

**CONSUMER PERCEPTIONS AND DEMAND FACTORS DRIVING CONSUMPTION
OF PUMPKIN PRODUCTS IN GULU CITY**

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**A DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND
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JANUARY 2024

DECLARATION

I **Rubangakene Derrick Otim** declare that this dissertation is my original work and has not been presented for the award of a degree in any other university or any other award.

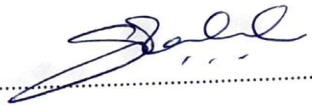
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APPROVAL

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DEDICATION

I dedicate this book to my late father Dr. Otim Michael, my late mum Mrs. Apiyo Agnes Otim, my grandfather Muzee Albino Obol, my brothers Odokonyero Raymond Obina, Lagen Daniel Otim, my dear friend Akena Johnson and all consumers of pumpkin products.

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LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
EDA	Exploratory Data Analysis
GUREC	Gulu University Research Ethics Committee
IMR	Inverse Mills Ratio
IRR	Incidence Rate Ratio
Kg	Kilogram
Km	Kilometer
LC	Local Council
NBR	Negative Binomial Regression Model
OLS	Ordinary Least Squares
RQ	Research Question
SPSS	Statistical Package for Social Sciences
UBOS	Uganda Bureau of Statistics
UGX	Uganda Shillings

ABSTRACT

Despite nutritional values of pumpkin products, they are not widely consumed by the local population. To enhance consumption of pumpkin products, understanding the influence of consumer perceptions combined with demand factors on consumption of pumpkin product is paramount. The study was set out to examine the relationship between socio-economic factors and sources of pumpkin products, assess the influence of consumer perceptions on consumption of pumpkin products and determine the factors affecting consumer demand decisions for pumpkin products. Using a cross-sectional survey 427 households in Gulu City, this study examined the influence of consumer perceptions and demand factors on consumption of pumpkin products. Data analysis involved descriptive statistics and two different models. Negative Binomial Regression Model (NBR) was used to assess the influence of consumer perceptions on consumption and Heckman Two-stage regression model was used to determine factors driving consumer decisions to demand for pumpkin products. Findings show that consumption of pumpkin products is influenced by consumer perceptions on health benefits on heart health, consumer taste and preference for aroma, hard skin, nutty taste, fibreness, perceived health benefits on eye vision, quantity consumed, income, reliance on self-production, boiled preparation, product price, household size, and sensitization on healthy foods. Consumer decision to purchase pumpkin products is driven by perceived health benefits for immunity, eyesight, heart health, and weight loss, marital status, income spent on products, proximity to supermarkets, number of men in the household and sensitization on healthy foods. Consumer decision on quantity demanded for pumpkin products depends on product prices, income price of substitutes, number of men in the household, and sensitization on healthy foods. The study recommends that sensitization programs should structure messages to emphasize the role of pumpkins in enhancing human health.

Keywords: *Pumpkin, Native vegetables, Consumption, Negative binomial regression model, Heckman regression model*

CHAPTER ONE: INTRODUCTION

1.1 Background

Pumpkin is an important crop for enhancing food security, most especially in regions lacking diverse and nutritious food (Nábrádi *et al.* 2014). Reportedly, pumpkin is a versatile and nutrient-rich crop, capable of providing a sustainable and affordable source of nutrition (Karanja *et al.* 2012). Given its ability to perform under conditions of low soil fertility, pumpkins barely require purchased inputs such as mineral fertilizers for production. This is evidenced by the high yields that tend to be obtained at farm-level under various agro-ecological zones with marginal fertility levels (Tittonell and Giller, 2013). However, the consumption of pumpkins is not widespread in Sub Saharan Africa (Johnson and Lee 2021). This in part has been blamed on negative consumer perceptions and the lack of knowledge on health value of pumpkins (Madhavan-Nambiar *et al.*, 2013). A case in point on consumer attitudes are the negative perceptions on pumpkin that it is a poor man's crop and food (Yok *et al.* 2016).

Pumpkins offer a variety of products for human consumption and other uses. First, the pumpkin fruits whose preparation for consumption may involve just simple boiling or steaming. Recent technological development is also enabling processing pumpkins into secondary products namely, pumpkin juice, pumpkin flour and others (Rock, 2021). Though, processed products are not common and few people consume them. A second product is the seeds which are increasingly being sold in supermarkets of East Africa. These seeds are rich in Zinc which facilitate absorption of digested food. Third, the pumpkin leaves are cooked in various ways, similar to other leafy greens. Common methods include boiling, stir-frying, or adding them to soups and stews. Pumpkin leaves are a good source of vitamins and minerals, including vitamin

A, vitamin C, calcium, iron, and potassium. These nutrients contribute to overall health and well-being. The fourth product, the pumpkin flour is a nutritious and versatile ingredient that can be used in a variety of recipes. It's made by drying and grinding pumpkin seeds into a fine powder retains many of the nutrients found in pumpkin seeds. It's a good source of protein, healthy fats, dietary fiber, vitamins (such as vitamin E and some B vitamins), and minerals (including magnesium, phosphorus, zinc, and iron) (Erickson, 2018; Rock, 2021).

From a nutritional perspective, pumpkin products offer substantial nutritional significance, boasting a range of food values that contribute to a well-rounded and healthful diet. Rich in vitamins, particularly vitamin A, pumpkin products are recognized for their positive impact on vision and immune health (Smith *et al.*, 2019). The study by Brown and Johnson (2021) highlights the presence of dietary fiber in pumpkin, aiding digestion and promoting gut health. Moreover, pumpkin seeds, often utilized in products like granola bars, are a notable source of plant-based protein, essential fatty acids, and magnesium, as outlined by Anderson and White (2020). These nutritional attributes make pumpkin products a valuable addition to both vegetarian and omnivorous diets, supporting cardiovascular health and overall wellness. Incorporating pumpkin-based foods into various meal options, from smoothies to soups, provides a flavorful way to harness the benefits of this nutrient-dense ingredient.

The pumpkin industry is currently facing a notable decline in demand for its products, driven by a confluence of factors that have created a challenging market environment. One significant reason is shifting consumer preferences towards healthier and more diverse food options. A study conducted by Smith *et al.* (2022) found that an increasing number of consumers are gravitating towards plant-based and superfood alternatives, leading to a decreased interest in

traditional pumpkin-based products. Furthermore, the seasonality of pumpkin items, often associated with autumn and holiday seasons, limits their market presence throughout the year, as highlighted by Johnson and Lee (2021). This cyclical demand pattern creates production inefficiencies and surplus during off-peak periods, exacerbating the supply gap. Additionally, global climate fluctuations have impacted pumpkin harvests, causing inconsistent quality and supply, as detailed in the report by Climate Watch Agriculture (2020). To address these challenges and stimulate demand, industry stakeholders need to diversify product offerings, promote year-round availability, and explore innovative culinary applications beyond traditional seasonal fare.

Consumer perceptions play a pivotal role in shaping the consumption patterns of pumpkin products. According to a study by Williams and Smith (2018), consumer perceptions are influenced by factors such as taste, health benefits, and cultural associations, which collectively impact their willingness to incorporate pumpkin items into their diets. Positive perceptions of the nutritional value and health benefits of pumpkin products, as detailed by Brown *et al.* (2020), have been shown to drive increased consumption, particularly among health-conscious individuals. Moreover, the work of Lee and Johnson (2019) highlights that nostalgic sentiments tied to seasonal traditions can create a surge in demand for pumpkin-based products during specific times of the year. Negative perceptions, on the other hand, such as misconceptions about high sugar content or limited versatility, can hinder consumption. Thus, consumer perceptions serve as a critical determinant in the adoption and integration of pumpkin products into dietary choices, showcasing the profound impact of these perceptions on consumer behavior.

Undertaking a study on consumer perceptions and demand for pumpkin products holds significant importance for various stakeholders, ranging from producers to policymakers. Research in this realm, as emphasized by Smith and Johnson (2017), offers a comprehensive understanding of how consumer perceptions shape the consumption patterns of pumpkin products. Unveiling the intricacies of these perceptions is crucial in tailoring marketing strategies and product development efforts to align with changing consumer preferences, as indicated by Brown *et al.* (2019). Moreover, the work of Williams and Anderson (2021) underscores the vital role of consumer perceptions in influencing dietary choices, particularly in relation to health and nutrition. Understanding the factors driving consumer demand decisions for pumpkin products, as highlighted by Lee and White (2020), empowers stakeholders to optimize supply chain management and foster innovation in the food industry. This knowledge not only informs product diversification but also aids in the formulation of policies aimed at promoting healthier eating habits by leveraging the popularity and nutritional benefits of pumpkin-based foods. Therefore, a robust investigation into consumer perceptions and demand for pumpkin products serves as a foundational step towards informed decision-making across sectors, contributing to both economic growth and public well-being.

1.2 Statement of the problem

Despite the nutritional benefits and the ability to supply food throughout the year, pumpkins and their associated products are not widely consumed (Nakaziba *et al.* 2021). For instance, fresh pumpkins, pumpkin seeds, powder, and pumpkin leaves have low consumer demand (Bua & Onang, 2017; Kamarubahrin *et al.* 2018). The low consumer demand for fruits and vegetables including pumpkins and their associated products is attributed to socio-demographic differences,

nutritional knowledge, urbanization, and food market policies among others (Madhavan-Nambiar *et al.*, 2013). However, the crop has not been given much attention in research nor promoted as a viable crop, particularly in northern Uganda. Pumpkin is multipurpose in that all the parts of the plant can be consumed and thus minimizing food wastage guaranteeing food and nutrition security (Yok *et al.* 2016).

Available research on consumption shows that the low level of domestic consumption of vegetables like pumpkins is related to income levels (Kabwama *et al.* 2019). Such previous research is devoid of information on the kind of role that tastes and preferences along with other demand factors play in the consumption of pumpkin pumpkins. Notably, studies that explicitly analyze demand decisions for pumpkin products as disaggregated by fruits, leaves, and seeds are conspicuously lacking necessitating further research. Therefore, this study sought to examine the drivers of consumer demand for pumpkin products so as to provide more insights on how pumpkins consumption can be enhanced as a strategy for improved community nutrition. Knowledge on drivers of consumption and demand decisions for pumpkin products is useful for policy action in promoting the consumption of healthy foods.

1.3 Objectives of the study

1.3.1 General Objective

The overall objective of the study was to examine the influence of consumer perceptions and demand factors on consumption of pumpkin products.

1.3.2 Specific objectives

The specific objectives of the research included the following.

- i. To assess the relationship between socio-economic factors and sources of pumpkin products
- ii. To analyze the influence of consumer perceptions on the consumption of pumpkin products
- iii. To determine the factors driving the consumer demand decisions for pumpkin products

1.4 Research questions

- i. What is the relationship between socio-economic factors and the sources of pumpkin products?
- ii. How do consumer perceptions influence the consumption of pumpkin products?
- iii. What are the factors driving the consumer decisions to demand for pumpkin products?

1.5 Scope of the study

The scope of the study was divided into two parts. That is contextual scope and geographical scope. In terms of the geographical scope, the study was limited to Gulu City with a focus on households that had been exposed to pumpkin products either by consuming the products or by sensitization of health benefits of the products in the past 12 months. Contextually, information was gathered on socio-economic characteristics of the consumers, consumer perceptions, frequency consumption of pumpkin products and demand for pumpkin products.

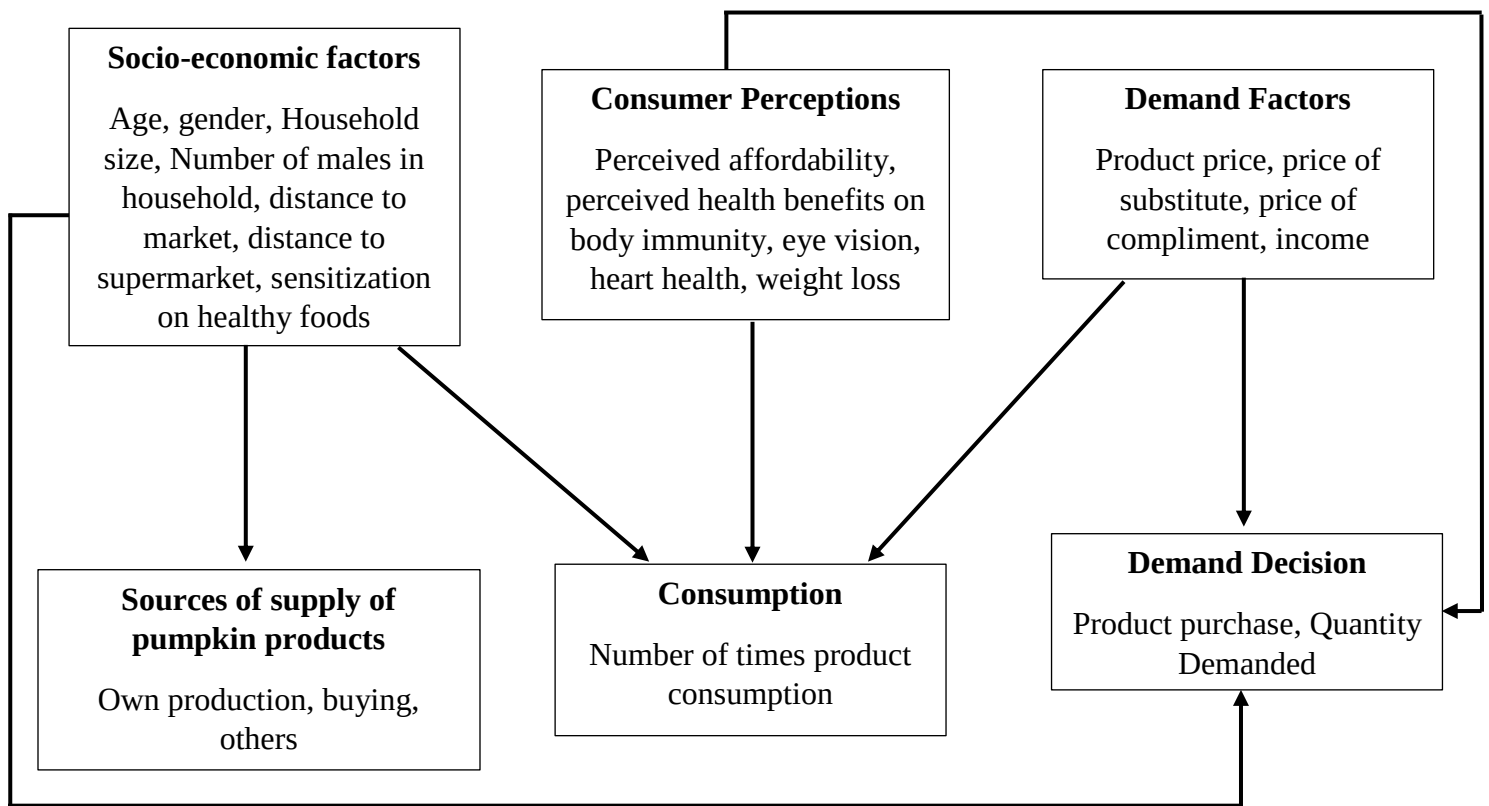
1.6 Justification of the study

Pumpkins like other indigenous vegetables have the potential to provide nutrition, food security and cash income to households in Uganda. More awareness creation on pumpkin's medicinal and nutritional values could increase its demand and transform it to a viable enterprise to address food insecurity, ill-health and poverty in Uganda. However, information on the consumer perceptions and demand for pumpkin products required for improving pumpkin production, consumption and marketing has not been well documented. There is a need for an inquiry into the consumer perceptions and demand for pumpkin products. This will provide ground for formulation of policy interventions and strategies for development and promotion of pumpkin value chain and consumptions for improved food security, incomes and livelihoods of households in Uganda in general.

1.7 Conceptual Framework

The relationship between the independent variables (socio-economic factors, consumer perception, and demand shifters) and the dependent variables (source of pumpkin product, consumption and demand decisions for pumpkin products) is not deterministic but rather complex and interconnected. Changes in socio-economic characteristics, consumer perceptions, and demand shifters can individually or collectively influence consumption and consumer demand decisions for pumpkin products. For example, if consumer perceptions towards pumpkin products are positive, driven by health benefits and taste and preference, and there are favourable socio-economic characteristics (e.g., higher income levels and education), this could lead to increased consumption and demand. Conversely, negative consumer perceptions or unfavourable socio-economic conditions may result in decreased consumption and demand.

Furthermore, changes in demand factors, such as a surge in advertising efforts promoting pumpkin products during the fall season, can create a temporary spike in consumption and demand. Overall, the relationship between the independent variables (socio-economic characteristics, consumer perceptions, and demand factors) and the dependent variables (consumption and demand for pumpkin products) is multifaceted, dynamic, and can vary depending on various contextual factors and interactions. This is illustrated in (Figure 1).



Source: Own Conceptualization

Figure 1: Conceptual framework for drivers of consumption and demand decisions for pumpkin products.

CHAPTER TWO: LITERATURE REVIEW

2.1 Production and attributes of pumpkins

Pumpkins (*Cucurbita spp.*) are a widely recognized and cultivated crop known for their distinctive appearance and culinary uses. They have a rich history and diverse attributes that make them a fascinating subject of study. Pumpkins have a long history and are believed to have originated in the Americas. The domestication of pumpkins can be traced back to Central America and Mexico, where they were cultivated by indigenous cultures thousands of years ago (Erickson, 2018). Native American tribes such as the Hopi and Navajo have a deep cultural connection to pumpkins and incorporated them into their traditional practices (Erickson, 2018).

