Consumers’ Preferences for Snail Meat
in the African Community of Pittsburgh, Pennsylvania

A Research Paper Presented for the Master of Science in
Agriculture and Natural Resources Degree
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DEDICATION

This research paper is dedicated to my beautiful and loving wife, Fatinma Olaleye. She is my greatest cheerleader, audience, and life-coach. She has been supportive throughout my life’s challenges. There were several times when I thought about dropping out of this program, but she stood by my side, and kept me going. I would like to thank my kids, Adebola Jr. and Abiola for keeping me on my toes, and giving me reasons to face day-to-day challenges.
ACKNOWLEDGEMENTS

I would like to thank Dr. Barbara Darroch for all her advice and support throughout my graduate studies, and with this research paper. I would also like to thank Dr. Joey Mehlhorn for his assistance in completing this research project. I am grateful for the information and assistance provided by Global Foods Inc. Pittsburgh, Pennsylvania.
ABSTRACT

Snail meat, also called escargot, is high in protein and iron, and contains almost all of the amino acids needed for human nutrition. In Africa, snails have been harvested in the wild, and sold in markets for decades, such that the Giant African Snail (GAS) (Archachatina marginata) is bound for extinction unless preservation measures like extensive snail farming are implemented. In Europe, Roman Snails (Helix pomatia) have been picked in the forest for food as early as the Roman Empire. The objective of this study was to determine consumer preference for various types of snail meat, and the awareness of snail farming within the African community in Pittsburgh, Pennsylvania. A consumer survey was conducted on the east side of Pittsburgh, Pennsylvania. Data were obtained from 131 respondents by random sampling, and subjected to descriptive statistics and Chi-square analysis to study relationships among specific demographic and socioeconomic factors. The results revealed 91% of the respondents preferred the GAS to the Periwinkle Snail or Roman Snail. Snail meat consumption was not related (P > 0.05) to income, education, or gender. Eighty–seven percent of the respondents had never considered engaging in snail farming; however, if given the opportunity to supplement their income through snail farming, 52% of the respondents would consider snail farming. Respondents with previous farm experience, of any kind, were more likely (P = 0.0325) to indicate a willingness to try snail farming. Due to the fact that live GAS is prohibited in the United States, GAS can only be purchased in commercially processed forms (frozen, dried or canned) imported from Africa. The main constraints to snail consumption are availability and price. In conclusion,
increased awareness of the nutritional content of snail meat among consumers will promote snail consumption in general, increase the varieties consumed, and encourage small-scale snail farming by 1st generation Africans in diaspora, especially those with plans to resettle in Africa in the future.

**Key words:** *Archachatina marginata*, Snail meat, Farming, Consumption.
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CHAPTER 1

Introduction

There is no written documentation about the history of snail farming. However, in the Middle Ages, the Romans had specific gardens where snails were selectively bred for eating. Snail husbandry spread throughout the Roman Empire but died out by the late Middle Ages (Nordsieck, 2010). In East and West Africa, due to their large populations, snails are consumed, sold for income, and exported to other countries (Cobbinah et al., 2008).

The nutritional benefits of snail meat cannot be overemphasized because it offers all the amino acids required by man (Adeyeye, 1996). Snail meat is high in protein, iron, and low in fat (Agbogidi et al., 2008). Snail consumption has increased in Africa due to more people avoiding red meat for health reasons (Omole et al., 2006). Unlike other extinction-prone wild animals that attract public or government intervention, the Giant African Snail (GAS) has received little to no intervention; if measures like snail farming are not promoted, the GAS may disappear from our forests.

In recent times, the wild snail population has declined considerably due mainly to the impact of man and other anthropogenic factors including deforestation, slash and burn agricultural practices and overexploitation of this animal resource to feed a growing population. Hence, the few remaining wild snails are captured before they reach maturity (Esak and Takerhash, 1992).
In Cote d’Ivoire, an estimated 7.5 million Kg of snails are eaten annually (Cobbinah, et al. 2008). In Cameroon, the government has improved the snail farming industry by creating snail-processing facilities for local snail consumption and export. These facilities create jobs, provide workshops, and act as a cooperative board by buying snails from local producers (Tebug, 2006).

