali Market, Bayelsa State, Nigeria and kept in plastic bucket for two weeks. The snail was washed properly with water. A plastic knife was used to scrap the outer shell and foot mouth (inner shell) to get rid of dirt, before samples from different parts were collected for analysis. Three composite samples were drawn from 6 snails; one from the feet, another from foot slime, and yet another from the visceral mass slime. The three samples were acid-digested before flame AAS analysis.

Sampling/sample preparation for organic components via GC-MS

The snails were bought from Swali Market, Bayelsa State, Nigeria and kept in stainless bucket for two weeks. The snail was washed properly with water. A metal knife was used to scrap the outer shell and foot mouth (inner shell) to get rid of dirt, before samples from different parts were collected for analysis.

Land snails were extensively washed to remove the extraneous mucus components, snails were dissected and mucus (5 mL) was collected from roughly 6 individuals by stimulating the surface of live snails by small metal knife (5 mL), which was taken for GC-MS analysis.

GC-MS analysis

Mucus of the snails was analyzed by GC-MS which was performed with a PERKIN ELMER CLARUS 500 Gas chromotograph equipped with a mass spectrometric detector (MSD). A fused silica capillary column (HP-5MS), 5% phenyl w 425 polysiloxane as non-polar stationary phase (30 m x 0.25 mm x i.d) and 0.25 µm film thickness was used. Operating conditions were as follows: injector port temperature, 250^{o}C.

Helium was used as a carrier gas at a flow rate of 1.0 ml/min pulsed splitless mode programmed at 8^{o}C/min to 260^{o}C, and held for 18 min. the total analysis time as 41 min. A 1 mL volume was injected splitless. The mass spectrometric detector (MSD) was operated in electron impact ionization mode with an ionizing energy of 70 eV, scanning from m/z 50-500. The ion source temperature was 230^{o}C and the quadruple temperature was 150^{o}C.

III. RESULTS AND DISCUSSION

Table 1 shows the results of heavy metals analysis in snail samples (foot secretion, secretion from viscera & snail foot flesh). The result parameters showed Sodium (Na) with a reading of 1872.2 mg/kg in the snail foot, 670.89 mg/kg in the viscera, and 396.76 mg/kg in the foot secretion. Potassium showed 3429.6 mg/kg amount in the foot, 70.34 mg/kg in the secretion from the viscera, 134.71 mg/kg in the secretion from the foot. Calcium showed 1226.4 mg/kg in the snail foot, 180.04 mg/kg in the secretion from the viscera, and 220.11 mg/kg from the secretion of the foot. Magnesium showed 1080.5 mg/kg in the snail foot, 130.38 mg/kg in the viscera, 219.15 mg/kg amount in the secretion from the foot. Copper showed 29.53 kg/mg in the snail foot, 28.83 kg/mg in the secretion from the viscera, and 17.12 mg/kg in the foot secretion. Zinc showed 27.34 mg/kg in the snail foot, 2.99 mg/kg in the secretion from viscera, and 2.586 kg/mg in the secretion from the foot. Manganese was detected to occur in 12.64kg/mg in the snail foot, 1.723 mg/kg in the secretion from the viscera, and 3.345 mg/kg in the foot secretion. Iron showed 89.21 mg/kg in the snail foot, 8.491 mg/kg in the secretion from the viscera, and 12.75 mg/kg in the foot secretion. Phosphorus showed 13.32 mg/kg in the snail foot, 0.609 mg/kg kg/mg in the viscera, and 6.431 mg/kg in the secretion from the foot. The overall result showed more of the analyzed metals in the snail foot, which followed by the secretion from the foot and secretion from the viscera, with exception of Na, Cu, and Zn which showed more in the secretion from the viscera than the secretion from the foot. The result shows that more of the trace elements which contain important nutrients for the development of teeth and bones are found in the snail meat (foot) (Prashanth et al., 2015).