Pumpkins belong to the *Cucurbitaceae* family and the *Cucurbita genus*. There are several species within the *Cucurbita genus*, including *C. maxima*, *C. pepo*, *C. moschata*, and *C. argyrosperma* (Nerson, 2020). Each species has distinct characteristics and varieties. For example, *C. maxima* includes popular pumpkin varieties like the *Atlantic Giant*, while *C. pepo* includes smaller decorative pumpkins like *Jack-o'-Lantern* types (Nerson, 2020).

Pumpkins exhibit a wide range of morphological attributes, including size, shape, color, and texture. They can vary from small, round varieties to large, oblong ones. The color of pumpkins can range from deep orange to yellow, green, or even white, depending on the variety (Erickson, 2018). Pumpkin plants are known for their large, lobed leaves and sprawling vines. Genetic studies have shed light on the diversity and relationships within the *Cucurbita genus*. DNA analysis have revealed the genetic relatedness and hybridization events among different pumpkin species, contributing to our understanding of their evolutionary history (Sebastian *et al.*, 2018).

Pumpkins are highly versatile in the culinary world. They are used in various dishes, including soups, pies, bread, and roasted vegetables. The flesh of pumpkins is known for its sweet and earthy flavour, making it a popular ingredient in both savory and sweet recipes (Erickson, 2018). In terms of nutritional value, pumpkins are rich in essential vitamins and minerals. They are a good source of dietary fibre, vitamin A, vitamin C, and potassium (Rock, 2021). Pumpkin seeds, also known as pepitas, are highly nutritious, containing protein, healthy fats, and various micronutrients (Rock, 2021).

A study by Wanjiku Kiharason, (2019b) revealed that many of the pumpkin farmers in Uganda appreciate the crop's nutritional and medicinal values since they provided vitamins, minerals, starch and proteins up to 57, 32, 39 and 5%, respectively. It was also found that pumpkins were mostly grown by low-income households who mainly utilize the leaves as vegetables and occasionally consume the fruit when cooked. Pumpkins were stored in raw form by carefully harvesting them with the stalk still attached. Pumpkin farmers store seeds for future planting (Wanjiku Kiharason, 2019a).

2.2 Consumer perceptions on consumption of indigenous vegetables and pumpkins

Most rural communities in many African farming systems depend on indigenous plants as a means of their livelihoods for both food and income from one cropping season to another (Mojeremane *et al.*, 2011). However, traditional vegetables which rural communities mainly utilize as food and medicine are rarely sold in markets (Mung'athia, 2020). Gido *et al.* (2017) revealed that traditional vegetables were a major source of food due to their ability to grow in marginal areas. Traditional dishes are cheap and provide quality nutrition to poor families both in urban and rural areas (Modibedi *et al.* 2021). Indigenous vegetables are important sources of

food and are recognized by communities for their nutritional and therapeutic properties (Kansiime *et al.* 2018).

Pumpkin fruits, leaves and flowers are used as vegetables while seeds are roasted to give oil or eaten as a snack. Most households mainly use pumpkin leaves as vegetables while seeds are used as a sauce and snack (Fungo *et al.* 2016). Mung'athia, (2020) noted that pumpkin was one of the most preferred traditional leafy vegetables. Similarly, Ndoro *et al.* (2007) established that in Zimbabwe, pumpkin leaves were consumed three to four times per week during the rainy season. In the Lake Victoria basin, pumpkins were used as relaxatives, anti-flatulent, anti-diarrhea, de-wormers and in the treatment of heartburns and ulcers (Ondigi *et al.*, 2008).

Traditional foods consumption was generally low mainly due to the negative perception given to these foods (Modibedi *et al.* 2021). In Zimbabwe, traditional vegetables were largely referred to as the “poor man’s food” because they are regarded as inferior and marginalized by the majority of people (Ndoro *et al.* 2007). Negative beliefs act as barriers but health, nutrition, tradition and culture are main drivers for indigenous and traditional foods consumption by rural communities (Gido *et al.* 2017). Indigenous and traditional foods are consumed for cultural, traditional and heritage reasons (Wanjiku Kiharason, 2019a). In South Africa, men preferred eating meat and left indigenous and traditional foods to be consumed by women and children (Zulu *et al.* 2022). A similar revelation was made by Ondigi *et al.*, (2008), pumpkin fruits are cooked and mainly consumed by women and children while men consider them as food for children.

2.3 Drivers of demand for indigenous vegetables and pumpkins

Most studies on consumer demand hypothesize that consumers' demand is influenced by socio-demographic factors like age, education income, gender, marital status and number of children in the family (Exenberger & Bucko, 2011). In addition, consumer perceptions and knowledge are also important factors influencing consumer demand. (Nandi *et al.* 2017) noted that women are more likely to demand for organic ethnic produce, and so are the highly educated and high-income groups.

Lim *et al.* (2010) reported that factors such as income, family size and consumers' awareness on the health benefits of the products' characteristics significantly increase consumers' demand for organic food products. Furthermore, married consumers as well as women demand more of the organic foods and willing to pay a higher premium. In addition, those who had children younger than 10 years old, the elderly, or people with family members having special diseases demand more of the indigenous vegetables because of their nutritional and medicinal values and they are willing to pay a higher premium price for these products. Another factor that was found to discourage consumer demand for indigenous vegetables was lack of advertising as consumers are not aware of availability and where to find these products.

Boccaletti & Nardella, (2000) reported consumers' demand and willingness to pay for food products in Italy and found that consumer demand is mainly affected by income and information. Boccaletti & Nardella, (2000) also revealed that consumers' demand and willingness to pay for pesticide-free fresh fruits and vegetables in Italy by taking a sample of 336 observations. The results showed that age, gender, education, place of residence, households with children, and household income were considered as socio-economic variables. In order to capture safety risk,

knowledge on pesticide-borne health risks and two other indices (pesticide concern and foodborne risk concern) were incorporated in the model. Although the high-income group demanded more and were willing to pay a premium for pesticide-free produce, male respondents and those with a university degree demanded less and were less likely to pay a premium for pesticide-free produce.

According to Ngigi *et al.* (2018), on the assessment of urban consumers' demand and willingness to pay for quality leafy vegetables in Kenya, the study revealed that consumer demand and willingness to pay for quality leafy vegetables was higher among high income consumers. It also found that number of dependents and access to information about food safety are among the significant drivers of consumers' demand and willingness to pay for quality leafy vegetables. Another survey conducted by Chelang'a *et al.* (2013), among urban consumers in Kenya, to determine the demand for African Leafy Vegetables discovered that consumers generally preferred African Leafy Vegetables to exotic leafy vegetables and were willing to pay an average premium of 79% for them; 88 % and 70 % in open air and supermarkets, respectively. The demand and willingness to pay premium was positively influenced by age, presence of children in the household, years of schooling of the household decision maker, and the number of years the consumers had been consuming African Leafy Vegetables.

Pacho, (2020) reported that, on average, consumers demand for inspected and organically produced food. In addition, consumers have a strong preference for domestically produced food and do not neglect produce coming from areas associated with poor agricultural practices. A study by Acheampong *et al.*, (2012) to ascertain consumer perceptions, purchasing behavior and WTP for safe vegetables in Ghana revealed that labelling, visual appearance, freshness and

availability had a significant influence on consumers' demand and willingness to pay higher prices for safe vegetables.

2.4 Research Gaps

From the literature reviewed, little information is available on pumpkins compared to other indigenous crops. The studies carried out on pumpkins in Uganda (Immaculate *et al.* 2019; Ondingi *et al.* 2008) concentrated on Local knowledge of pumpkin production, performance, and utilization systems for value addition avenues, Comparative analysis of production practices and utilization of pumpkins by smallholder farmers. Most research studies focused on production and utilization of indigenous African leafy vegetables (Mod, 2020; Moser *et al.* 2011; Mung'athia, 2020).

The influence of consumer perceptions on consumption and the drivers of demand for pumpkin and its associated products have not been given a focus by previous studies in the country. It is therefore necessary to examine influence of consumer perceptions on consumption and drivers of demand for pumpkin products. This will provide a ground for a comprehensive study to inform the development of appropriate research and policy interventions to enhance consumption of pumpkin and its associated products particularly in Gulu City. This study therefore characterized the consumers of pumpkin products, examined the influence of consumer perceptions on consumption of pumpkin products and examined the drivers of demand for pumpkin products.

CHAPTER THREE: METHODOLOGY

3.1 Study Area

The study was conducted in the two divisions of Gulu City and the study population comprised of households in the city. Gulu City is located in Northern Uganda between the coordinates 2°46'54.0"32N and 32°17'57.0" E. Gulu City is approximately 333 kilometers from Uganda's capital and largest city Kampala. Despite having a high number of corporate individuals like university staffs, NGO staffs, civil servants, and staffs of private companies who require nutritious foods like pumpkins, there is a low demand for pumpkin and its associated products. Additionally, Gulu City have several markets where pumpkin fruits and leaves are sold as well as supermarkets where processed pumpkin products such as roasted pumpkin seeds and pumpkin flour are sold. Furthermore, reports indicate that the low consumption of pumpkin leaves is attributed to the negative attitude individuals have towards its consumption. The map of the study area

in (Figure

is shown 2).

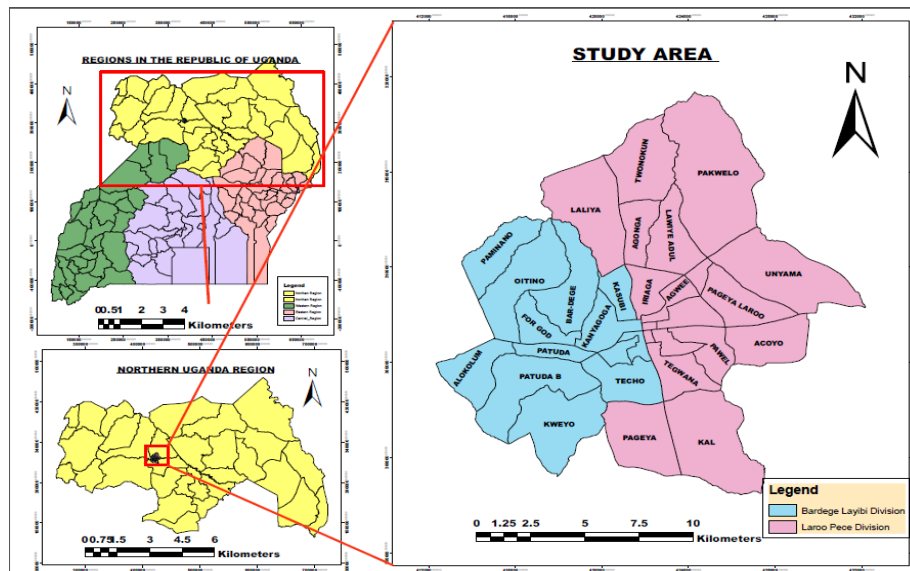


Figure 2: Map of Gulu City

Source: Authors drawing

3.2 Study Design

A cross-sectional survey was conducted between December 2022 and January 2023 to collect primary data from household consumers of pumpkin and its associated products. A structured, researcher administered questionnaire was used to collect data on socio-economic characteristics of consumers of pumpkin products, consumption of pumpkin products and non-own price demand factors.

3.3 Sample size determination and sampling procedure

3.3.1 Sample size determination

In the process of developing this thesis, the determination of an appropriate sample size played a pivotal role in ensuring the robustness and reliability of the research outcomes. To achieve this, the Morgan table (Appendix IV), as proposed by Krejcie and Morgan (1970), was employed as a valuable tool for estimating the required sample size. This method was chosen for its ability to systematically calculate a sample size that aligns with the desired level of confidence, margin of error, and the size of the target population. According to Krejcie and Morgan's seminal work, it is essential to ensure that a sample size is sufficiently large to yield results that can be generalized to the broader population accurately.

The Morgan table, in this particular study, yielded an estimated sample size of 384 respondents. However, to account for potential non-responses, a further 43 respondents were included in the sample. This additional number is consistent with the recommendations by Krejcie and Morgan

(1970), who emphasize the importance of considering potential non-responses or incomplete data when determining sample size. In total 427 respondents were considered for this study. By adhering to their guidelines, this research aimed to enhance the credibility and representativeness of its findings while maintaining methodological rigor and a comprehensive approach to sample size determination (Krejcie & Morgan, 1970).

3.3.2 Sampling Procedure

Since, there are no specific consumers of pumpkins in one place, this study opted to generally sample households in Gulu city. Sub-subsequently, respondents from selected households were asked to respond to question of whether in their households had consumed pumpkin fruits, pumpkin seeds and pumpkin leaves in the previous 12 months. A multistage sampling procedure was adopted to select the study respondents. The study area was divided into two divisions namely; Laroo-Pece and Bardege-Layibi divisions using stratified sampling method. A simple random sampling procedure was used to sample communities which are known to have markets where pumpkin fruits are sold and supermarkets where processed pumpkin products are sold and have been exposed to nutritional education programs. Thus, the twenty cells communities were; Abuga, Pawel Central, Agwee, Airfield, Awich, Bwonagweno, Commercial Road, Cubu, Kasubi, Katikati, Kirombe, Laliya, Pida, Obiya, Forest, Unyama B and Obiya West. A list of households was obtained from the local authorities (Town Clerks and LC1 chairpersons) in the study area and a simple random sampling technique was used in selecting 427 households. The respondents were household heads above the age of 18 years or their spouses since they are responsible for making consumption decisions at their households.

3.4 Data Collection

3.4.1 Data collection instruments

Data was collected through the administration of structured questionnaires in face-to-face interviews. Prior to the primary data collection exercise, the questionnaire was pretested on selected consumers of pumpkins in Lira City to evaluate the appropriateness of the design, coherence, and relevance of the questions. Lira City was chosen because just like Gulu City, the households have access and were exposed to pumpkin products and have more chances of buying the pumpkin products. The necessary modifications were made on the questionnaires after pretesting in order to capture the relevant information related to the study objectives of the study. The questionnaires comprised of both close-ended and open-ended questions to collect data. Open-ended questions were appropriate for prompting the respondents to formulate their answers, while close-ended questions enabled respondents to choose a response from a given list of options.

The questionnaire was structured capture data as follows; the first section of the questionnaire focused on the socio-demographic factors including age of the respondents in complete years, the level of education of the respondents in the number of years spent in school, distance the market in kilometers (km), other sources of income and household composition. The second section captured information on consumption of pumpkin products particularly information was collected on the form consumed, quantity of the pumpkin in number of pumpkin fruits, weight pumpkin fruit in Kilograms (Kg), pumpkin seeds in Kilograms (Kg), pumpkin flour in Kilograms (Kg) and the pumpkin leaves in bundles consumed per annum. Further the information on prices of the pumpkins and its associated products were captured in Ugandan

shillings, number of times consumer consumed pumpkin products. The third section focused on the non-own price demand shifters including price of substitutes, price of compliments, proportion of income spent on the product.

3.5 Data Quality Control

3.5.1 Content validity and reliability

In order to ensure content validity, questionnaire items were formulated around the aspects of the problem being investigated with guidance from the supervisor. A pre-test of the questionnaire was conducted on 10 respondents who are not inhabitants of the study area. During the exercise, the flow of questions and responses were examined to see if they satisfactorily tackle the specific objectives. After the pre-tests, modifications were made to the questionnaire to improve the reliability of the content (Mugenda, 2003). There was a keen supervision of research assistants who were well trained on skills for conducting ethical research and the study and had an excellent command of the local language during the data collection process.

3.6 Data Analysis

The data collected was edited, coded, and cleaned to ensure consistency, uniformity, and accuracy. Data was entered into the statistical package for social scientists (SPSS V₂₀) for analysis, and STATA V₁₅. The statistical packages chosen made the analysis neat and precise (Boudjeka Guemkam *et al.*, 2018). Descriptive statistics such as means, standard deviations, percentages and frequencies were performed as a way of exploring the data. Econometric analysis was later performed following the research objectives.

3.6.1 Assessing relationship between socio-economic and sources of pumpkin products

To address this objective, descriptive statistic including the mean, frequency, percentages and standard deviations were used. One-way ANOVA was used to compare the means of the socio-economic characteristics of the consumers across the sources of pumpkin products. The Chi-square test was used test for association between sources of pumpkin products and socio-economic characteristics of the consumers.

3.6.2 Analyzing the influence of consumer perceptions on consumption of pumpkin products

The data structure of the dependent variables, i.e., consumption of pumpkin products that took on count values, necessitated that this study uses a Poisson-type regression model for analysis. Accordingly, the Negative Binomial Regression (NBR) was selected for analysis because of its property of the Poisson-gamma mixture distribution (Champahom *et al.*, 2022) and thus, its efficiency predicting count data outcomes. Notably, the dependent variable (consumption of pumpkin products) consisted of only non-negative integer values and the variance of the dependent variable is greater than the mean as explained in the study of Guo *et al.* (2020).