France is the world’s leading consumer of snails followed, in order, by Italy, Spain, and Germany (Dragicevic & Baltic, 2009). Individual statistics on the US consumption of snails are not available; however, in 1995, US imports of snails came from 24 countries, and were worth more than $4.5 million (Paulina, 2012).

As of 2009, there were 1.5 million African immigrants residing in the US (McCabe, 2011). With this population, the demand for GAS will exceed supply because only a few African grocery stores sell snail meat, and they carry only frozen meat. This creates scarcity and high prices for snail meat at these grocery stores. The Pittsburgh African community is a typical example, where GAS is only available locally at Global Foods.
Research Objectives

This study was designed to meet the following research objectives:

1. Collect demographic data on snail consumers.
2. Identify the types of snail preferred by consumers.
3. Determine the constraints of snail consumption within the community.
4. Increase the awareness of the nutritional value of snail meat among the African community.
5. Assess the awareness of small-scale snail farming within the African Community of Pittsburgh Pennsylvania.
CHAPTER 2

Literature Review

Snail Species Used for Food

Of snail species found in Africa, the most popular are *Achatina fulica*, *Achatina achatina* and *Archachatina marginata*. In Nigeria, *Archachatina marginata* is the most popular, while in Ghana; *Achatina achatina* is considered best for consumption. Land snails collected from the forest have traditionally been a major part of the West African diet (Ejidike, 2002). *Archachatina marginata* is a large snail, growing up to 20 cm and weighing up to 500g (Amusan and Omidiji, 1999). Unlike other *Archachatina* species, its shell is less pointed. *Archachatina marginata* is grey, with a head that is darker than the rest of its body. Due to its African rain forest origin, it is best suited for snail farming in Nigeria. *Achatina achatina* can grow up to 30 cm, and has a characteristic stripe pattern and pointed shell. *Achatina fulica*, like the *Archachatina marginata*, can grow up to 20 cm but averages only 250g in weight (Cobbinah et al., 2008).

The *Archachatina marginata* species thrives best in environments with temperatures of 25 to 30 °C, and a year-round relative humidity of 75-95%; otherwise the snails will go into hibernation or dormancy (Pollard, 1975). While in dormancy, the snail’s shell is sealed off by a white, calcareous layer to prevent water loss from the body.
The Roman Snail (*Helix Pomatia*), is a land snail found all over Europe. Roman snails live in forest, gardens, vineyards, and along rivers; they have been picked for millennia to serve as food since the Roman Empire, hence the name, Roman Snail. (Nordsieck, 2010). With a maximum width of 45 mm, Roman Snails are found on well drained lime-rich soils. (Swanson et al., 2011).

Abalone (*Haliotidae*), often called ear snail due to their rounded and highly arched shaped shell that resembles an ear, are edible sea snails found primarily off the southern coast of New Zealand, South Africa and Australia and West North America and Japan in the Northern Hemisphere. Abalone feed on algae, and it takes up to four years to reach harvest size. (Dept. of Fisheries WA 2013).

Queen Conch (*Lobatus Gigas*) is a species of large edible sea snail that are gonochoristic in nature. Unlike most other snail species, which are hermaphroditic, Queen Conch is distinctively male and female (NOAA 2013). Queen conch is found in the Greater Caribbean tropical zone, including Jamaica and the Turks and Caicos Islands (British West Indies) (NOAA 2013). Although Queen Conch meat is served at seafood restaurants in the United States, they are imported from the Caribbean due to the ban on its harvest in U.S. coastal waters (Cruz 2013).

Periwinkle Snails (*Littorinna Littorea*) are small edible land snails that are found from Northern Spain to the White Sea, Russia in Europe, and along the Atlantic coast of New England and Canada. Periwinkle Snail are oval shaped, growing up to 10-12mm in width and up to 52 mm in height at maturity, over a life span of 5-10 years (BBC 2005).
**Nutritional Value of Snail Meat**

Snail meat provides a large amount of protein and is comparable to poultry, pork, and beef for protein content (Table 1). Among all species of snails consumed in Africa, the GAS (*Archachatina marginata*) offers the most protein, and other minerals, such as iron, magnesium, calcium, phosphorous, potassium, and sodium, required for proper growth and development in human beings (Fagbuaro et al., 2006). Snails are reported to have low lipid content and saturated fatty acids, which helps prevent heart related diseases (Ajayi, 1978). Snail meat is a source of vital minerals and vitamins required for normal tissue development and maintenance (Tables 2 and 3). Its low cholesterol content makes it a suitable meat for those suffering from diabetes, hypertension, and other heart diseases (Funmilayo 2008). As reported by Ademolu et al. (2004), snails prefer vegetables more than any other kind of food. Therefore, properly raised snail will offer a nutritious food.