Table 1: Result for heavy metals analysis in snail samples

S/N	Parameter(s)	Foot Secretion	Visceral mass Secretion	Snail Foot
1.	Sodium, Na (mg/kg)	396.76	670.89	1,872.2
2.	Potassium, k (mg/kg)	134.71	70.34	3,429.6
3.	Calcium, Ca (mg/kg)	220.11	180.04	1,226.4
4.	Magnesium, Mg (mg/kg)	219.15	130.38	1,080.5
5.	Copper, Cu (mg/kg)	17.12	28.83	29.53
6.	Zinc, Zn (mg/kg)	2.586	2.99	27.34
7.	Manganese, Mn (mg/kg)	3.345	1.723	12.64
8.	Iron, Fe (mg/kg)	12.75	8.491	89.21
9.	Phosphorus, P (mg/kg)	6.431	0.609	13.32

Offiong et al., (2013) carried out proximate and nutrient analysis of Achatina achatina and reported levels of nutrients were: Ca (1112.86 mg/kg), Mg (63.35 mg/kg), Mn (14.45 mg/kg), Cu (9.72 mg/kg), Zn (0.79 mg/kg), P (100.00 mg/kg), Na (79.00 mg/kg). These levels are generally lower than the levels determined in this work and this could be attributable to the differences in the environmental conditions from which the snails were harvested.

Chemical constituents of mucus from Achantina Achantina foot GC-MS analysis of mucus detected the presence of the following compounds: Oxime, methoxy-phenyl, cyclotrisiloxane, hexamethyl, Pentadecane, Diethyl phthalate, 10-methylnonadecane, Hexatricontane, 1, 2-Dibenzenedicarboxylic acid dibutyl ester (Table 2). Data showed that seven compounds were identified in this GC-MS analysis. Oxime, methoxy-phenyl, and cyclotrisiloxamehexamethyl were mainly characterized by a high concentration of total compounds (12.88 and 57.95%, respectively), while 1, 2-Benzenedicarboxylic acid,dibutyl ester, and Pentadecane were characterized by low concentration of total compounds (2.21 and 3.55%), respectively.

Table 2: Table of GC-MS results of Secretion from foot

Peak No	Name of compound	%composition
1.	Oxime-methoxy-phenyl	12.88
2.	Cyclotrisiloxamehexamethyl	57.95
3.	Pentadecane	3.55
4.	Diethyl Phthalate	14.2
5.	10-methylnonadecane	4.51
6.	Hexatriacontane	4.70
7.	1,2-Benzene dicarboxylic acid	2.21

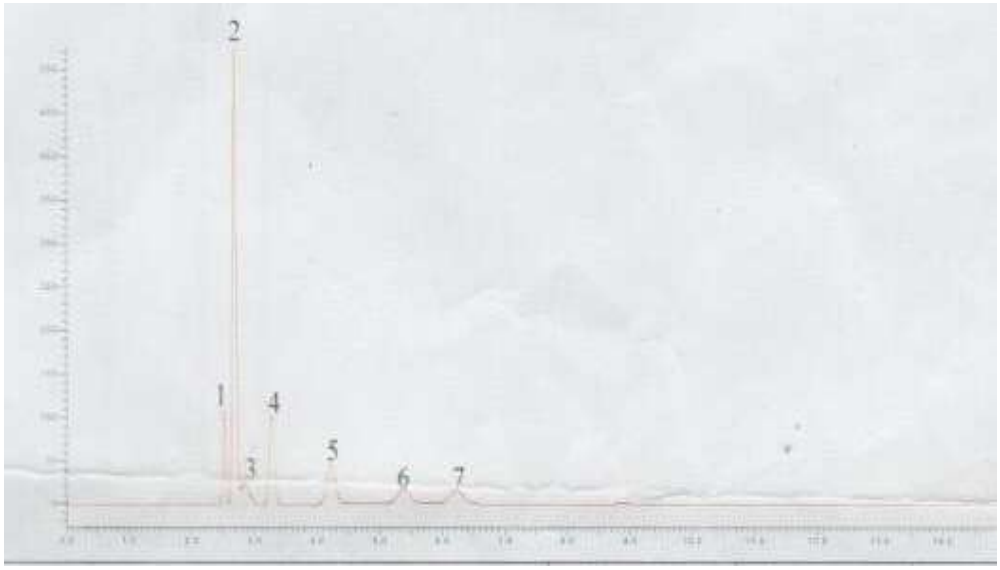

Figure 1: Chromatogram of Secretion from snail foot

Also, the data in Table 3 shows the chemical constituents of mucus analyzed from the visceral. Three compounds were identified in this mucus, both oxime methoxy-phenyl, and diethyl phthalate were mainly characterized by a high concentration of total compounds (81.37 and 14.2%, respectively), while 10-methylnonadecane was characterized by a low concentration (4.51%).