Model diagnostic tests were performed to determine the most appropriate functional model to use. A goodness of fit test using the log-likelihood values was used to compare the count data models that is Standardized Poisson (SP), Generalized Poisson (GP), Generalized Linear Model (GLM), Zero Inflated Poisson (ZIP) and Negative Binomial Regression (NBR) model. The log-likelihood values indicate that NBR model have the largest value indicating that the Negative Binomial Regression model fit the data significantly well. The test of hypothesis of adequacy of

the NBR over the SP shows that the dispersion parameter for the pumpkin fruit (-0.061), pumpkin leaves (0.446) and pumpkin seeds (0.244), suggesting evidence if significant over dispersion of the data. Therefore, the null hypothesis of equi-dispersion was rejected. The Akaike Information Criteria (AIC) for pumpkin fruit (1749.87), pumpkin leaves (2189.92) and pumpkin seeds (1659.78) and the Bayesian Information Criteria (BIC) for pumpkin fruit (1826.94), pumpkin leaves (2258.88) and pumpkin seeds (1738.75) revealed that the NBR model had marginally lower values for than the other count data models, providing significant justification for the choice of the Negative Binomial Regression model over the other count data models to estimate the frequency of consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds.

Thus, the empirical model, for which NBR was employed, is as specified in equation (1):

$$Consump = \alpha + X' \beta + W' \rho + \varepsilon \quad (1)$$

Where: *Consump* is consumption that takes on a positive integer, α is the regression constant, β is a vector of coefficients associated with consumer perceptions and X' is a vector of consumer perceptions that influence consumption. ρ is a vector of coefficients associated with control variables while W' is the vector of control variables namely socio-economic factors and product attributes that are assumed to influence consumption of pumpkin products. The pumpkin products included in this study are: pumpkin fruit, pumpkin leaves and pumpkin seeds. Detailed description and measurement of these variables are presented in Table 3.1. ε is the error term or random disturbance.

The choice of variables in (Table 3.1) were informed by literature. However, the choice of the final variables included in the model was based on how well the model meets the basic

assumptions, in addition to relevant post estimation statistics. Prior to data analysis, a pairwise correlation of the independent variables was done and those having a Pearson correlation coefficient of greater than 0.45 were excluded in the model. Data analysis followed several trials with each trial followed by post-estimation test after which an appropriate corrective step was done so that the final model would meet all the required conditions. The corrective steps included removing highly insignificant variables, scrutiny for multicollinearity and eliminating variables with VIF greater than 10. The model fit was improved by transforming some continuous explanatory variables (distance to market, years of schooling) to natural logarithms.

Table 3.1: Variables used in the Negative Binomial Regression Model

Variable	Description/Measurement of variable	Apriori sign
Hardskin	Dummy: Preference for product hard skin (Prefer = 1, Do not prefer = 0)	+
Aroma	Dummy: Preference for product aroma (Prefer = 1, Do not prefer = 0)	+
Col	Dummy: Preference for product color (Prefer =1, Do not prefer = 0)	+
Ntaste	Dummy: Preference for product nutty taste (Prefer =1, Do not prefer = 0)	+
Fibr	Dummy: Preference for product fibreness (Prefer = 1, Do not prefer = 0)	+
Perimmun	Dummy: Perceived health benefit on body immunity (Yes = 1, No = 0)	+/-
Pervision	Dummy: Perceived health benefit on eye vision (Yes = 1, No = 0)	+/-
Perheart	Dummy: Perceived health benefit on heart health (Yes = 1, No = 0)	+/-
Perweightl	Dummy: Perceived health benefit on weight loss (Yes = 1, No = 0)	+/-
QuantC	Quantity consumed of product (Kilograms, bundles)	+
ProdPrice	Product price (Ugandan shillings)	-
PropIncom	Proportion of income spent on food (Uganda shillings)	+
Perafford	Dummy: Perceived product affordability (Affordable= 1, Not affordable = 0)	+/-
Oprod	Dummy: Reliance on own production (Yes = 1, No = 0)	+
Hsize	Number of persons in a household (Number)	+/-
SensHfood	Dummy: Sensitized on health foods (Yes = 1, No = 0)	-
Fcons	Dummy: Form of pumpkin fruit consumed (boiled) (Yes = 1, No = 0)	+
Educ	Number of years spent in school (Years)	+/-

3.6.3 Determining factors affecting consumer demand decisions for pumpkin products

To determine the factors driving consumer demand decision for pumpkin products, a two-step Heckman's procedure was employed as used by Sebatta *et al.* (2014), Mutayoba and Ngaruko (2015) and Kyaw *et al.* (2018). Firstly, the Heckman Two-Stage model was preferred in this study because of its advantages over the Probit and Tobit models in its ability to eliminate selection bias. The Heckman model also separates the effect of variables on the probability of consumer decision to demand for pumpkin products. This model is a proven estimation technique that simultaneously deals with two-stage regression conditions. It also corrects the problem of selection bias across study conditions. In the first stage, this model deals with the discrete consumer decision to purchase or not. In the second stage that integrates the Inverse Mills' Ratio (IMR) in the regression, the model selects consumers who decide to purchase and regresses explanatory variables along with the IMR on the consumer decision on the quantity demanded of the pumpkin product. The IMR is a variable for controlling bias that comes with sample selection, when two categories of decisions are integrated in the same regression, for instance, discrete consumer decisions to purchase and consumer decision on quantity demanded. In this study, the first stage of the consumer decision to purchase was expressed as shown in equation (2):

$$Purch_Dec = \alpha + X'\beta + Z'\rho + \varepsilon \quad (2)$$

Where: *Purch_Dec* is the purchase decision that takes on the value of 1, if the consumer purchases a pumpkin product, and 0, if otherwise. α is the regression constant, β is a vector of coefficients associated with consumer decision to purchase and X' is a vector of consumer perceptions that influence consumer decision to purchase. ρ is a vector of coefficients associated with control variables while Z' is the vector of control variables namely socio-economic factors

and product attributes that potentially influence consumer decision to purchase pumpkin products. ε is the error term or random disturbance. The pumpkin products included in this study are: pumpkin fruit, pumpkin leaves and pumpkin seeds. Detailed description and measurement of these variables are presented in Table 3.2. The second stage of the Heckman model was expressed as show in equation (3).

$$Quant_dd' = \beta_0 + W'\beta + \gamma\varphi + \varepsilon \quad (3)$$

Where, $Quant_dd'$ is the quantity demanded of the pumpkin product. In this study, the quantity demanded was measured as the quantity consumed of the pumpkin product during the past 12 months. In this study, the pumpkin products included are pumpkin fruit, pumpkin leaves and pumpkin seeds. W' represents a vector of product attribute and socio-economic variables namely own price, price of compliment, price of substitute, proportion of income spent on product, number of males in household and sensitization on healthy foods which are further described in Table 3.2; $\gamma\varphi$ is the inverse mills ratio component of the regression and ε is the error term. Lastly, β_0 and β represent the constant and the various parameters respectively to be estimated.

The choice of variables in Table 3.2 were informed by literature. However, the choice of the final variables included in the model was based on how well the model meets the basic assumptions, in addition to relevant post estimation statistics. Prior to data analysis, a pairwise correlation of the independent variables was done and those having a Pearson correlation coefficient of greater than 0.45 were excluded in the model. Data analysis followed several trials with each trial followed by post-estimation test after which an appropriate corrective step was done so that the final model would meet all the required conditions. The corrective steps

included removing highly insignificant variables, scrutiny for multicollinearity and eliminating variables with VIF greater than 10. The model fit was improved by transforming some continuous explanatory variables (age, distance to market, years of schooling, quantity of leaves, price of substitute (cow peas “boo”), price of compliment(salt), price of pumpkin seeds, quantity of seeds, price of substitute (soybeans)) to natural logarithms.

Table 3.2: Variable used in the Heckman Two Stage model

Variable	Description/Measurement of variable	Apriori sign
ProdPrice	Unit price of pumpkin and its associated products (Ugandan shillings)	-
NumMales	Number of males in Household (count)	+/-
SensHfood	Dummy: Sensitized on healthy food (Yes = 1, No = 0)	+/-
PriceC	Price of compliment (Ugandan shillings)	-
PriceS	Price of Substitute (Ugandan Shillings)	+
Gend	Dummy: Gender of respondent (Male = 1, Female = 0)	+/-
PropIncom	Proportion of income spent on product (Ugandan shillings)	+
DistSmark	Distance to supermarket (Kilometers)	
Age	Age of respondents (years)	+
Educ	Number of years spent in school (Years)	+/-
MaritalS	Dummy: Marital Status of respondent (Married = 1, Not Married = 0)	+/-
Perimmun	Dummy: Perceived health benefit on body immunity (Yes = 1, No = 0)	+
Pervision	Dummy: Perceived health benefit on eye vision (Yes = 1, No = 0)	+
Perheart	Dummy: Perceived health benefit on heart health (Yes = 1, No = 0)	+
Perweightl	Dummy: Perceived health benefit on weight loss (Yes = 1, No = 0)	+

3.7 Ethical Consideration

The study observed all the laws of the country and demonstrated high level of integrity without any form of compromise. The researcher sought ethical clearance from the Gulu University Research and Ethics Committee (GUREC) (Appendix II). The study also sought authorization from relevant offices such as Gulu City Town Clerk and Division Assistant Clerks as well as informed consent from the research participants. The respondents were asked before interviewing them and further be requested to agree to participate by signing the consent form and be interviewed. To achieve privacy, and confidentiality, the researcher abided by the

principle of voluntarism and maintained the highest level of confidentiality of the respondent's details. The researcher observed the COVID-19 prevention guidelines by ensuring that at all times there was hand sanitizing, wearing of face masks and social distancing while conducting interviews with the respondents.

3.8 Limitation and Delimitation of the study

The researcher faced the challenge of the lack of willingness of respondents to participate in the study. This was mitigated through prior community engagement to create awareness about the study and its likely benefits to the community.

CHAPTER FOUR: PRESENTATION OF RESULTS

4.1 Relationship between socio-economic factors and sources of pumpkin products

The results (Table 4.1) show that majority of the households (95%), (91%) and (82%) had consumed pumpkin fruit, pumpkin leaves and pumpkin seed respectively. Findings further reveal that majority of the households (96%) had not consumed pumpkin flour.

Table 4.1: Consumption of pumpkin and its associated products

	Pumpkin Fruit	Pumpkin Leaves	Pumpkin Flour	Pumpkin Seed
Did not consume	21(4.9)	39(9.1)	411(96.3)	79(18.5)
Consumed	406(95.1)	388(90.9)	16(3.7)	348(81.5)

Source: Field Survey, (2022)

The results (Table 4.2) show that slightly more than half (55%), (56%) and (54%) of the consumers of the pumpkin fruit pumpkin leaves and pumpkin seeds respectively were female while close to two third of the consumers of pumpkin flour were female. In terms of marital status, majority (82%), (83%) and (83%) of the consumers of pumpkin fruit pumpkin leaves and pumpkin seeds respectively were married whereas half of the consumers of pumpkin flour were married. The chi-square results for marital status were statistically significant at ($p < 0.1$) indicating that there was a statistically significant association between marital status and the source of pumpkin fruit.

Regarding sensitization in healthy foods, close to three quarter (71%), (72%) and (71%) of the consumers of the pumpkin fruit, pumpkin leaves and pumpkin seeds respectively reported they had no sensitization on healthy foods whereas half of the consumers of pumpkin flour had no sensitization on healthy foods. Most (61%), (74%) and (80%) of the consumers relying on own production, buying and other sources of pumpkin fruit respectively reported not being sensitized

on healthy foods. The chi-square results show a statistically significant association at ($p < 0.05$) between sensitization on healthy foods and source of pumpkin fruit.

With reference to income category, two out of the five (41%, 43% and 43%) of the consumers of pumpkin fruit, pumpkin leaves and pumpkin seeds respectively reported a monthly income of between UGX 250,000 and UGX 499,000 while more than a third of the consumers of the pumpkin flour reported a monthly income of less UGX 250,000. However, few consumers of pumpkin fruit (4%), pumpkin leaves (4%) and pumpkin seeds (4%) had over a million Uganda shillings per month. The chi-square results reveal a statistically significant association at ($p < 0.1$) and ($p < 0.01$) implying a statistically significant relationship between household income and the sources of the pumpkin leaves and pumpkin seeds respectively.

The chi-square test for Gender reveal that it was statistically insignificant, indicating that the distribution of this characteristic across the source of pumpkin fruit, pumpkin leaves, pumpkin flour and pumpkin seeds was almost similar. Similarly, the chi-square test for marital status and sensitization on healthy foods showed that they were statistically insignificant, implying that the distribution of these characteristics in the source of pumpkin leaves, pumpkin flour and pumpkin seeds were similar. Furthermore, the chi-square test for income category revealed that it was statistically insignificant for the sources of pumpkin fruit and pumpkin flour.

Table 4.2: Chi-square test for association between socio-economic factors and sources of pumpkin products

Product Source	Percentage																			
	Pumpkin Fruit					Pumpkin Leaves					Pumpkin Flour					Pumpkin Seeds				
	Own production N=103	Buy N=243	Others N=60	Total N=406	χ^2	Own production N=128	Buy N=216	Others N=44	Total N=388	χ^2	Own production N=1	Buy N=10	Others N=5	Total N=16	χ^2	Own production N=95	Buy N=197	Others N=56	Total N=348	χ^2
Variables																				
Gender																				
Female	59.2	53.9	50.0	54.7	1.447	51.6	54.2	65.9	54.6	2.763	100.0	60.0	60.0	62.5	0.640	53.7	52.8	60.7	54.3	1.124
Male	40.8	46.1	50.0	45.3		48.4	45.8	34.1	45.4		0.0	40.0	40.0	37.5		46.3	47.2	39.3	45.7	
Marital Status																				
Not Married	20.4	14.4	26.7	17.7	5.627*	22.7	14.4	18.2	17.5	3.849	100.0	30.0	80.0	50.0	4.400	18.9	15.2	21.4	17.2	1.441
Married	79.6	85.6	73.3	82.3		77.3	85.6	81.8	82.5		0.0	70.0	20.0	50.0		81.1	84.8	78.6	82.8	
Sensitization on healthy foods																				
No	61.2	73.7	80.0	71.4	8.071**	65.6	75.0	75.0	71.9	3.732	100.0	60.0	20.0	50.0	3.200	64.2	74.1	73.2	71.3	3.192
Yes	38.8	26.3	20.0	28.6		34.4	25.0	25.0	28.1		0.0	40.0	80.0	50.0		35.8	25.9	26.8	28.7	
Income Category																				
< 250,000	31.1	25.1	40.0	28.8	9.861	34.4	23.6	25.0	27.3	11.974*	0.0	40.0	40.0	37.5	5.920	38.9	23.4	25.0	27.9	25.703***
250,000 – 499,000	39.8	46.1	25.0	41.4		35.2	49.1	34.1	42.8		0.0	10.0	20.0	12.5		34.7	50.3	30.4	42.8	
500,000 – 1,000,000	25.2	24.7	30.0	25.6		26.6	24.1	31.8	25.8		100.0	40.0	0.0	31.2		25.3	23.4	32.1	25.3	
> 1,000,000	3.9	4.1	5.0	4.2		3.9	3.2	9.1	4.1		0.0	10.0	40.0	18.8		1.1	3.0	12.5	4.0	
Source: Field Survey, (2022); Number of respondents = 427, χ^2 denotes Pearson's Chi-square coefficient, ***, ** & * implies $p < 0.01$, $p < 0.05$ and $p < 0.1$																				

The findings (Table 4.3) show that the mean distance to the super market for the consumers of pumpkin fruit was (2.9km). The mean distance to the super market for the consumers relying on buying (3.23km) was greater than the mean distance to the supermarket for those who relied on own production (2.5km) and other sources (2.48km) for pumpkin fruit. The ANOVA test results indicate that there was a statistically significant difference in mean distance to the supermarket between those who relied on own production and buying and those who relied on buying and other sources for pumpkin fruit at ($p < 0.01$). In terms of the mean price of substitute (sweet potatoes), the mean price of substitute (sweet potatoes) for consumers who relied on own production (UGX 1,975) was greater than the mean price of substitute (sweet potatoes) for those who relied on buying (UGX 1,969) and those who relied on other sources (UGX 1,966) for pumpkin fruit. Referring to number of males in household, the mean number of males in household for consumers who relied on other sources for pumpkin fruit (2.83) was greater than the mean number males in household for consumers who relied on own production (2.74) and buying (2.36) for pumpkin fruit. The ANOVA test reveal that there was a significant difference in the mean number of males in household between consumers who relied on own production and buying and those who relied on buying and other sources for pumpkin fruit at ($p < 0.05$). Regarding age, education and household size, the means were (41 years), (9 years), and (5 people) respectively. Referring to distance to market, price of compliment (salt) and quantity consumed, the means were (0.89km), (UGX 1,649) and (18.66kg) respectively. The ANOVA results indicate no statistically significant mean difference in age, education, household size, distance to market, price of compliment (salt) and quantity consumed between consumers who relied on own production, buying and other sources for pumpkin fruit.