**Snail Farming**

The snail farming business is often portrayed as a profitable business (Odunaiya, 1995); this may be true if it is managed properly. Snail farming or heliculture ranges from backyard snail farms, to a small-scale snailery, to large-scale commercial snail farms. The capital requirement for establishing a snailery is small, and unlike other small farm ventures, the practice requires little labor with no strenuous physical exertion (Goodman, 2008). Snail farming could be practiced
**Table 1. Nutritional values of snail meat compared to the meat of other food animals**

<table>
<thead>
<tr>
<th>Food items</th>
<th>Carbohydrate</th>
<th>Protein</th>
<th>Fat</th>
<th>Ash</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Snail meat</td>
<td>2.93</td>
<td>20.7</td>
<td>1.21</td>
<td>1.49</td>
<td>73.7</td>
</tr>
<tr>
<td>2. (a) Beef</td>
<td>-</td>
<td>17.5</td>
<td>22.0</td>
<td>0.9</td>
<td>60.0</td>
</tr>
<tr>
<td>(b) Pork</td>
<td>-</td>
<td>11.9</td>
<td>45.0</td>
<td>0.6</td>
<td>42.0</td>
</tr>
<tr>
<td>(c) Lamb</td>
<td>-</td>
<td>15.7</td>
<td>27.7</td>
<td>0.8</td>
<td>56.0</td>
</tr>
<tr>
<td>3. Poultry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Chicken</td>
<td>-</td>
<td>20.2</td>
<td>12.6</td>
<td>1.0</td>
<td>81.8</td>
</tr>
<tr>
<td>(b) Duck</td>
<td>-</td>
<td>16.2</td>
<td>30.0</td>
<td>1.0</td>
<td>68.6</td>
</tr>
<tr>
<td>(c) Turkey</td>
<td>-</td>
<td>20.2</td>
<td>20.2</td>
<td>1.0</td>
<td>79.3</td>
</tr>
<tr>
<td>(d) Dried fish</td>
<td>-</td>
<td>60.0</td>
<td>21.0</td>
<td>15.0</td>
<td>4.0</td>
</tr>
<tr>
<td>4. Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Cow (whole milk)</td>
<td>5.0</td>
<td>3.5</td>
<td>3.8</td>
<td>0.7</td>
<td>87.3</td>
</tr>
<tr>
<td>(b) Goat</td>
<td>4.5</td>
<td>3.8</td>
<td>4.8</td>
<td>0.8</td>
<td>86.4</td>
</tr>
<tr>
<td>6. Eggs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) White of egg small amount</td>
<td>10.5</td>
<td>Small</td>
<td>1.0</td>
<td>88.0</td>
<td></td>
</tr>
<tr>
<td>(b) Yolk of egg small amount</td>
<td>15.5</td>
<td>33.5</td>
<td>1.0</td>
<td>49.5</td>
<td></td>
</tr>
</tbody>
</table>

Note: Ash contains the minerals
Table 2: Mineral composition of snail meat

<table>
<thead>
<tr>
<th>MINERAL</th>
<th>UNIT</th>
<th>Amount/100g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>mg</td>
<td>10.0</td>
</tr>
<tr>
<td>Iron</td>
<td>mg</td>
<td>3.5</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg</td>
<td>2.5</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>mg</td>
<td>272.0</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg</td>
<td>382.0</td>
</tr>
<tr>
<td>Sodium</td>
<td>mg</td>
<td>70.0</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg</td>
<td>1.0</td>
</tr>
<tr>
<td>Copper</td>
<td>mg</td>
<td>0.4</td>
</tr>
<tr>
<td>Selenium</td>
<td>µg</td>
<td>27.4</td>
</tr>
</tbody>
</table>