Table 3: Table of GC-MS results of Secretion from Visceral mass

Peak No	Name of compound	%composition
1.	Oxime –methoxy-phenyl	81.37
2.	Diethyl phthalate	14.2
3.	10-methylnonadecane	4.51

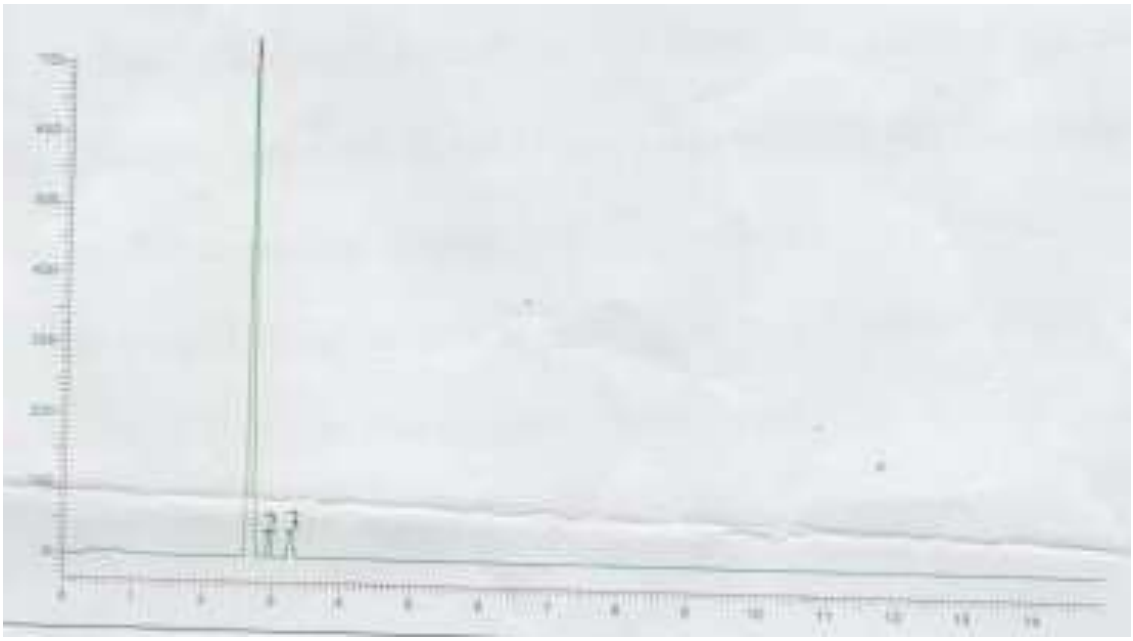

Figure 2: Chromatogram of Secretion from Viscera

It is obvious that the different composition of mucus from different parts of the land snail, oxime methoxy-phenyl, and diethyl phthalate were major components found, and in different concentrations. Adikwu, 2006 found that the trail mucus consists primarily of large, carbohydrate-rich molecules.

Sallam et al., 2009 reported that Oxime, methoxy-phenyl and cyclotrisiloxane, hexamethyl were major components found in three species of land snail.

The antibiotics properties of methoxyphenyl-oximes and other oximes were discovered and well reported (Barghouthi et al., 2017). 10-methylnonadecane was among the compounds identified in two different varieties of khat; whose oils were found to display antioxidant activities (Hailu et al., 2017). Venkatesh et al., 2014 identified twelve bioactive components such as Cyclotrisiloxane in the ethanol leaf extracts of Solanum villosum. Lachenmeier et al., (2007) reported that diethyl phthalate has been applied as denaturing agent for ethyl alcohol (denaturing of alcohol is undertaken for the purposes of exemption from excise duty that is applied to nondenatured forms. Arbale et al., (2012) isolated and identified 1, 2 benzenedicarboxylic acid as one of the bioactive compounds in Ehretia laevis.

IV. CONCLUSION

Snail slime contains nutrients such as sodium, Potassium, calcium, magnesium, copper, zinc, manganese, iron, phosphorus. The slime also contains oxime-methoxy-phenyl and 10-methylnonadecane which are respectively known to have antibiotics and antioxidant properties. Therefore, eating slimy snail may not have adverse effect on human health. Other organic compounds detected in the slime includes cyclotrisiloxamehexamethyl, pentadecane, diethyl phthalate, hexatriacontane, 1,2-Benzene dicarboxylic acid.

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