For pumpkin leaves, the findings (Table 4.3) reveal that in terms of distance to market, consumers who relied on other sources for pumpkin leaves (1.21km) had greater mean distance to market compared to those who relied on buying (0.83km) and own production (0.79km) for pumpkin leaves. The ANOVA test reveal that there was a statistically significant difference in the mean distance to market between consumers who relied on own production and other source and those who relied on buying and other sources for pumpkin leaves at ($p<0.01$). Regarding the distance to super market, the mean distance to supermarket for consumers who relied on buying (3.30km) was greater than for those who relied on own production (2.49km) and other sources (2.48km) for pumpkin leaves. The ANOVA test further reveal that there was a statistically significant difference in the mean distance to supermarket between consumers relying on own production and buying and those who relied on buying and other sources for pumpkin leaves at ($p<0.01$). With reference to the quantity consumed, the mean quantity consumed by consumers who relied on own production (77 bundles) was greater than for those who relied on other sources (46 bundles) and those who relied on buying (43 bundles). The ANOVA test results indicate that there was a statistically significant difference in the mean quantity consumed of pumpkin leaves by consumers who relied on own production, buying and other sources for pumpkin leaves. Referring to the number of males in household, the mean number of males in household for consumers who relied on other sources (2.82) was greater than for those who relied on own production (2.80) and for those who relied on buying (2.34). Further, the ANOVA test indicate that there was a statistically significant difference in the mean number of males in household between consumers who relied on own production and buying for pumpkin leaves at ($p<0.01$). In terms of age, education and household size, the means were (31 years, 14 years and 4 people) respectively.

Table 4.3: One-way ANOVA test for association between socio-economic factors and sources of pumpkin products

Product Source	Mean (standard deviation)																			
	Pumpkin Fruit					Pumpkin Leaves					Pumpkin Flour					Pumpkin Seeds				
	Own production N=103	Buy N=243	Others N=60	Total N=406	F-ratio	Own production N=128	Buy N=216	Others N=44	Total N=388	F-ratio	Own production N=1	Buy N=10	Others N=5	Total N=16	F-ratio	Own production N=95	Buy N=197	Others N=56	Total N=348	F-ratio
Variable																				
Age	42.01	39.17	42.28	41.78	2.01	40.16	40.55	52.00	31.50	0.50	30.40	42.58	37.61	43.07	2.05	42.58	37.61	43.07	39.85	5.55**
Education	9.83	10.43	10.50	9.80	0.86	10.50	9.48	3.00	14.50	1.89	12.60	9.44	10.59	10.25	3.73	9.44	10.59	10.25	10.22	2.57
Household size	5.73	5.45	6.15	5.95	2.22	5.44	6.02	5.00	4.00	2.44	3.60	6.07	5.30	6.11	0.20	6.08	5.30	6.11	5.64	4.79**
Distance to market	0.85	0.94	0.69	0.89	2.53*	0.79	0.83	1.21	0.86	5.54***	0.50	1.50	1.80	1.53	0.29	0.89	0.91	0.95	0.91	0.08
Distance to supermarket	2.48	3.23	2.50	2.93	6.64***	2.49	3.30	2.48	2.94	7.77***	2.00	2.77	2.10	2.51	0.13	2.43	3.47	2.71	3.06	9.43**
Price of substitute (Potatoes)	1975.73	1969.1	1966.67	1970.44	4.11															
Price of substitute (cowpeas “boo”)						225.00	212.50	250.00	220.88	1.76										
Price of substitute (soybeans)																2134.74	2261.42	2233.93	2222.41	0.63
Price of compliment (Salt)	1639.81	1667.49	1590.00	1649.02	0.78	2092.19	1925.46	1988.64	1987.63	0.68						1636.84	1693.91	1542.86	1654.02	2.68
Quantity consumed	22.58	18.43	12.86	18.66	0.19	77.05	43.61	46.52	54.97	10.15**	10.00	3.85	1.80	3.59	1.57	2.40	1.27	1.83	1.67	8.03**
Males in Household	2.74	2.36	2.83	2.52	4.32**	2.80	2.34	2.82	2.55	5.29***	0.00	1.80	2.20	1.94	0.20	2.82	2.34	2.70	2.53	4.27*
Source: Field Survey, (2022); Number of respondents = 427, ***, ** & * implies p < 0.01, p < 0.05 and p < 0.1																				

With reference to price of substitute (cow peas “boo”), and the price of compliment (local salt), the means were (UGX 220) and (UGX 1,987) respectively. However, the ANOVA test indicate that there was no statistical significance in the means for age, education, household size, price of substitute (cow peas “boo”), and the price of compliment (local salt) between consumers who relied on own production, buying and other sources for pumpkin leaves.

The results (Table 4.3) indicate that the mean age of consumers relying on other sources of pumpkin seeds (43years) was greater than that of those relying on own production (42years) and buying (37years) respectively. The results of ANOVA test reveal that there was a statistically significant difference in the mean age those who relied on own production, buying and other sources for pumpkin seeds at ($p < 0.01$). This implies that consumers of pumpkin seeds relying on other sources were older than those relying on own production and buying. In terms of Household size, the mean household size of consumers of pumpkin seeds was five (5). The mean household size those who relied on other sources for pumpkin seeds (6.11) was greater than that of those who relied on own production and buying for pumpkin seeds. The ANOVA test results show that there was a statistically significant difference in the mean household size of consumers of pumpkin seeds who relied on own production and buying and those who relied on buying and other sources for pumpkin seeds at ($p < 0.01$). Regarding the quantity consumed of pumpkin seeds, the mean quantity consumed was (1.67kg). The mean quantity consumed of pumpkin seeds by those who relied on own production (2.40kg) was greater than for those who relied on other sources (1.83kg) and those who relied on buying (1.27kg). The ANOVA test results reveal that there was a statistically significant difference in the mean quantity consumed of pumpkin seeds between consumers who relied on own production, buying and other sources for pumpkin seeds at ($p < 0.01$). With reference to the number of males in the household, mean number for

males in household was for consumers who relied on own production (2.83) was greater than the mean number of males in household for consumers who relied on buying (2.34) and other sources (2.70) for pumpkin seeds. The ANOVA test results show that there was a statistically significant difference in the mean number of males in households of consumers relying on own production and buying for pumpkin seeds at ($p < 0.05$). In terms of education, price of substitute (soybeans), price of compliment (salt), the means were (10 years), (UGX 2,222), and (UGX 1,654) respectively. The ANOVA test revealed no statistically significant difference between the means of education, price of substitute (soybeans) and price of compliment (salt) respectively for consumers who relied on own production, buying and other sources for pumpkin seeds.

For pumpkin flour, the findings (Table 4.3) indicate that the means for age, education, and household size were (43 years), (10 years), and (6 people) respectively. Regarding distance to market, distance to supermarket, quantity consumed and number of males in household were (1.53 km), (2.51 km), (3.59kg) and (1.94) respectively. However, the ANOVA test indicated that there was no statistically significant difference in the mean age, education, household size, distance to market, distance to supermarket, quantity consumed and number of males in household between consumers who relied on own production, buying and other sources for pumpkin flour.

4.2 Influence of consumer perceptions on consumption of pumpkin products

The results of Negative Binomial Regression concerning the influence of consumer perceptions on consumption of pumpkin products are presented in Table 4.4. These results show a significant log likelihood ratio for the empirical models on pumpkin fruits (-855.93), pumpkin leaves (-1077.96) and pumpkin seeds (-812.89) suggesting that the empirical data fitted well the

estimation model. The R^2 for the model on pumpkin fruit (0.209), pumpkin leaves (0.189) and pumpkin seeds (0.186) suggest that the specification factors in each separate model were explaining about 21%, 19% and 19%, respectively, of the total variation in the consumption of pumpkin products. On the basis of findings on for R^2 and log likelihood, the assumption that empirical data fitted well the estimation model was confirmed.

Results on consumer tastes and preferences show that food aroma positively and significantly influence the frequency of consumption of pumpkin leaves ($p < 0.01$). Skin hardness only posted positive and significant effects on pumpkin fruits ($p < 0.05$). Lastly, Nutty taste ($p < 0.05$) and fibreness ($p < 0.01$) are significant and positive for pumpkin seeds. In terms of IRR, the findings means that preference for food aroma increases consumption of pumpkin leaves with odd increasing by 26.8%. Preference for skin hardness of pumpkin fruit increases consumption of pumpkin leaves with odds increasing by 20.6%. Preference for nutty taste and fibreness increases consumption of pumpkin seeds with odds increasing by 20.6% and 65.3% respectively. Perception on health benefits on eye vision ($p < 0.05$) as well as heart health ($p < 0.05$) posted positive and significant effects on frequency of consumption of pumpkin seeds. However, the finding on perceptions on health benefits on the heart ($p < 0.1$) is negative and significant for pumpkin fruits. The IRR findings imply that, perceived health benefits on eye vision and heart health increases the consumption of pumpkin seeds with odds increasing by 23.0% and 21.4% respectively. Perceived health benefits for heart health reduces consumption of pumpkin fruits with odds increasing by 89.1%.

Table 4.4: Influence of consumer perceptions on consumption of pumpkin products

Product Variable	Pumpkin Fruit		Pumpkin Leaves		Pumpkin Seeds	
	Coefficient (SE)	IRR (SE)	Coefficient (SE)	IRR (SE)	Coefficient (SE)	IRR (SE)
Aroma	0.036(0.067)	1.036(0.069)	0.237(0.082) ***	1.268(0.104) ***		
Color	0.023(0.058)	1.023(0.059)	0.099(0.076)	1.104(0.084)		
Hard skin	0.187(0.091) **	1.206(0.110) **				
Nutty Taste					0.187(0.092) **	1.206(0.111) **
Fibreiness					0.502(0.093) ***	1.653(0.154) ***
Perceived health benefit on body immunity	0.055(0.059)	1.057(0.063)	0.047(0.079)	1.048(0.082)	-0.104(0.100)	0.902(0.090)
Perceived health benefit on vision	-0.027(0.059)	0.974(0.058)	0.001(0.076)	1.001(0.076)	0.207(0.093) **	1.230(0.115) **
Perceived health benefit on heart health	-0.115(0.066) *	0.891(0.059) *	0.089(0.093)	1.093(0.102)	0.194(0.104) *	1.214(0.126) **
Perceived health benefit on weight loss	-0.005(0.062)	0.995(0.061)	-0.047(0.093)	0.954(0.088)	0.108(0.103)	1.115(0.115)
Quantity Consumed	0.027(0.002) ***	1.027(0.002) ***	0.115(0.008) ***	1.122(0.008) ***	0.140(0.025) ***	1.150(0.029) ***
Product price	-0.0003(0.000) ***	1.000(0.000) ***	-0.018(0.004) ***	0.983(0.004) ***	-0.327(0.055) ***	0.721(0.040) ***
Distance to Market	-0.007(0.041)	0.993(0.041)	-0.204(0.056) ***	0.815(0.046) ***	-0.014(0.065)	0.986(0.064)
Proportion of Income spent on product	0.066(0.028) **	1.068(0.030) **	0.079(0.032) **	1.082(0.035) **	0.070(0.037) *	1.072(0.039) *
Education	0.069(0.053)	1.072(0.057)	-0.064(0.072)	0.938(.068)	-0.202(0.083) **	0.816(0.068) **
Perceived product affordability	-0.0004(0.070)	1.002(0.065)	0.174(0.096) **	1.190(0.117) **	0.088(0.131)	1.092(0.143)
Reliance on own production	0.202(0.051) ***	1.223(0.062) ***	0.229(0.073) ***	1.258(0.092) ***	0.529(0.086) ***	1.694(0.146) ***
Household Size	-0.028(0.012) **	0.972(0.012) **	-0.042(0.015) ***	0.959(0.014) ***	0.020(0.017)	1.002(0.018)
Sensitization on healthy Foods	-0.060(0.060)	0.942(0.057)	-0.103(0.077)	0.902(0.069)	-0.197(0.091) **	0.821(0.075) **
Form Consumed (boiled)	0.398(0.099) ***	1.489(0.147) ***				
Constant	-0.191(0.366)	0.826(0.302)	0.552(0.441)	1.738(0.767)	2.618(0.643)	13.708(8.808)
Dispersion	Mean	Mean	Mean	Mean	Mean	Mean
Number of Observation	427	427	427	427	427	427
Log Likelihood	-855.93	-855.93	-1077.96	-1077.96	-812.89	-812.89
Pseudo R ²	0.209	0.209	0.189	0.189	0.186	0.186
AIC	1749.87	1749.87	2189.92	2189.92	1659.78	1659.78
BIC	1826.94	1826.94	2258.88	2258.88	1738.75	1738.75

Source: Field Survey, (2022); ***, ** & * implies $p < 0.01$, $p < 0.05$ and $p < 0.1$

Results also reveal that quantity consumed is a major factor that positively and significantly influence the consumption of pumpkin products as follows: pumpkin fruit ($p<0.01$), pumpkin leaves ($p<0.01$) and pumpkin seeds ($p<0.01$). Similarly, reliance on own production as source of product presents positive and significant influence on consumption of pumpkin fruits ($p<0.01$), pumpkin leaves ($p<0.01$) and pumpkin seeds ($p<0.01$). Furthermore, perception on product affordability ($p<0.05$) posted a positive and significant influence on the consumption of pumpkin leaves. On another hand, boiled form of pumpkin fruit positively and significantly influences the consumption of pumpkin fruit ($p<0.01$). Lastly, income also positively and significantly influence the consumption of pumpkin fruits ($p<0.05$), pumpkin leaves ($p<0.05$) and pumpkin seeds ($p<0.1$). For negatively influencing factors, product price is significant for pumpkin fruits ($p<0.01$), pumpkin leaves ($p<0.01$) and pumpkin seeds ($p<0.01$). Likewise, household size is significant for pumpkin fruit ($p<0.05$) and pumpkin leaves ($p<0.01$). Similarly, sensitization on healthy foods presented a negative and significant influence on the consumption of pumpkin seeds ($p<0.05$). The IRR values imply that an increase in the quantity increases consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds with odds increasing by 2.7%, 12.2% and 15.0% respectively. Similarly, reliance on own production for product increases consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds with odds increasing by 22.3%, 25.8% and 69.4 respectively. Furthermore, perceived product affordability increases consumption of pumpkin leaves with odds increasing by 19.0%. On another hand, boiled form of pumpkin fruit increases consumption of pumpkin fruit with odds increasing by 48.9%. Lastly, an increase in income increases consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds with odds increasing by 6.8%, 8.2% and 7.2% respectively. For negatively influencing factors, an increase in the product price reduces consumption of pumpkin leaves and pumpkin seeds with odds

increasing by 98.3% and 72.1% respectively. While for the pumpkin fruit, an increase in the product price reduces the consumption of pumpkin leaves but the odds do not change. Furthermore, an increase in the household size reduces the consumption of pumpkin fruit and pumpkin leaves with the odds increasing by 97.2% and 95.9% respectively. Similarly, sensitization on healthy foods reduces the consumption of pumpkin seeds with the odds increasing by 82.1%.

4.3 Factors driving consumer demand decisions

The two-stage Heckman model results on the influence of factors driving consumer demand decisions for pumpkin products are presented in Table 4.5. These results show a significant log likelihood ratio for the empirical models on pumpkin fruits (41.09), pumpkin leaves (949.90) and pumpkin seeds (348.86) suggesting that the empirical data fitted well the estimation model. The significant inverse mill ratio (IMR) for the empirical model on pumpkin fruit (-10.424), pumpkin leaves (0.258) and pumpkin seeds (0.166) suggest that the sample selection bias have been corrected. On the basis of findings on for Wald Chi-square and IMR, the assumption that empirical data fitted well the estimation model was confirmed.

First stage results (Table 4.5) show that perceived health benefit on eye vision ($p<0.05$), heart health ($p<0.1$), body immunity ($p<0.05$), and weight loss ($p<0.01$) as well as income ($p<0.01$), distance to supermarket ($p<0.01$) and marital status ($p<0.01$) significantly and positively influence consumer purchase decisions for pumpkin fruits. It is only number of male members of household ($p<0.1$) that negatively influence pumpkin demand decisions. Turning to pumpkin leaves, the positive and significant determinants of consumer purchase decisions include perceived health benefit on body immunity ($p<0.05$), income ($p<0.01$), marital status ($p<0.05$)

and distance to the supermarket ($p < 0.01$). For pumpkin seeds, factors that positively and influence demand decisions are perceived health benefit for eye vision ($p < 0.05$), heart health ($p < 0.05$), body immunity ($p < 0.01$), and weight loss ($p < 0.05$), as well as income ($p < 0.01$) and distance to supermarket ($p < 0.01$). Surprisingly, sensitization on healthy foods ($p < 0.05$) posted a significant negative influence.