Source: USDA (2006)

Table 3: Vitamins in snail meat

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>UNIT</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiamin</td>
<td>mg</td>
<td>0.01</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>mg</td>
<td>0.12</td>
</tr>
<tr>
<td>Niacin</td>
<td>mg</td>
<td>1.40</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>mg</td>
<td>0.13</td>
</tr>
<tr>
<td>Folate</td>
<td>µg</td>
<td>6.0</td>
</tr>
<tr>
<td>Vitamin B12</td>
<td>µg</td>
<td>0.50</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>IU</td>
<td>100.0</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>mg</td>
<td>5.0</td>
</tr>
<tr>
<td>Vitamin K</td>
<td>µg</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Source: USDA (2006)
within the backyard of a house because snails require little space (Ejidike, 2002). The success of a snail-breeding venture begins with choosing the most suitable species for production. Setting up a snailery at home in your backyard could be as simple as gathering a few old tires or oil drums, and introducing carefully selected snails for breeding (Cobbinah et al., 2008). Snail farming in the U.S. is uncommon; however, a handful of individuals have been known to raise snails as a hobby or for income (Kang and Pailthorp, 2013).

**Factors Affecting Consumption of Snail Meat**

Price is a major constraint to snail meat consumption; due to its scarcity, snail meat is more expensive than other meat of food animals. At the time of this research, snail meat (GSA) at Global Foods was $15.98 per pound, while the average price for USDA Choice sirloin steak and boneless chicken breast at the local grocery stores were $5.99 and $2.99 per pound, respectively.

Cleaning and prepping live snails for cooking is a constraint because it involves several processes which include storing the snails in bucket or sack in a shaded and cool place for up to 4 days without food, to enable the snails to discharge all aliments in their intestinal tract (Cobbinah et al., 2008). Upon extraction of the snail meat from its shell, the snail requires washing with vinegar or lime or lemon juice several times to remove the slime on its body. Then it requires parboiling with salt and vinegar to kill any likely bacteria (Cobbinah et al., 2008).

Although snail meat is very nutritious, there are many superstitious beliefs about snails; while some are positive, others portray the eating of snails as a taboo. Some cultures believe that eating snails makes an individual sluggish or slow due to
the slimy nature of the snail’s secretion. Some religions, such as Islam and the Jewish faith, prohibit eating of snail meat (Cobbinah et al., 2008).
CHAPTER 3

Materials and Methods

A questionnaire was developed and approved by the University of Tennessee at Martin Institutional Review Board (13-226-E05-4005). The survey was conducted at Global Foods Inc, a popular multi-ethnic grocery store in Pittsburgh, Pennsylvania. The survey took place daily from March 2, 2013 to April 10, 2013 between 10am and 4pm. Customers were selected by random and systematic sampling in the store, and were asked to complete questionnaires before approaching the checkout line. Out of 197 customers asked to partake in the survey, a total of 131 respondents completed the questionnaires giving a 66.5% response rate. The questionnaire was designed to obtain data about their snail meat consumption, snail farming awareness, and socio-economic background.

Statistical Analysis

Completed questionnaires were aggregated and descriptive statistics (means and percentages) were calculated, using Microsoft Excel. Using SAS (SAS Version 9.3, SAS Institute Inc, Cary NC) the chi-square test and Fisher’s Exact test were used to examine the following relationships among variables:

1. Was income, education level, or gender related to whether or not respondents ate snail meat?
2. Was income, education level, or gender related to frequency of snail meat consumption?
3. Was income related to the constraints affecting consumption of snail meat?
4. Was frequency of snail meat consumption related to awareness of its nutritional value?

5. Was farm experience (yes or no), degree of farm experience, or home-type related to willingness to farm snails?
Out of 131 respondents of the survey, 55% were male, and 45% were female. Eighteen percent of respondents did not indicate their level of education, and the majority of the other respondents had obtained a Bachelors degree (Table 4). The majority of survey respondents had an annual household income of less than $48,000 (Table 4). This study took place in a predominantly African community, so responses to the survey, may have been influenced by the ethnic backgrounds of respondents.

**Table 4.** Socio-economic background of survey respondents.

<table>
<thead>
<tr>
<th>Profile</th>
<th>Percentage (%)</th>
<th>Total respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest level of education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>25.2</td>
<td>107</td>
</tr>
<tr>
<td>Associates</td>
<td>23.4</td>
<td></td>
</tr>
<tr>
<td>Bachelors</td>
<td>38.3</td>
<td></td>
</tr>
<tr>
<td>Graduate</td>
<td>12.1</td>
<td></td>
</tr>
<tr>
<td>Annual Household Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below $24K</td>
<td>40.0</td>
<td>95</td>
</tr>
<tr>
<td>$24k - $48K</td>
<td>44.2</td>
<td></td>
</tr>
<tr>
<td>$48K - $72K</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>Above $72K</td>
<td>7.4</td>
<td></td>
</tr>
</tbody>
</table>
Thirty-five percent of the respondents did not eat snails, and of the respondents who ate snail, most (91%) preferred the Giant African Snail (GAS) over the Periwinkle Snail, and Roman snail respectively (Figure 1). Out of 85 respondents, 69% consumed snails occasionally; 22% ate snails one to three times per week (Table 5).

Constraints to snail consumption (indicated by 85 respondents) included availability (32%), price (41%), and cleaning (27%) as shown in Figure 2. Availability and price constraints could be attributed to the fact that GAS can only be purchased in commercially processed forms (frozen, dried or canned) imported from Africa. Additional comments from respondents claiming that live GAS was banned in the US were verified at the website of the Animal and Plant Health Inspection Service department of the United States Department of Agriculture (USDA, 2013). Live GAS is banned in the US due to the species’ voracious appetite. GAS is known to eat at least 500 types of plants including peanuts, beans, cucumbers and melon. If fruits or vegetable are not available, the snails will eat a wide variety of ornamental plants, tree bark, and even paint stucco on houses (Akinnusi, 1998; Akintomide, 2004).

When asked where they normally purchased their snails, the majority (80%) of respondents indicated that they bought their snails from the local grocery store (Table 6). This high percentage is likely influenced by the fact that the survey was conducted at a grocery store. However, the only grocery store that sells GSA in Pittsburgh, PA is Global Foods Inc.
Figure 1. The types of snail preferred by respondents to the survey (n = 85).

Table 5. Number and percentage of respondents grouped by the frequency with which they eat snail meat.

<table>
<thead>
<tr>
<th></th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occasionally</td>
<td>59</td>
<td>69.4</td>
</tr>
<tr>
<td>Once a week</td>
<td>9</td>
<td>10.6</td>
</tr>
<tr>
<td>2-3 times a week</td>
<td>9</td>
<td>10.6</td>
</tr>
<tr>
<td>Twice a month</td>
<td>8</td>
<td>9.4</td>
</tr>
<tr>
<td>Total</td>
<td>85</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Figure 2. Constraints affecting snail consumption, as identified by survey respondents (n = 85)

Table 6. Where do you buy your snails?

<table>
<thead>
<tr>
<th>Location</th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grocery store</td>
<td>68</td>
<td>80.0</td>
</tr>
<tr>
<td>Online</td>
<td>4</td>
<td>4.7</td>
</tr>
<tr>
<td>Farmer’s Market</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>Restaurant</td>
<td>10</td>
<td>11.8</td>
</tr>
<tr>
<td>Total</td>
<td>85</td>
<td>100.0</td>
</tr>
</tbody>
</table>
When asked if they had any animal farming experience, 38% of respondents claimed to have some type of animal farming experience. This factor may have influenced the percentage (52%) of respondents who are willing to engage in snail farming, if given the opportunity. There is a renewed interest in snail farming as a growing number of people are becoming health conscious in Nigeria, and are avoiding red meat (Omole et al., 2006). Starting a small-scale snail farm requires little space, minimal resources, commitment, and no farming experience; therefore most respondents of this survey were potential snail farmers.

Whereas half of the respondents confirmed their readiness to engage in snail farming, only 30% lived in a house with a backyard (Table 7). With a backyard and a handful of old tires or drums, a snailery can be established (Cobbinah et al., 2008). Most snail species can be raised at home in the United States except for the GAS, due to its ban by the USDA. However, special permits may be required and other regulations need to be followed to raise any type of snails in the U.S. (USDA, 2013).