Second stage results (Table 4.5) reveal that product price ($p < 0.01$) and income ($p < 0.1$) are negatively related to quantity demand of pumpkin fruit. Price of the substitute ($p < 0.01$) is however positively related to quantity demanded of pumpkin fruit. These findings conformed to theoretical expectations. For pumpkin leaves, product price ($p < 0.01$) is negative and significantly related to quantity demanded. On the other hand, income ($p < 0.01$) and number of male members of household ($p < 0.01$) are positive and significantly related to quantity demanded suggesting pumpkin leaves are valuable to consumers with more males in their household. Sensitization on health foods ($p < 0.1$) is significant and positively related to quantity demanded. Lastly, for pumpkin seeds, income ($p < 0.01$) and price of substitute are negatively related to quantity demanded. However, product price ($p < 0.01$) is significant and negatively related to quantity demanded of pumpkin fruit, pumpkin leaves and pumpkin seeds. The findings imply that a unit increase in the price of pumpkin fruit, pumpkin leaves and pumpkin seeds will result in a decrease the quantity demanded of pumpkin fruit, pumpkin leaves and pumpkin seeds by 0.004, 0.858 and 0.344 respectively. In terms of the proportion of income spent on product, a one Uganda shilling increase in the proportion of income spent on pumpkin fruit, pumpkin leaves and pumpkin seeds will result in an increase the quantity demanded of pumpkin leaves and pumpkin seeds by 0.054 and 0.045 respectively but decreased the quantity demanded of pumpkin

fruit by 0.322 and vice versa. In addition, a unit increase in the price of sweet potatoes will result in an increase the quantity demanded of pumpkin fruit by 0.009.

Table 4.5: Two Stage Heckman models for drivers of demand for Pumpkin Products

Variable	Pumpkin Fruit		Pumpkin Leaves		Pumpkin Seeds	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Quantity Demanded (Outcome Model)						
Product Price	- 0.004 ***	0.001	- 0.858***	0.035	- 0.344***	0.019
Proportion of income Spent on product	- 0.322 *	0.186	0.054***	0.007	0.045***	0.008
Number of Males in HH	- 0.933	0.667	0.058***	0.021	- 0.013	0.016
Sensitization on Healthy foods	- 0.813	2.036	0.103*	0.061	- 0.056	0.047
Price of Compliment (Salt)	- 0.002	0.002	0.002	0.003	0.086	0.116
Price of Substitute (Potatoes)	0.009 ***	0.003				
Price of Substitute (Cowpeas, “Boo”)			- 0.013	0.111		
Price of Substitute (Soybeans)					0.878***	0.126
Constant	19.418	5.319	4.911	0.558	4.169	1.237
Demand Decision (Selection Model)						
Gender	- 0.007	0.142	-0.128	0.139	0.028	0.137
Marital Status	0.598***	0.184	0.450**	0.179	0.138	0.176
Age	0.358	0.254	0.254	0.248	0.047	0.243
Education	- 0.040	0.153	0.071	0.149	0.031	0.152
Number of males	- 0.099*	0.053	- 0.048	0.054	- 0.072	0.054
Proportion of income spent on	0.235***	0.033	0.164***	0.022	0.151***	0.031
Distance to the Supermarket	0.292***	0.096	0.332***	0.098	0.306***	0.098
Sensitization on healthy foods	- 0.211	0.150	- 0.127	0.146	- 0.291**	0.147
Perceived health benefits on body immunity	0.387**	0.160	0.394**	0.163	0.542***	0.164
Perceived health benefits on eye vision	0.352**	0.171	0.082	0.164	0.435**	0.170
Perceived health benefits on heart health	0.368*	0.195	0.043	0.189	0.412**	0.194
Perceived health benefits on weight loss	0.469***	0.197	0.423	0.175	0.423**	0.181
Constant	- 2.223**	1.033	-1.982*	1.029	-1.030	1.018
Inverse Mill Ratio	- 10.424***	3.284	0.258**	0.118	0.166**	0.079
No. of observations	427		427		427	
Prob > chi2	0.000		0.000		0.000	
Wald chi2 (6)	41.09		949.90		348.86	

Source: Field Survey, (2022); ***, ** & * implies $p < 0.01$, $p < 0.05$ and $p < 0.1$

CHAPTER FIVE: DISCUSSION OF RESULTS

5.1 Relationship between socio-economic factors and the sources of pumpkin products

The study findings reveal that more than half of the consumers of pumpkin fruit, pumpkin leaves, pumpkin seeds, pumpkin flour and pumpkin seeds were female. Female consumers often prioritize their dietary choices and consider the nutritional content of the foods they consume. Pumpkins are known for their nutrient density and health benefits including their rich content of vitamins, minerals and fiber, female consumers may be more inclined to incorporate pumpkin products into their diets as part of their overall nutritional goals and wellness effort. This finding agrees with the findings of Nandi *et al.* (2017) who reported more consumers of organic fruits and vegetables in India were women compared to their male counterparts. There is thus evidence from the current study that majority of consumers of pumpkin products are women.

The current study noted that most of the consumers of pumpkin fruit, pumpkin leaves and pumpkin seeds were married. Findings also show that half of the consumers of pumpkin flour were married. This could be because married couples may be more health-conscious and prioritize healthier dietary choices for themselves and their families. Pumpkins are often perceived as nutritious and beneficial due to their rich content of vitamins, minerals, and antioxidants. Married individuals may be more inclined to include pumpkin products in their shopping carts as part of their efforts to maintain a healthy diet and provide wholesome options for their families. This finding is related to the findings of Nandi *et al.* (2017) who reported that 95% of the consumers of organic fruits and vegetables in India were married, it can thus be argued that there are more married consumers of pumpkin products than the unmarried.

Furthermore, findings showed that majority of the consumers of pumpkin fruit, pumpkin leaves, pumpkin flour and pumpkin seeds were not sensitized on healthy foods. The marketing and advertising of food products often heavily promote convenience, taste, or specific product features rather than focusing on overall health benefits. Consumers may be exposed to advertisements or marketing campaigns that highlight the taste or convenience of pumpkin products rather than their nutritional value. This can lead to a lack of awareness or knowledge about the health benefits associated with consuming pumpkin products. This finding is contrary to the findings of Boccaletti & Nardella, (2000) who found out that consumers of pesticide-free fresh fruits and vegetables had knowledge on healthy foods.

There was evidence that most of the consumer of pumpkin fruit, pumpkin leaves, pumpkin flour and pumpkin seeds earned less than UGX 500,000 thousand shillings. It's worth mentioning that the relationship between income and fruit and vegetable consumption is complex and can be influenced by various factors. Additionally, individual preferences, dietary traditions, and personal choices also play a significant role in determining consumer behavior. This finding is comparable to the finding of Mainimo *et al.* (2022) who reported that majority of households in Central Uganda earned below UGX 500,000.

Furthermore, the study findings revealed that there was statistically significant difference in the mean age of consumers of pumpkin seeds who relied on own production, buying and other sources. It indicates that consumers who relied on buying were younger compared to those who relied on own production and other sources for pumpkin seeds. This can be explained by the fact that younger consumers, especially those living in urban areas or smaller living spaces, may have limited opportunities for home production of pumpkins. They may prioritize convenience and

opt to buy pumpkins from commercial sources. In contrast, older consumers who have larger properties or gardens may have the space and resources to grow their own pumpkins. This finding is in agreement with the finding of Owusu & Anifori, (2011) who reported that younger consumers were more relied on buying organic fruits and vegetables in Ghana.

Findings also showed that there was a statistically significant difference in the household size of consumers who relied on own production, buying and other sources for pumpkin seeds. Findings indicated that households that relied on buying were smaller compared to households who relied on own production and other sources for pumpkin seeds. This could be attributed to the fact that smaller households typically have fewer members, which means they have lower overall consumption needs. As a result, they may find it more practical and cost-effective to buy the necessary items from external sources, such as grocery stores or markets, rather than relying on producing or growing those items themselves. This finding is in line with the finding of Joshi *et al.* (2022) who reported that the average household size of consumers of fruits and vegetables in Kachanpur District in Nepal was about five people.

Similarly, there was a statistically significant difference in the distance to market for consumers who relied own production, buying and other sources for pumpkin leaves. This indicated that consumers who relied on other sources for pumpkin leaves moved longer distance to market compared those who relied on own production and buying for pumpkin leaves. This could be because consumers who rely on other sources may have limited access to pumpkin leaves in their immediate vicinity. They may need to travel to areas where pumpkin leaves are more abundant or where they have established connections to obtain them. This could result in longer distances traveled to access markets. This finding relates to the finding of Ayieko *et al.* (2011) who

reported that consumers of fresh fruits and vegetables in urban Kenya moved on average about 2 kilometers to the market.

Additionally, the study findings revealed that consumers who rely on buying for pumpkin fruit, pumpkin leaves and pumpkin seeds moved longer distance to market compared to those who rely on own production and other sources for pumpkin fruit, pumpkin leaves and pumpkin seeds. This could be explained by the fact that pumpkin products might be available seasonally or in limited quantities in certain areas. Consumers who rely on buying may need to search for supermarkets that consistently offer pumpkin leaves, even if it means traveling longer distances. This finding agrees with the finding of Gido *et al.* (2017) that revealed that urban dwellers in Kenya moved longer distance to retail outlets like supermarkets compared to their counterparts who are rural dwellers.

Results further indicated that consumers who relied on own production for pumpkin fruit paid slightly higher price for substitute sweet potatoes compared to those who relied on buying and other sources. This could be attributed to the fact the prices of different agricultural products, including sweet potatoes and pumpkins, can vary based on various factors such as supply and demand dynamics, production costs, market conditions, and geographic location. This finding correlates with the finding of Mergenthaler *et al.* (2009) that indicated that price of fruits and vegetables in Vietnam varied across different locations.

On quantity consumed, results show a statistically significant difference in the quantity consumed of pumpkin leaves between consumers who relied own production, buying and other sources for pumpkin leaves. Also results showed a statistically significant difference in quantity consumed of pumpkin seeds between consumers who relied on own production, buying and

other sources for pumpkin. Consumers who relied on own production consumed more pumpkin leaves compared to those who relied on buying and other sources for pumpkin leaves and pumpkin seeds. This could be attributed to the fact that consumers who grow their own pumpkins have easier access to the produce. They can harvest the pumpkins directly from their own gardens whenever they desire, allowing them to have a steady and convenient supply. This finding resonates with the findings of Faye *et al.* (2023) that revealed that consumers in rural Senegal consumed more fruits and vegetables since they produced their own fruits and vegetables.

Results also showed that consumer households that relied on other sources for pumpkin fruit and pumpkin leaves had more males in their households compared to consumer households who relied on own production and buying for pumpkin fruit and pumpkin leaves. Findings also showed that consumer households that relied on own production for pumpkin seeds had more males compared to those that relied on buying and other sources for pumpkin seeds. This finding is contrary to the findings of Klerman *et al.* (2014) that revealed that average number of men in American households was two.

5.2 Influence of consumer perceptions on consumption of pumpkin products

Results showed that for pumpkin fruit, as the consumer's preference for pumpkin fruit with hard skin increases, it is assumed that they will buy more of the pumpkin fruit. As a result, they tend to consume pumpkin fruit more frequently. This finding is in tandem with the apriori expectation of positive relationship and corroborates with (Moser *et al.*, 2011). This could be attributed to the fact that hard skin pumpkins have a denser and firmer flesh compared to soft-skinned pumpkins. This attribute makes them suitable for a wide range of culinary applications. They can be baked,

roasted, steamed, or used in soups, stews, pies, and other savory dishes. Thus, consumers who prefer pumpkins with a firmer texture may choose hard skin varieties to achieve specific cooking results.

Study findings also show that aroma positively and significantly influence the consumption of pumpkin leaves. This implies that consumption of pumpkin leaves increases with consumer preference for its aroma. This could be because sense of taste is closely intertwined with our sense of smell, and aroma can enhance the taste experience and pleasant aromas can create a sense of anticipation and pleasure, which can increase the consumption of pumpkin leaves. This finding agrees with the findings of Dando & Small, (2008) who reported that pleasant aroma increased frequency of consumption of wine. Ruijschop *et al.* (2016) also reported that food aroma consistently increased intake and frequency of consumption. Similarly, Yeomans & Prescott, (2008) revealed that aroma significantly increased the consumption of chocolate and apple.

Preference for nutty taste positively and significantly influence the consumption of pumpkin seeds. This implies that when consumer preference for nutty taste increases, consumption of pumpkin seeds increases. This could be because the unique flavor profile of pumpkin seeds, with its mild nuttiness and subtle sweetness, can be highly appealing to people. Also, nutty taste complements both sweet and savory preparations, making them a versatile ingredient. This finding is in sync with the findings of Han *et al.* (2015), that revealed preference for nutty taste significantly increased the consumption among consumers Korean rice wine.

Also, preference for fibreness significantly and positively influence the consumption of pumpkin seeds. This means that consumption of pumpkin seeds increases with increase in consumer

preference for fibreness of pumpkin seeds. This could be attributed to the fact that when individuals consume pumpkin seeds with a higher fibrous content, it can contribute to a greater sense of fullness and satisfaction, potentially reducing the urge to snack on other less nutritious foods. Pumpkin seeds with higher fibrousness can provide additional dietary fiber, which aids in promoting regular bowel movements and preventing constipation and presence of fiber gives them a slightly chewy and substantial texture, which can be satisfying to bite into. This finding agrees with the findings of Diane *et al.* (2013) that revealed that consumer preference for dietary fibre increased frequency of consumption of foods with high fibre content among cardiovascular patients. Finding of Devinder *et al.* (2011) also revealed that preference for fibreness increased frequency of consumption.

Perceived health benefit on eye vision positively and significantly influences consumption of pumpkin seeds. This indicates that frequency of consumption of pumpkin seeds increases with increase in perceived health benefit on eye vision. This could be attributed to the fact that individuals who are aware of the potential benefits of certain foods, like pumpkin seeds, in supporting eye health may be motivated to incorporate them into their diet on a regular basis. This finding aligns with the findings of Antonides & Van der Oest (2012) that reported that perception on health benefits increased the frequency of consumption of natural and environmentally friendly food products. Also, findings of Rothman *et al.* (2009) suggested that perceived health benefits can positively influence consumption of a product.

Further perceived health benefit on heart health significant and positively influence consumption of pumpkin seeds but negatively influences consumption of pumpkin fruit. This suggests that as the consumers' perception on the health on heart health increases, their consumption of pumpkin

seeds increases but their consumption of pumpkin fruit reduces. This could be explained by the fact that as consumers adopt plant-based eating patterns for cardiovascular health reasons, they may incorporate pumpkin seeds as a convenient and nutritious snack or ingredient, leading to increased consumption frequency. The reduction in consumption of pumpkin fruit could be explained by the fact that individual preferences and circumstances can vary, and there may be specific factors that could potentially affect an individual's consumption patterns. These factors might include taste preferences, availability, pricing, personal dietary restrictions, and other individual considerations. The finding agrees with the findings of Antonides & Van der Oest (2012) that reported that perception of health benefits increased the frequency of consumption of natural and environmentally friendly food products. Also, findings of Rothman *et al.* (2009) suggested that perceived health benefits can positively influence consumption of a product.

Also, quantity consumed of pumpkin fruit, pumpkin leaves and pumpkin seeds had a positive impact on consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds, a result that highlights the important role of quantity consumed in consumption decision making of consumers of the pumpkin products. This finding is consistent with that of Wansink, *et al.* (2005) that reported that the quantity consumed influenced the frequency of consumption, as larger portions led to increased overall intake and that of Bobroff *et al.* (2007) that suggested that the quantity consumed can impact consumption, particularly in the context of binge eating. In a similar study, Hetherington *et al.* (2006) reported that the quantity consumed was higher in social situations, suggesting that the quantity consumed can influence consumption.

Product price measured as a per unit price of a pumpkin product in Ugandan shilling is significant and negatively related to consumption of pumpkin fruit, pumpkin leaves and pumpkin

seeds. The means that if product price increases by one-shilling, consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds reduces by 0.03%, 1.8% and 72.1% respectively. This is consistent with a prior expectation of negative relationship with adoption intensity. This is also consistent with the findings of Andreyeva *et al.* (2010) that report that increased prices acted as a deterrent to frequent consumption across different food categories. Also, Epstein & Dearing (2010) noted that when the price of the food increased, individuals reduced their consumption frequency

Similarly, distance to market had a significant and negative relationship with consumption of pumpkin leaves. This implies that when distance to market increases by one kilometer, consumption of pumpkin leaves reduces by 81.5%. This finding agrees with the finding of Venter *et al.* (2014) noted that the distance to the market influenced the availability and accessibility of game meat, leading to a reduced consumption frequency. Bongaarts & Cleland (1994) also reported that when individuals have limited access to markets due to distance, it can reduce the frequency of consumption. Findings of Jilcott Pitts *et al.* (2013) also revealed that limited access to local markets can reduce consumption due to the inconvenience and reduced availability of fresh produce.

Conversely, proportion of income spent on product has a positive and significant influence on consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds. It is worth noting that the general relationship between income and food consumption patterns suggests that as the proportion of income spent on a particular food item increase, individuals may be more inclined to consume it more frequently. This can be attributed to the notion that individuals tend to prioritize and consume foods that represent a higher proportion of their budget if such food is

perceived to be of high value. This finding corroborates with the findings of Popkin & Guilkey (1997)'s study that revealed that the proportion of income spent on these healthier food options influenced consumption frequency. Relatedly, Drewnowski & Specter (2004) and Powell & Chaloupka (2009) reported that the proportion of income spent on food influenced consumption.

In this study, education has been found to significantly and negatively influence consumption of pumpkin seeds. This suggests that consumers who spent more years in school tend to consume pumpkin seeds less frequently. This could be explained by the fact that better education comes with improved incomes that enable individuals to access a variety of food types and thus, limiting attention for certain traditional foods like pumpkin seeds. These influences may also vary based on individual experiences and values, potentially impacting the frequency of consuming certain foods. This finding is contrary to the findings of Fernald *et al.* (2011) that revealed that education positively and significantly influenced frequency of consumption among low-income population in Madagascar. Further Wardle *et al.* (2000) reported that individuals with higher education consumed a higher frequency of fruits and vegetables compared to those with lower education levels.