Table 7. Number and percentage of respondents grouped by the type of home in which they live.

<table>
<thead>
<tr>
<th></th>
<th>Respondents</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartment</td>
<td>44</td>
<td>33.6</td>
</tr>
<tr>
<td>Condo</td>
<td>19</td>
<td>14.5</td>
</tr>
<tr>
<td>House w/o backyard</td>
<td>28</td>
<td>21.4</td>
</tr>
<tr>
<td>House with backyard</td>
<td>40</td>
<td>30.5</td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
<td>100.0</td>
</tr>
</tbody>
</table>
According to Fisher’s exact test, whether or not the respondents ate snail meat was not significantly related to income, education level, or gender (Table 8). In addition, frequency of snail meat consumption was not related to income, education level or gender (Table 8). Although 41% of respondents indicated that price was a constraint that affected snail meat consumption, income level was not related (P = 0.4280) to whether or not they ate snails (Figure 3), nor was income level related to the frequency with which they ate snail meat (P = 0.4886; Table 8). Income level was also not related to the type of constraint indicated by the respondents (P = 0.0775; Table 8). There was no relationship (P = 0.2388) between frequency of snail meat consumption and awareness of nutritional value, indicating that being aware of the nutritional value of the meat did not necessarily increase consumption.

Past experience with farming was significantly (P = 0.0325; Table 8) related to whether or not respondents would consider snail farming (Figure 4). However, when those with experience in farming were asked to rate their level of experience (below average, average, or above average), the level of experience was not related (P = 0.1709) to willingness to try snail farming (Figure 5).
Table 8. Results from Fisher’s Exact test to test for relationships among factors in the survey.

<table>
<thead>
<tr>
<th>Factors tested for relationship</th>
<th>P-value for Fisher’s Exact Test*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income vs. whether or not they eat snail meat</td>
<td>0.4280</td>
</tr>
<tr>
<td>Education vs. whether or not they eat snail meat</td>
<td>0.4248</td>
</tr>
<tr>
<td>Gender vs. whether or not they eat snail meat</td>
<td>1.0000</td>
</tr>
<tr>
<td>Income vs. frequency of consumption of snail meat</td>
<td>0.4886</td>
</tr>
<tr>
<td>Gender vs. frequency of consumption of snail meat</td>
<td>0.1273</td>
</tr>
<tr>
<td>Education vs. frequency of consumption of snail meat</td>
<td>0.1137</td>
</tr>
<tr>
<td>Income vs. constraints affecting consumption of snail meat</td>
<td>0.0775</td>
</tr>
<tr>
<td>Frequency of consumption of snail meat vs. awareness of its nutritional value</td>
<td>0.2388</td>
</tr>
<tr>
<td>Farm experience (yes or no) vs. willingness to farm snails</td>
<td>0.0325</td>
</tr>
<tr>
<td>Amount of farm experience vs. willingness to farm snails</td>
<td>0.1709</td>
</tr>
<tr>
<td>Home type vs. willingness to farm snails</td>
<td>0.8327</td>
</tr>
</tbody>
</table>

*A significance level of 0.05 was used.

Figure 3. The relationship between income categories and whether or not the respondents ate snails. Fisher’s exact test $P = 0.428$. Numbers above each bar represent counts for each category.
Figure 4. Relationship between respondents having any farming experience and whether or not respondents would consider snail farming. Fisher's exact test $P = 0.0325$. Numbers above each bar represent counts for each category.

Figure 5. Relationship between farming experience level and whether or not respondents would consider snail farming. Fisher's exact test $P = 0.1709$. Numbers above each bar represent counts for each category.
Chapter 5

Conclusion

More immigrants of African ethnicity prefer the GAS compared to other types of snail. It may be possible to increase snail consumption if constraints such as availability and price can be alleviated by means of increased importation, and awareness within the African community. Many respondents are unaware that there are online multi-ethnic stores that sell and ship frozen snails within the United States. Snails purchased in this way may alleviate all constraints to snail consumption as expressed by the respondents. The snails are cleaned before packaging and shipping, which eliminates the tedious cleaning process. They may be cheaper than snails purchased locally, because online stores may have less overhead costs, which may reflect in their prices. Buying online offers the consumer a variety of stores to choose from, which eliminates the issue of availability. The protein content of snail meat equals that of red meat, which is considered by some to be harmful to the body.