This study further reveals that perceived product affordability positively and significantly influences consumption of pumpkin leaves. This implies that when individuals perceive a product as more affordable, they are more likely to consume it more frequently. This could be attributed to the fact perceived affordability is subjective and can vary among individuals based on their income levels, personal financial circumstances, and individual priorities. Additionally, external factors such as promotional discounts, sales, or changes in market prices can also influence the perceived affordability and subsequently affect consumption. The study finding is

in line with the finding of Hume *et al.* (2016) that revealed that perceived affordability positively and significantly influenced consumption decision among red meat consumers in Australia. Also, An *et al.* (2015) reported that perceived affordability played a role in increasing the frequency of soda consumption among California children. Furthermore, finding of Beydoun & Wang (2008) revealed that perceived affordability positively influenced the consumption of healthy foods among adults in the US.

Additionally, reliance on own production positively and significantly influences consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds. This implies that consumption increased with increased consumer reliance on own production for pumpkin fruit, pumpkin leaves and pumpkin seeds. This could be explained by the fact that When individuals rely on their own production, they have greater control over the availability of the product. Furthermore, when individuals produce the product themselves, they have greater control over its quality and also creates a sense of accomplishment and pride. This finding is in line with the finding of Blair (2009) and Carney *et al.* (2012) who highlighted that those individuals growing their own fruits, vegetables, or herbs are more likely to consume them regularly.

Results further show that household size significantly and negatively influences consumption of pumpkin fruit and pumpkin leaves. This implies that when household size increases by one person, consumption of pumpkin fruit and pumpkin leaves reduces by 97.2% and 95.9% respectively. This is because in larger households, individuals may need to share limited quantities of food among more people, have more diverse tastes and preferences among household members and often require more coordination and planning in terms of meal preparation and grocery shopping. This finding corroborates with the finding of Datar & Nicosia

(2012) and Harttig *et al.* (2013) who suggested that household size negatively impacted on consumption pattern.

Furthermore, findings show that sensitization on health foods negatively and significantly influence consumption of pumpkin seeds. Whereas sensitization efforts may increase awareness about healthy foods, consumption of the foods could be limited if those foods are not readily available or accessible to individuals and if individuals are not accustomed to the taste of healthy foods or do not find them as appealing as less healthy option. This finding is contrary to the findings of Van der Horst *et al.* (2014), Evans *et al.* (2012) and Wyse *et al.* (2011) that reported that sensitization increased the frequency of consumption of fruits and vegetables among children.

Furthermore, study finding revealed that form consumed (boiled) positively and significantly influence consumption of pumpkin fruit. This implies that consumption of pumpkin fruit increases when the form is boiled. This is because boiling pumpkin is a relatively simple and straightforward cooking method and boiled pumpkin fruit have a soft and tender texture, which may be more palatable to some individuals compared to other cooking methods. This finding is consistent with the findings of Kimura *et al.* (2018) and Carlsen *et al.* (2010) that reported that boiling increases retention of water-soluble nutrients and improves digestibility of certain food components.

5.3 Factors driving consumer demand decisions

5.3.1 Consumer decisions to purchase pumpkin products

This study reveals that married consumers were more likely to buy pumpkin fruit and pumpkin leaves compared to consumers who were not married. Married individuals often prioritize the well-being of their families. They are more likely to be health-conscious and recognize the importance of consuming a balanced diet, including fruits and vegetables. As a result, they are more motivated to purchase these nutritious foods to support the health and well-being of their spouse and children (Lagerkvist *et al.*, 2013). Within a marriage or partnership, there can be mutual support and encouragement for healthy behaviors. For example, if one partner has a preference for pumpkin products (pumpkin fruit and pumpkin leaves) or values their nutritional benefits, they may influence the other partner to make similar choices. Thus, social support within a marital relationship can positively impact the decision to buy pumpkin fruit and pumpkin leaves.

Household size plays a key role in consumption decision and consequently the decision to buy food in the household (Nandi, Bokelmann, Gowdru, Nandi, et al., 2017). This study revealed that as the number of males in household increased, they were less likely to buying pumpkin fruit. This could be because different genders may have varying food preferences and consumption habits. For example, Jekanowski *et al.* (2000) suggested that males, on average, may have a higher preference for certain types of foods, such as meat or protein-rich options, compared to females. These preferences could influence the overall food purchasing decisions in a household. Societal norms, cultural traditions, and gender roles can also impact the decision-making process related to food purchases. For instance, in some cultures, males may traditionally have more involvement or responsibility in decision-making for food choices, while females may have different roles within the household. The number of males in a household, particularly in relation to the total number of family members, can influence the decision to buy food. This may be due

to factors such as income levels, individual preferences, and cooking responsibilities within the household.

Additionally, increase proportion of income spent on pumpkin fruit, pumpkin leaves and pumpkin seeds was associated with more likelihood of buying pumpkin fruit, pumpkin leaves and pumpkin seeds. Pumpkins are often associated with health benefits due to their rich nutrient profile and potential positive effects on various aspects of health. Individuals who are health-conscious and prioritize their well-being may be more inclined to allocate a larger proportion of their income to purchasing pumpkins as part of their efforts to maintain a healthy diet. This finding agrees with the findings of Boccaletti & Nardella, (2000) that indicated that income positively and significantly influenced willingness to pay for fruits and vegetables in Italy.

Similarly, distance to supermarket positively and significantly influence the consumer decision to buy pumpkin fruit, pumpkin leaves and pumpkin seeds. When the supermarket is closer, individuals may be more inclined to make frequent visits. This can lead to a higher likelihood of purchasing pumpkins as part of their regular grocery shopping trips. The convenience of a shorter distance encourages more frequent shopping and increases the chances of buying pumpkins. Also, with a nearby supermarket, individuals can purchase pumpkins on an as-needed basis. They can buy smaller quantities without the need for extensive storage space at home. This flexibility and convenience encourage individuals to buy pumpkins more frequently, as they can easily replenish their supply when needed. This finding is in support of the findings of Chelang'a *et al.* (2013) that revealed that distance to the supermarket positively and significantly influenced willingness to pay for fruits and vegetables in Kenya. Bhattarai (2019) also reported that

proximity to supermarket significantly influenced the consumer decision to pay for organic fruits and vegetables in Nepal.

Furthermore, findings show that sensitization on healthy foods was significantly and negatively associated with the consumer decision to buy pumpkin seeds. This finding is contrary to the expected *apriori*. While pumpkin seeds are generally considered nutritious and beneficial for health, individuals may have personal taste preferences that differ from the perceived healthiness of certain foods. In this case, even if individuals are sensitized on healthy foods, they may not personally prefer the taste or texture of pumpkins, leading to a reduced likelihood of buying them. The decision to buy pumpkins can also be influenced by their availability and accessibility. If individuals do not have easy access to pumpkins due to limited availability in their local markets or grocery stores, it can hinder their ability to make the decision to buy them, regardless of their sensitization to healthy foods. This finding is contrary to the findings of McKenna *et al.* (2017) that demonstrated the positive influence of sensitization on healthy foods in promoting the decision to buy and consume fruits and vegetables among children. Findings of Hearty & Heinz (2017) also showed that sensitization on healthy foods positively and significantly influenced decision to buy and consume fruits and vegetables among College Students.

The study findings further show that perceived health benefit on body immunity positively and significantly influenced the consumer decision to buy pumpkin fruit, pumpkin leaves and pumpkin seeds. This implies that consumers who perceived pumpkin fruit, pumpkin leaves and pumpkin seeds to have health benefits on body immunity were more likely to buy these products. Increased consumer awareness and interest in maintaining a healthy lifestyle have driven the demand for foods that offer potential health benefits. With the growing emphasis on immune

health, consumers actively seek out products that can support their immune system. The perceived health benefit of pumpkins on body immunity aligns with this health-conscious mindset, making pumpkins an attractive choice for purchase. This finding is consistent with the findings of Hearty & Heinz (2017) and McKenna *et al.* (2017).

Also, findings shows that perceived health benefit on eye vision, perceived health benefit on heart health and perceived health benefit on weight loss had a positive and significant influence on the consumer decision to buy pumpkin fruit and pumpkin seeds. Marketing efforts and educational campaigns that highlight the eye health benefits of pumpkins can influence consumer purchase decisions. By increasing awareness and knowledge about the specific nutrients and benefits of pumpkins for eye vision, marketers and health professionals can shape consumer perceptions and drive demand for pumpkin products. These findings corroborate with the findings of (Chelang'a *et al.* 2013; Lagerkvist *et al.* 2013; Ngigi *et al.* 2018).

5.3.2 Drivers of quantity demanded

The estimated price elasticities in absolute value were below unity, implying that demand for pumpkin fruit, pumpkin leaves and pumpkin seeds were inelastic. A reduction in the availability of pumpkin fruit, pumpkin leaves and pumpkin seeds probably due to scarcity especially in the rainy seasons for example may cause a price hike of pumpkin fruit, pumpkin leaves and pumpkin seeds, a reduction in the frequency of consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds and thus the quantity demanded of pumpkin fruit, pumpkin leaves and pumpkin seeds. This finding generally conforms to the economic theory that depicts an inverse relationship between quantity demanded and price. This finding is in line with the findings of

Laurette *et al.* (2014) that reported that consumers of fruits in the US were very sensitive to price changes and tend to demand lesser as price increased.

Study findings also revealed that as the proportion of income spent on pumpkin fruit, pumpkin leaves and pumpkin seeds increased, the demand for pumpkin leaves and pumpkin seeds increased but the demand for pumpkin fruit decreased. This could be because as the consumer incomes increase, they have more disposable income available for spending on pumpkin leaves and pumpkin seeds. With a higher proportion of income allocated to the pumpkin leaves and pumpkin seeds, consumers can afford to purchase more of them, leading to an increase in their quantity demanded. The decrease in quantity demanded of pumpkin fruit with an increase in the proportion of income spent on pumpkin fruit could be explained by the fact that as the proportion of income spent on pumpkin fruit increased the consumers tend to substitute pumpkin fruit with other products. The higher the disposable income the higher the proportion of income spent on pumpkin leaves and pumpkin seeds and therefore the higher the chances of demanding for more of these pumpkin products.

It was equally observed that a unit increase in the number of males in household resulted in an increase in the quantity demanded of pumpkin leaves. The increase in the number of males in the household could be due to visitations and the number of male children born in the family increase the demand for food, shelter, clothing, health, education and other needs. This makes demand for animal products like meat uneconomical and may necessitate consumption of relatively cheaper foods such as pumpkin leaves. This finding is comparable to the results of Huang *et al.* (2016) that reported that large households in China demanded more food. Similarly,

findings by Lemeilleur *et al.* (2015) found household size to have a positive and significant effect on quantity of dairy products consumed among households in Senegal.

Furthermore, there is a likelihood of consumers who were sensitized on healthy foods to consume more pumpkin leaves than their counterparts who were not sensitized. This could be attributed to the fact that consumers who are sensitized on healthy foods become more knowledgeable about the benefits of consuming these pumpkin leaves, such as their high content of vitamins, minerals, and dietary fiber. This awareness motivates individuals to make conscious choices and incorporate more pumpkin leaves into their diet. This finding is comparable to the finding of Uglem *et al.* (2012) who asserted that sensitization and awareness about healthy foods positively influenced adolescents' consumption of fruits and vegetables in rural Norway. Reicks *et al.* (2012) also found that sensitization on healthy foods significantly increased demand for fruit and vegetables among African American families.

The estimated cross price elasticity is positive implying that pumpkin fruit and sweet potatoes are substitutes. When the price of sweet potatoes increases, consumers may perceive pumpkin fruits more affordable and attractive alternative. This finding conforms with the economic theory that depicts a positive relationship between quantity demanded of a product and the price of another product.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion

The study findings reveal that there was a significant difference in marital status, sensitization on healthy foods, income category, age, household size, distance to market, distance to supermarket price of substitute, number of males in household and quantity consumed between consumers who rely on own production, buying and other sources for pumpkin fruit, pumpkin leaves and pumpkin seeds. It can therefore be concluded that marital status, sensitization on healthy foods, income category, age, household size, distance to market, distance to supermarket price of substitute, number of males in household and quantity consumed greatly varies between consumers who rely on own production, buying and other sources for pumpkin fruit, pumpkin leaves and pumpkin seeds.

On the influence of consumer perceptions on of consumption; consumer preference for aroma, hard skin, nutty taste, fibreness, perceived health benefit on eye vision, quantity consumed, proportion of income spent on product, reliance on own production and formed consumed (boiled) positively and significantly influenced consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds. On the other hand, perceived health benefit on heart health, product price, household size and sensitization on healthy foods had a negative and significant impact on consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds. It can therefore be concluded that consumption of pumpkin products is strongly dependent on consumer preference for product aroma, hard skin, nutty taste, fibreness as well as perceived health benefit on eye vision, heart health, and weight loss, quantity consumed, proportion of income spent on product, product

price, household size and sensitization on healthy foods, reliance on own production and formed consumed (boiled).

On the factors driving consumer decision to demand for pumpkin products, the study establishes that consumer decision to purchase pumpkin fruit, pumpkin leaves and pumpkin seeds is positively and significantly influenced by marital status, proportion of income spent on product, distance to super market, perceived health benefit on body immunity, eye vision, heart health weight loss. However, the consumer decision to buy pumpkin fruit, pumpkin leaves and pumpkin seeds is negatively and significantly influenced by number of males in household and sensitization on healthy food. It can therefore be concluded that consumer decisions to purchase pumpkin fruit, pumpkin leave and pumpkin seeds are driven by perceived health benefit on body immunity, perceived health benefit on eye vision, heart health, weight loss, marital status, proportion of income spent on product, distance to super market, number of males in household and sensitization on healthy food.

Regarding factors affecting the consumer decision on quantity demand; the study establishes that product price, proportion of income spent on product, sensitization on healthy foods and price of substitutes significantly influence quantity demand for pumpkin fruit, pumpkin leaves and pumpkin seeds. Therefore, it can be concluded that consumer decision on quantity demanded for pumpkin products is driven by product price and proportion of income spent on product, price of substitute and sensitization on healthy foods.

6.2 Recommendations

On the basis of the negative impact of perceived health benefit on heart health, product price, household size and sensitization on healthy foods on the frequency of consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds, it is worth noting that sensitization programs on healthy foods should not only be enhanced but structured in such a way that it emphasizes the role of pumpkins in enhancing human health. This is likely to improve perceived health benefits of pumpkin and its associated products even for larger household size. For instance, sensitization on healthy foods programs highlight the nutritional benefits of pumpkins, such as their high fiber content, vitamins, and minerals could increase consumption and demand of pumpkin and its associated products.

Furthermore, recommends that development programs on agricultural promotion across the public and private sector, should focus attention on availing market information on desired product quality, traders and consumer preferences. Such programs should also ensure that the engage in partnerships with local vegetable farmers to produce pumpkin and its associated products to ensure their availability throughout the year.

On the basis of consumer preferences, the study recommends that pumpkin-based product development processes should put more emphasis on attractive product aroma, color, nutty taste and fibreness as well as making the product affordability. This will make pumpkin-based products appealing to the consumers thus enhancing their consumption among the local population.

For further research, the study recommends revisiting the relationships that turnout insignificant and therefore inconclusive. For instance, the insignificant relationship between perceived health benefit on body immunity, perceived health benefit on weight loss, color and frequency of consumption of pumpkin fruit, pumpkin leaves and pumpkin seeds. Also, the insignificant relationship between age, gender, education and consumer decision to buy pumpkin fruit, pumpkin leaves and pumpkin seeds can be tested on a different context that varies in agro-ecological condition and market setting.

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APPENDICE

Appendix I: Survey Tool

Gulu University Faculty of Agriculture Household Survey Questionnaire					
Questionnaire ID:..... Enumerator:.....					
I am..... from the Faculty of Agriculture and Environment, Gulu University. I am conducting a study on Consumer Perception and Demand for Pumpkin products in Gulu City. You have been selected as a study participant. We kindly request you to respond to our questions. For your assurance, this information shall not be shared with any organization or institution but shall only be used for this study.					
Date of Interview	Village/Cell	Ward/Parish	Division/Subcounty	District/City	Contact of Respondent
			Laroo-Pece =1 Bardege-Layibi = 2	Gulu City = 1	

PART A: Socio Economic Characteristics

In the table below, I am interested in knowing some information concerning your household. Kindly, respond to the questions in the spaces provided.

1. Sex of respondent A1	2. Age of household head (Complete years) A2	3. Marital Status A3	4. Education level (Years spent in school) A4	5. Distance to the nearest market (km) A5	6. Distance to the nearest supermarket (km) A6	7. Have you received any sensitization on healthy diets? A7	8. If yes, concerning what aspects? A8	9. If yes, what was the source of information? A9	10. What activities do you do to earn money (Indicate as many as appropriate) A10	11. How much do you earn from each activity in a month? A11	12. How many are you in your household? A12
										1 = 2 = 3 =	1 = 2 = 3 =

										4 =	4 =
										5 =	5 =
A1: Sex Male = 1 Female = 2		A3: Marital Status Single = 1 Married = 2 Divorced = 3 Widowed = 4				A7: Sensitized Yes = 1 No = 2	A8: Aspects Food = 1 Nutrition = 2	A9: Source Radio =1 TV = 2 Relatives = 3 Social Groups = 4 Others Specify = 5	A8: Main occupation Farmer = 1 Business = 2 Casual Worker = 3 Employed/Salaried = 4 Others Specify =5		A11: HH Size Total Size = 1 Total Male = 2 Total Female =3 Total < 15years =4 Total > 64years = 5

PART B: Consumption of Pumpkins and associated Products

In this section, we interested in information concerning consumption of pumpkins. Kindly, respond to the questions as appropriate

a) Pumpkins

1. Are you aware of any health value(s) of pumpkins? B11	2. If yes, which ones do you know about pumpkins? B12	3. In the previous 12 months, have you consumed a pumpkin? B13	4. If yes, what was the reasons for you to eat pumpkins? B14	5. If yes, in what form did you take the pumpkin? B15	6. If yes, what was the source of pumpkin? B16	7. If yes, how many times (estimate) in the previous 12 months have you taken pumpkins?	8. If yes, how many pumpkins do you estimate to have got in the previous 12 months?	9. If yes, could you estimate the average weight of the pumpkins (kg) you normally get?	10. If you have been buying, at what price do you normally get a pumpkin?	11. If you have not been buying, at what price do you think members in your community buy pumpkins?	12. If you have taken pumpkins in the previous 12 months, which of the attributes below do you prefer? (select as many as possible)? B17
B11: Aware Yes = 1 No =2	B12: Health values Immunity =1 Vision = 2 Heart health = 3 Weight loss =4 Healthy Skin =5 Others = 6	B13: Taken Yes = 1 No = 2	B14: Reasons Cheap = 1 Health = 2 Available = 3	B15: Form Boiled = 1 Soup = 2 Fried = 3	B16: Source Own production =1 Bought = 2 Offered by friend/relative = 3						B17: Attributes Light Sweet Scent (Aroma) = 1 Yellow Colour = 2 Orange Colour = 3 Soft Pumpkin = 4 Hard Pumpkin = 5 Sweet taste = 6 Hard Skin = 7 Soft Skin = 8

b) Pumpkin leaves

1. Are you aware of any health value(s) of pumpkin leaves? B21	2. If yes, which ones do you know about pumpkin leaves? B22	3. In the previous 12 months, have you consumed pumpkin leaves? B23	4. If yes, what was the reasons for you to eat pumpkin leaves? B24	5. If yes, in what form did you take the pumpkin leaves? B25	6. If yes, what was the source of pumpkin leaves? B26	7. If yes, how many times (estimate) in the previous 12 months have you taken pumpkin leaves?	8. If yes, how many bundles of pumpkin leaves do you estimate to have got in the previous 12 months?	9. If you have been buying, at what price do you get a bundle of pumpkin leaves?	10. If you have not been buying, at what price do you think members in your community buy a bundle of pumpkin leaves?	11. If you have taken pumpkin leaves in the previous 12 months, which of the attributes below do you prefer? (select as many as possible)? B27
B21: Aware Yes = 1 No = 2	B22: Health values Immunity =1 Vision = 2 Heart health = 3 Weight loss =4 Healthy Skin =5 Others = 6	B23: Taken Yes = 1 No = 2	B24: Reasons Cheap = 1 Health = 2 Available = 3	B25: Form Fresh = 1 Dried = 2	B26: Source Own production =1 Bought = 2 Offered by friend/relative = 3					B27: Attributes Tenderness = 1 Aroma = 2 Dark Green Colour = 3 Light Green Colour = 4

c) Pumpkin flour

1. Are you aware of any health value(s) of pumpkin flour? B31	2. If yes, which ones do you know about pumpkin flour? B32	3. In the previous 12 months, have you consumed pumpkin flour? B33	4. If yes, what was the reasons for you to eat pumpkin flour? B34	5. If yes, in what form did you take the pumpkin flour? B35	6. If yes, what was the source of pumpkin flour? B36	7. If yes, how many times (estimate) in the previous 12 months have you taken pumpkin flour?	8. If yes, how much pumpkin flour (kg) do you estimate to have got in the previous 12 months?	9. If you have been buying, at what price do you get a kg of pumpkin flour?	10. If you have not been buying, at what price do you think members in your community buy pumpkin flour?	11. If you have taken pumpkin flour in the previous 12 months, which of the attributes below do you prefer? (select as many as possible)? B37
B31: Aware Yes = 1 No = 2	B32: Health values Immunity =1 Vision = 2 Heart health = 3 Weight loss =4 Healthy Skin =5	B33: Taken Yes = 1 No = 2	B34: Reasons Cheap = 1 Health = 2 Available = 3	B35: Form Pure pumpkin = 1 Blend with millet = 2 Blend with soy = 3	B36: Source Own production =1 Bought = 2 Offered by friend/relative = 3					B37: Attributes Aroma = 1 Yellow Powder = 2 Stickiness = 3 Sweet light taste =4

	Others = 6								
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d) Pumpkin Seeds

1. Are you aware of any health value(s) of pumpkin seeds? B41	2. If yes, which ones do you know about pumpkin seeds? B42	3. In the previous 12 months, have you consumed pumpkin seed? B43	4. If yes, what was the reasons for you to eat pumpkin seeds? B44	5. If yes, what form did you take the pumpkin seeds? B45	6. If yes, what was the source of pumpkin seeds? B46	7. If yes, how many times (estimate) in the previous 12 months have you taken pumpkin seeds?	8. If yes, how much pumpkin seeds (kg) do you estimate to have got in the previous 12 months?	9. If you have been buying, at what price do you get a kg pumpkin seed?	10. If you have not been buying, at what price do you think members in your community buy pumpkin seeds?	11. If you have taken pumpkin seeds in the previous 12 months, which of the attributes below do you prefer? (select as many as possible)? B47
B41: Aware Yes = 1 No = 2	B42: Health values Immunity = 1 Vision = 2 Heart health = 3 Weight loss = 4 Healthy Skin = 5 Others = 6	B43: Taken Yes = 1 No = 2	B44: Reasons Cheap = 1 Health = 2 Available = 3	B45: Form Roasted = 1 Not roasted = 2	B46: Source Own production = 1 Bought = 2 Offered by friend/relative = 3					B47: Attributes Nutty taste = 1 Fibreness = 2 Hardiness = 3 Chewy texture = 4

PART C: Non-own price demand factors

In this section, were interested in information concerning other foods you consume in your household. Kindly, respond as appropriate

a) Pumpkins

Prices of common compliments					Prices of common Substitutes					
1. If you buy pumpkins, what proportion (estimate) of income (as %) do spend on pumpkin?	2. If you do not buy, on average, what proportion (estimate) of income do you think people like you elsewhere spend on pumpkins?	3. If you consume as soup or fried, what has been the price of onions/garlic per kg in the previous 12 months?	4. If you do not consume as soup/fried, at what has been the average price of onion/garlic in the previous 12 months?	5. In the previous 12 months, how many kgs (estimate) of onions/garlic did you consume?	6. In the previous 12 months, what has been the price of cassava per heap?	7. In the previous 12 months, how many (estimate) heaps of cassava did you consume?	8. What weight do you estimate this heap of cassava?	9. In previous 12 months, what has been the price of sweet potatoes per heap?	10. In the previous 12 months, how many (estimate) heaps of potatoes did you consume?	11. What is the average weight (estimate) of this heap of sweet potato in Kg?

b) Pumpkin leaves

Prices of common compliments						Prices of common Substitutes			
1. If you buy pumpkins, what proportion (estimate) of income (as %) do you spend on pumpkin leaves?	2. If you do not buy, on average, what proportion (estimate) of income do you think people like you elsewhere spend on pumpkin leaves?	3. If you blend pumpkin leaves with Jute Mellow (Otigo diri) for sauce, what has been the price (average) of local salt (Magadi) in the previous 12 months?	4. If you do not blend, at what has been the price (average) of local salt (Magadi) per kg in the previous 12 months?	5. In Previous 12 months what has been the average price of jute mellow (otigo diri) per bundle?	6. In the previous 12 months, how many bundles (estimate) of jute mellow (otigo diri) have consumed?	7. In previous 12 months, what has been the price of Cow peas(boo) per bundle?	8. In previous 12 months, how many bundles (estimate) of cow peas (boo) have you consumed?	9. In previous 12 months, what has been the price of Hibiscus (malakwang) per bundle?	10. In previous 12 months, how many bundles (estimate) of hibiscus (malakwang) have you consumed?

c) Pumpkin flour

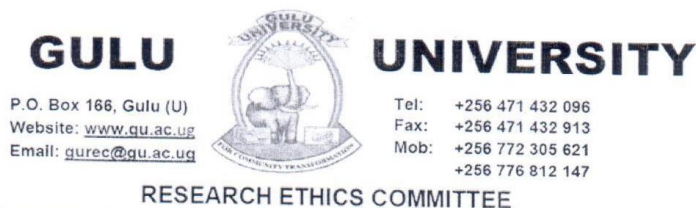
Prices of common compliments						Prices of common Substitutes				
1. If you buy pumpkins, what proportion (estimate) of income (as %) do you spend on pumpkin flour?	2. If you do not buy, on average, what proportion (estimate) of income do you think people like you elsewhere spend on pumpkin flour?	3. If you blend pumpkin flour with millet for porridge, what has been the price (average) of sugar in the previous 12 months?	4. If you blend pumpkin flour with millet flour, what quantity of millet flour did you blend with the pumpkin flour (kg)?	5. In Previous 12 months what has been the average price of millet flour per kg?	6. If you do not blend, at what price (average) has been sugar in the previous 12 months?	7. In the previous 12 months, how much sugar (kg) did you consume?	8. In previous 12 months, what has been the price of Soy flour?	9. In the previous 12 months, what quantity of soy flour did you eat?	10. In the previous 12 months, what has been the price maize flour?	11. In the previous 12 months, what quantity (estimate) of maize flour did you eat (kg)?

d) Roasted Pumpkin Seeds

Prices of common compliments					Prices of common Substitutes			
1. If you buy pumpkins, what proportion (estimate) of income (as %) do spend on pumpkin seed?	2. If you do not buy, on average, what proportion (estimate) of income do you think people like you elsewhere spend on pumpkin seeds?	3. If you roast the pumpkin seeds, what has been the price (average) of salt (kg) in the previous 12 months?	4. If you do not roast, at what price (average) has been salt (kg) in the previous 12 months?	5. In the previous 12 months, what is the quantity of salt that you have used?	6. In previous 12 months, what has been the price of groundnuts?	7. In the previous 12 months, how many kg of groundnuts did you eat?	8. In previous 12 months, what has been the price of soybeans?	9. In the previous 12 months, how many kg of soybeans did you eat?

Thank you for your cooperation!!!!

Appendix II: Approval Letter from Research Ethics Committee (GUREC)



To: Derrick Rubangakene

10/03/2023

Gulu University
0776516725

Type: Initial Review

Re: GUREC-2022-458: Consumer Perceptions and Demand for Pumpkin Products in Gulu City, 3.0,
2023-03-10

I am pleased to inform you that at the 95th convened meeting on 19/01/2023, the Gulu University REC, committee meeting, etc voted to approve the above referenced application.

Approval of the research is for the period of 10/03/2023 to 10/03/2024.

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

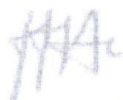
1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of **10/03/2024** in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by Gulu University REC:



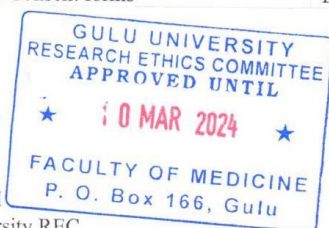
No.	Document Title	Language	Version Number	Version Date
1	COVID-19 Risk Management Plan of the study	English	3.0	2023-03-10
2	Protocol	English	3.0	2023-03-10
3	Data collection tools	English	2.0	2023-02-23
4	Informed Consent forms	Acholi	2.0	2023-02-23
5	Informed Consent forms	English	2.0	2023-02-23

Yours Sincerely



Dr. Gerald OBAI

For: Gulu University REC



Appendix III: Plagiarism Check Report

GULU

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Gulu - Uganda



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PLAGIARISM CHECK

Declaration for Originality Form

This form must be completed and signed for all scholarly work produced.

Name: DERRICK OTIM RUBANGAKENE
Personal File No.(staff) Reg. (student). 21/U/2375/MAE/PS
Faculty/Institute: AGRICULTURE AND ENVIRONMENT
Department: DEPARTMENT OF RURAL DEVELOPMENT AND AGRIBUSINESS
Title and bibliographic description of the work
**CONSUMER PERCEPTIONS AND DEMAND FACTORS DRIVING CONSUMPTION
OF PUMPKIN PRODUCTS IN GULU CITY**

Declaration.

1. I understand what plagiarism is and I am aware of the University policy on this regard,
2. I declare that this ...**Thesis**... (thesis, dissertation, essay, assignment, paper, report etc.) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work or my work has been used, this has been properly acknowledged and referenced in accordance with Gulu University requirements,
3. I have not sought or used the services of any professional agency to produce this work,
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own,
5. I understand that any false claim of this work shall result in disciplinary action in accordance with University Policy on Plagiarism.

Signature [Signature]

Date 15/04/2023

Originality Report

The article/thesis/document titled above have been subjected to plagiarism check and the level was found to be.....**20%** (percent) this is classified as:

- ☒ **Minor**
☐ Moderate
☐ Serious

Yours sincerely,

Dr. Ongaya Kizito (PhD)
Senior Librarian

Appendix IV: Informed consent

Title of the study: CONSUMER PERCEPTIONS AND DEMAND FOR PUMPKIN AND PUMPKIN PRODUCTS IN GULU CITY.

Invigilator(s): Rubangakene Derrick Otim

Institution(s): Gulu University

Introduction

I am **Rubangakene Derrick Otim** from the Faculty of Agriculture and Environment, Gulu University. I am conducting a study on Consumer Perception and Demand for Pumpkin and Pumpkin Products in Gulu City. You have been selected as a study participant. We kindly request you to respond to our questions. For your assurance, this information shall not be shared with any organization or institution but shall only be used for this study.

A brief Description of the Sponsors of the Project

This study is funded by Rubangakene Derrick Otim (Principal Investigator).

Purpose

The study seeks to examine consumer perceptions and demand for pumpkin and pumpkin products in Gulu City. The study will serve as a suitable tool for agricultural researchers and it will enable producers of pumpkin products gain adequate knowledge needed to produce pumpkin products that meet the consumer needs. This will in turn enhance the quality and quantity of the pumpkin products produced to improve consumer experience using the pumpkin

products. The discoveries of the study will attract the attention of researchers, and promote awareness among scientists, policymakers, and producers.

Procedures

Your participation in this study will involve answering the questions while filling in the questionnaires as requested.

Who will Participate in the Study?

You have been chosen to participate in this study because you have access and have been exposed to pumpkin products in the selected study area. The interview will last for approximately thirty minutes or less and the participants will be 427 with you inclusive.

Risks/Discomforts

The only risk that could be faced in the course of this survey is the risk of the spread of COVID-19 during the conduct of research and this will be mitigated by adhering to COVID-19 and Ebola SOP measures such as ensuring the use of hand sanitizers and nose masks and keeping social distancing.

Also ensuring social distancing to minimize body contacts as well as the use of gloves, nose marks and hand sanitizers will be appropriately employed as a preventive measure for Ebola virus.

Time Compensation

Research Participants will be compensated for their time with gift items such as bar soaps,

sugar and bathing soap. Also, they will receive compensation in form of travel allowances and lunch, including appropriate care in the case of any injury. However, the research assistants will be compensated with cash remuneration in line with an agreed amount prior to data collection.

Benefits

The potential benefit of this study is that it will increase the production and marketing of quality pumpkin products that are consistent with the with the consumer needs. Research participants will also get feedback on the findings and progress of the products, and any new information that affects the study participants (including incidental findings) will be made available to research participants.

Confidentiality

Your identity will not be revealed to anyone as we shall only use codes to identify participants. Information obtained will only be accessible by the research team. Soft copies of the data will be protected by password and hard copy files will be kept under lock and key. Confidential information will only be accessed by the principal investigator.

Alternatives

You do not have to participate in this study if you are not interested. You will not lose any benefit in case of no participation.

Costs

There will not be any additional cost incurred as a result of participating in this study.

Inquiries

If you have any questions related to the study or your rights as a research participant, you can contact the principal investigator, Rubangakene Derrick Otim on telephone 0776516725 or via email at derrickpotim@gmail.com

Statement of Voluntaries

Participation in the research study is voluntary and you may join of your own free will. You have a right to withdraw from the study at any time without penalty.

If you have any issues pertaining to your rights and participation in the study, please contact the Chairperson, Gulu University Research Ethics Committee (GUREC), Dr. Gerald Obai Tel: No., 0772305621; email: lekobai@yahoo.com/lekobai@gmail.com; or the Uganda National Council for Science and Technology on plot 6 Kimera Road, Ntinda, Kampala on Tel 0414705500.