Raising snails requires minimal resources including less time commitment, little capital, and no special feeds compared to other animals that are raised for food. Except for the GAS, which is prohibited in the United States, the USDA has stipulated containment guidelines for non-indigenous snails (Roman Snail-\textit{Helix pomatia}, Brown Snail-\textit{Helix aspersa}, etc) that are raised by individuals, educators, researchers or commercial entities in the US. Thirty percent of the respondents live in a house with a backyard, which makes it possible for them to raise snails on a
small scale. To preserve snails in the wild, and prevent the GAS from extinction, snail farming should be promoted through advocating the nutritional value, and increased funding for potential farmers. Fifty-two percent of the respondents expressed their willingness to engage in snail farming if given the opportunity but raising the GAS is only feasible for those respondents who plan on returning to Africa in the future. Currently, in Nigeria, demand exceeds supply, such that most snail farmers have supply contracts with major food businesses. Snail farming should be started on a small scale to experience the benefits and challenges of the business. It is best to start the business as a part-time occupation.
References


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Appendix A
Global Foods Incorporation Customer Survey.

Informed Consent Statement
Global Foods Incorporation Survey 2013

This survey is being conducted by the University of Tennessee at Martin (UT Martin), Department of Agriculture, Geosciences, and Natural Resources. The survey is designed to inform the public about the moneymaking opportunities in small-scale snail farming. Your response, and any personal information given in this survey are confidential. No information will be released to any third party. All data collected in this survey will be aggregated, and only summarized information will be used. You may choose not to answer any part or question on the survey, and may discontinue the survey at any time. Survey results will be stored separately from this consent document, which will be kept in a locked cabinet for three years in the faculty advisor’s office, per University of Tennessee at Martin IRB requirements.

Thank you for your participation in this survey.

Sincerely,

David Olaleye

University of Tennessee at Martin

____________________________________________________________________________________________

I have read the above information and agree to participate in this survey. I understand that participation is voluntary. I may choose to not answer any question or portion of the survey and I may withdraw at any time.

Signature: ____________________________ Date: ____________________________
Appendix B

1. Do you eat snails? (Check one)

   YES ☐ NO ☐

   If you answered yes, go to question 2: if you answered no, go to question 7.

2. What type of snail do you eat? (Circle one)

   a. Giant African Snail
   b. Abalone
   c. The Roman snail
   d. Tsalingaria
   e. Queen Conch
   f. Periwinkle snail

3. How do you like your snail cooked (Circle one)

   a. Boiled
   b. Fried
   c. Raw
   d. Grilled

4. How often do you eat snails? (Circle one)

   a. Once a week
   b. Two–three times a week
   c. Twice a month
   d. Occasionally

5. Where do you buy your snails?

   a. Grocery store
   b. Farmers market
c. Restaurant
d. Online

6. Apart from restaurant purchases, in what condition do you buy your snails?
   
a. Frozen
b. Canned
c. Dried
d. Live

7. Do you have any animal farming experience? (Check one)
   
   YES ☐ NO ☐

8. If you answered yes, how would you describe your experience? (Circle one)
   
a. Below average
b. Average
c. Above average

9. Have you ever considered snail farming? (Check one)
   
   YES ☐ NO ☐

**Demographics**

10. Sex (Circle one): Male  Female

11. Age __________ years

12. Highest level of education completed (Circle one)
   
a. Did not complete high school
b. High School
c. Associate Degree
d. Bachelor degree
e. Graduate degree (MS, PhD, etc)
f. Professional Degree (MD, Lawyer, etc)

13. What is annual household income? (Circle one)
   a. Below $24,000
   b. $24,000-$48,000
   c. $48,000-$72,000
   d. $72,000 and above

14. If given the opportunity, would you like to supplement your income? (Check one)
   YES ☐ NO ☐

15. Which of the following do you live in? (Circle one)
   a. Apartment
   b. Condo
   c. House w/o a yard
   d. House with a yard

16. Please provide any additional comments here (for example, what ideas do have about snail farming?)