If you consent to participate in the study, kindly indicate by signing/thumb print in the space below;

Name Signature/thumbprint of Participant Date

Name Signature of Witness Date.....

Name Signature of Interviewer Date

.....

Appendix V: Krejcie and Morgan Table

<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

Appendix VI: Negative Binomial Regression for Pumpkin Fruit (STATA Output)

```

Negative binomial regression              Number of obs   =       427
                                         LR chi2(17)      =      453.21
Dispersion      = mean                  Prob > chi2      =      0.0000
Log likelihood = -855.93263              Pseudo R2       =      0.2093

```

Times_consfruit	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Prefer_fruitslightsweetscent	.0355905	.0667552	0.53	0.594	-.0952473	.1664282
Prefer_yellowcolour	.0225589	.0575656	0.39	0.695	-.0902676	.1353853
Health_pumpkinfruit_immunity	.0554015	.059344	0.93	0.351	-.0609106	.1717136
Health_pumpkinfruit_vision	-.0266638	.0591589	-0.45	0.652	-.142613	.0892855
Health_pumpkinfruit_heart	-.1147044	.0659459	-1.74	0.082	-.243956	.0145473
Health_pumpkinfruit_weight	-.0051285	.0616686	-0.08	0.934	-.1259967	.1157396
QuantityFruit_kg	.0268921	.0015481	17.37	0.000	.0238579	.0299263
Priceperkg_fruit	-.0003398	.0000843	-4.03	0.000	-.000505	-.0001746
log_distancetomarket	-.0066351	.0409964	-0.16	0.871	-.0869865	.0737164
Propincome_fruit	.0660467	.0281149	2.35	0.019	.0109425	.1211509
log_Education	.0691981	.0532397	1.30	0.194	-.0351499	.1735461
Reason_consfruit_cheap	-.0003641	.0699535	-0.01	0.996	-.1374704	.1367423
Source_fruit_ownproduction	.2016675	.0510598	3.95	0.000	.1015921	.3017428
Prefer_hardskin	.1869163	.0913383	2.05	0.041	.0078966	.3659361
Form_consfruit_boiled	.3981909	.0988662	4.03	0.000	.2044166	.5919652
Total_HHsize	-.0279737	.0119808	-2.33	0.020	-.0514556	-.0044918
Sens_Hfoods	-.0596158	.0600403	-0.99	0.321	-.1772926	.0580609
_cons	-.1911247	.3661877	-0.52	0.602	-.9088394	.52659
/lnalpha	-5.934202	4.069256			-13.9098	2.041393
alpha	.0026473	.0107727			9.10e-07	7.701333

LR test of alpha=0: chibar2(01) = 0.06

Prob >= chibar2 = 0.401

Appendix VII: IRR Negative Binomial Regression for Pumpkin fruit (STATA Output)

```
Negative binomial regression      Number of obs   =      427
                                LR chi2(17)            =    453.21
Dispersion      = mean          Prob > chi2       =    0.0000
Log likelihood = -855.93263      Pseudo R2        =    0.2093
```

Times_consfruit	IRR	Std. Err.	z	P> z	[95% Conf. Interval]	
Prefer_fruitslightsweetscent	1.036231	.0691738	0.53	0.594	.9091481	1.181079
Prefer_yellowcolour	1.022815	.058879	0.39	0.695	.9136867	1.144978
Health_pumpkinfruit_immunity	1.056965	.0627245	0.93	0.351	.9409074	1.187338
Health_pumpkinfruit_vision	.9736886	.0576023	-0.45	0.652	.8670895	1.093393
Health_pumpkinfruit_heart	.8916297	.0587994	-1.74	0.082	.7835221	1.014654
Health_pumpkinfruit_weight	.9948846	.0613531	-0.08	0.934	.8816177	1.122703
QuantityFruit_kg	1.027257	.0015903	17.37	0.000	1.024145	1.030379
Priceperkg_fruit	.9996602	.0000843	-4.03	0.000	.9994951	.9998254
log_distancetomarket	.9933869	.0407253	-0.16	0.871	.9166895	1.076501
Propincome_fruit	1.068277	.0300345	2.35	0.019	1.011003	1.128795
log_Education	1.071648	.0570543	1.30	0.194	.9654607	1.189516
Reason_consfruit_cheap	.999636	.069928	-0.01	0.996	.8715601	1.146533
Source_fruit_ownproduction	1.223441	.0624687	3.95	0.000	1.106932	1.352213
Prefer_hardskin	1.205526	.1101107	2.05	0.041	1.007928	1.441863
Form_consfruit_boiled	1.489128	.1472245	4.03	0.000	1.226809	1.807537
Total_HHsize	.9724139	.0116503	-2.33	0.020	.9498458	.9955183
Sens_Hfoods	.9421264	.0565655	-0.99	0.321	.8375347	1.05978
_cons	.8260296	.3024819	-0.52	0.602	.4029917	1.693149
/lnalpha	-5.934202	4.069256			-13.9098	2.041393
alpha	.0026473	.0107727			9.10e-07	7.701333

Note: Estimates are transformed only in the first equation.

Note: _cons estimates baseline incidence rate.

LR test of alpha=0: chibar2(01) = 0.06

Prob >= chibar2 = 0.401

Appendix VIII: Negative Binomial Regression for Pumpkin Leaves (STATA Output)

```

Negative binomial regression              Number of obs   =       427
                                         LR chi2(15)      =      502.15
Dispersion      = mean                  Prob > chi2       =      0.0000
Log likelihood = -1077.958              Pseudo R2        =      0.1889

```

Numbtimes_consleaves	IRR	Std. Err.	z	P> z	[95% Conf. Interval]	
Prefer_leavearoma	1.268024	.1036607	2.90	0.004	1.080294	1.488378
Prefer_lightgreencolour	1.104271	.0841559	1.30	0.193	.9510555	1.282169
Health_leaves_immunity	1.047653	.0824461	0.59	0.554	.8979074	1.222373
Health_leaves_vision	1.000953	.0762216	0.01	0.990	.8621753	1.162069
Health_leaves_hearthealth	1.092578	.102149	0.95	0.344	.9096426	1.312304
Health_leaves_weightloss	.9539397	.0884567	-0.51	0.611	.7954098	1.144066
Priceperbundel_leaves	.9825939	.0038411	-4.49	0.000	.9750944	.9901512
log_distancetomarket	.8154171	.0455759	-3.65	0.000	.7308088	.9098207
propincome_leaves	1.081719	.0346472	2.45	0.014	1.015899	1.151803
Source_leaves_ownproduction	1.257557	.0916741	3.14	0.002	1.090125	1.450705
log_Education	.9379018	.0677713	-0.89	0.375	.8140497	1.080597
Total_HHsize	.958821	.0140237	-2.88	0.004	.9317253	.9867047
Quantity_leaves	1.121974	.0084847	15.22	0.000	1.105467	1.138728
Reason_consleaves_cheap	1.189716	.1145563	1.80	0.071	.9851044	1.436827
Sens_Hfoods	.9022765	.0691238	-1.34	0.179	.7764773	1.048457
_cons	1.73814	.76686	1.25	0.210	.7320457	4.126969
/lnalpha	-1.437236	.1159287			-1.664452	-1.21002
alpha	.2375834	.0275427			.1892943	.2981912

Note: Estimates are transformed only in the first equation.

Note: _cons estimates baseline incidence rate.

LR test of alpha=0: chibar2(01) = 492.72

Prob >= chibar2 = 0.000

Appendix IX: IRR Negative Binomial Regression for Pumpkin Leaves (STATA Output)

```

Negative binomial regression           Number of obs   =          427
                                      LR chi2(15)        =        370.54
Dispersion      = mean                Prob > chi2       =         0.0000
Log likelihood = -812.89193            Pseudo R2        =         0.1856

```

Numb_times_conspumpkinseeds	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Prefer_nuttytaste	.1873689	.092185	2.03	0.042	.0066897	.3680482
Prefer_fibreiness	.502322	.0930817	5.40	0.000	.3198852	.6847588
Health_seeds_immunity	-.1036567	.1000106	-1.04	0.300	-.299674	.0923605
Health_seeds_vision	.2067221	.0934891	2.21	0.027	.0234869	.3899574
Health_seeds_hearthealth	.1936957	.1039093	1.86	0.062	-.0099628	.3973541
Health_seeds_weigthloss	.1084047	.1031723	1.05	0.293	-.0938092	.3106187
logpriceperkg_seeds	-.3266802	.0554549	-5.89	0.000	-.4353697	-.2179906
Quantitypumpkinseeds_kg	.1400805	.024775	5.65	0.000	.0915223	.1886387
log_distancetomarket	-.0137834	.0652265	-0.21	0.833	-.141625	.1140582
PropIncome_seeds	.0696487	.0367179	1.90	0.058	-.0023171	.1416146
log_Education	-.202334	.0829661	-2.44	0.015	-.3649445	-.0397235
Total_HHsize	.0020319	.017865	0.11	0.909	-.0329829	.0370467
Reason_consseeds_cheap	.0877435	.1310042	0.67	0.503	-.16902	.3445071
Source_seedscons_ownproduction	.5292229	.0861199	6.15	0.000	.360431	.6980148
Sens_Hfoods	-.197053	.0913119	-2.16	0.031	-.376021	-.018085
_cons	2.617956	.6425803	4.07	0.000	1.358521	3.87739
/lnalpha	-1.522466	.1735188			-1.862557	-1.182376
alpha	.2181731	.0378571			.1552751	.3065496

LR test of alpha=0: chibar2(01) = 98.73

Prob >= chibar2 = 0.000

Appendix X: Negative Binomial Regression for Pumpkin Seeds (STATA Output)

```

Negative binomial regression           Number of obs   =       427
                                      LR chi2(15)        =       370.54
Dispersion      = mean                Prob > chi2       =       0.0000
Log likelihood = -812.89193            Pseudo R2        =       0.1856

```

Numb_times_conspumpkinseeds	IRR	Std. Err.	z	P> z	[95% Conf. Interval]	
Prefer_nuttytaste	1.206072	.1111817	2.03	0.042	1.006712	1.444912
Prefer_fibreiness	1.652554	.1538225	5.40	0.000	1.37697	1.983293
Health_seeds_immunity	.9015347	.0901631	-1.04	0.300	.7410598	1.09676
Health_seeds_vision	1.229641	.114958	2.21	0.027	1.023765	1.476918
Health_seeds_hearthealth	1.213727	.1261175	1.86	0.062	.9900867	1.487883
Health_seeds_weighthloss	1.114499	.1149854	1.05	0.293	.9104564	1.364269
logpriceperkg_seeds	.7213144	.0400004	-5.89	0.000	.6470254	.804133
Quantitypumpkinseeds_kg	1.150366	.0285004	5.65	0.000	1.095841	1.207605
log_distancetomarket	.9863112	.0643336	-0.21	0.833	.8679467	1.120817
PropIncome_seeds	1.072132	.0393665	1.90	0.058	.9976856	1.152133
log_Education	.8168221	.0677685	-2.44	0.015	.6942352	.9610552
Total_HHsize	1.002034	.0179014	0.11	0.909	.9675551	1.037742
Reason_consseeds_cheap	1.091708	.1430184	0.67	0.503	.844492	1.411294
Source_seedscons_ownproduction	1.697613	.1461983	6.15	0.000	1.433947	2.009759
Sens_Hfoods	.8211471	.0749805	-2.16	0.031	.6865879	.9820776
_cons	13.70767	8.80828	4.07	0.000	3.890436	48.29799
/lnalpha	-1.522466	.1735188			-1.862557	-1.182376
alpha	.2181731	.0378571			.1552751	.3065496

Note: Estimates are transformed only in the first equation.

Note: _cons estimates baseline incidence rate.

LR test of alpha=0: chibar2(01) = 98.73 Prob >= chibar2 = 0.000

Appendix XI: IRR Negative Binomial Regression for Pumpkin Seeds (STATA Output)

```

Negative binomial regression              Number of obs   =       427
                                         LR chi2(15)      =       370.54
Dispersion      = mean                  Prob > chi2       =       0.0000
Log likelihood = -812.89193              Pseudo R2        =       0.1856

```

Numb_times_conspumpkinseeds	IRR	Std. Err.	z	P> z	[95% Conf. Interval]	
Prefer_nuttytaste	1.206072	.1111817	2.03	0.042	1.006712	1.444912
Prefer_fibreless	1.652554	.1538225	5.40	0.000	1.37697	1.983293
Health_seeds_immunity	.9015347	.0901631	-1.04	0.300	.7410598	1.09676
Health_seeds_vision	1.229641	.114958	2.21	0.027	1.023765	1.476918
Health_seeds_hearthealth	1.213727	.1261175	1.86	0.062	.9900867	1.487883
Health_seeds_weighthloss	1.114499	.1149854	1.05	0.293	.9104564	1.364269
logpriceperkg_seeds	.7213144	.0400004	-5.89	0.000	.6470254	.804133
Quantitypumpkinseeds_kg	1.150366	.0285004	5.65	0.000	1.095841	1.207605
log_distancetomarket	.9863112	.0643336	-0.21	0.833	.8679467	1.120817
PropIncome_seeds	1.072132	.0393665	1.90	0.058	.9976856	1.152133
log_Education	.8168221	.0677685	-2.44	0.015	.6942352	.9610552
Total_HHsize	1.002034	.0179014	0.11	0.909	.9675551	1.037742
Reason_consseeds_cheap	1.091708	.1430184	0.67	0.503	.844492	1.411294
Source_seedscons_ownproduction	1.697613	.1461983	6.15	0.000	1.433947	2.009759
Sens_Hfoods	.8211471	.0749805	-2.16	0.031	.6865879	.9820776
_cons	13.70767	8.80828	4.07	0.000	3.890436	48.29799
/lnalpha	-1.522466	.1735188			-1.862557	-1.182376
alpha	.2181731	.0378571			.1552751	.3065496

Note: Estimates are transformed only in the first equation.

Note: _cons estimates baseline incidence rate.

LR test of alpha=0: chibar2(01) =_98.73

Prob >= chibar2 = 0.000

Appendix XII: Two-stage Regression for Pumpkin Fruit (STATA Output)

```

Heckman selection model -- two-step estimates   Number of obs   =       427
(regression model with sample selection)        Selected      =       250
                                                Nonselected    =       177

                                                Wald chi2(6)    =       41.09
                                                Prob > chi2     =       0.0000

```

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
QuantityFruit_kg						
Priceperkg_Fruit	-.003621	.000863	-4.20	0.000	-.0053124	-.0019297
Pricesalt	-.0019839	.0017366	-1.14	0.253	-.0053876	.0014197
Priceperkgpotatoes	.008634	.002632	3.28	0.001	.0034754	.0137927
Propincom_fruit	-.3421763	.1857262	-1.84	0.065	-.7061929	.0218403
Total_male	-.9328636	.6666749	-1.40	0.162	-2.239522	.3737952
Sens_food	-.8130788	2.036067	-0.40	0.690	-4.803697	3.177539
_cons	19.41757	5.318686	3.65	0.000	8.993136	29.842
Source_fruit_bought						
Gender	-.0070841	.1418375	-0.05	0.960	-.2850804	.2709122
Marital_Status_Married	.5976626	.1839435	3.25	0.001	.2371399	.9581853
log_Age	.3580009	.2450568	1.46	0.144	-.1223016	.8383033
log_Education	-.0397735	.1529971	-0.26	0.795	-.3396423	.2600953
log_distancetosupermarket	.2921669	.0962109	3.04	0.002	.103597	.4807368
Propincom_fruit	.235	.0331332	7.09	0.000	.1700601	.2999398
Total_male	-.0985576	.053298	-1.85	0.064	-.2030197	.0059046
Sens_food	-.2107892	.1495723	-1.41	0.159	-.5039454	.082367
Health_pumpkinfruit_immunity	.3869044	.1603474	2.41	0.016	.0726293	.7011796
Health_pumpkinfruit_vision	.3523532	.1713121	2.06	0.040	.0165877	.6881187
Health_pumpkinfruit_heart	.3679404	.1950872	1.89	0.059	-.0144235	.7503044
Health_pumpkinfruit_weight	.4690499	.1973711	2.38	0.017	.0822096	.8558902
_cons	-2.223152	1.033112	-2.15	0.031	-4.248014	-.1982887
/mills						
lambda	-10.42438	3.28424	-3.17	0.002	-16.86137	-3.987385
rho	-0.72172					
sigma	14.443746					

Appendix XIII: Margins for selection model for pumpkin fruit (STATA Output)

	Delta-method					
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]	
Gender	-.0022124	.0442938	-0.05	0.960	-.0890267	.0846019
Marital_Status_Married	.186655	.0551962	3.38	0.001	.0784725	.2948376
log_Age	.1118066	.0760181	1.47	0.141	-.037186	.2607993
log_Education	-.0124216	.0477739	-0.26	0.795	-.1060567	.0812135
log_distancetosupermarket	.0912462	.0289876	3.15	0.002	.0344315	.1480609
Propincom_fruit	.0733924	.0089349	8.21	0.000	.0558804	.0909045
Total_male	-.0307803	.0164633	-1.87	0.062	-.0630478	.0014871
Sens_food	-.0658312	.0463675	-1.42	0.156	-.1567098	.0250474
Health_pumpkinfruit_immunity	.1208335	.0491926	2.46	0.014	.0244177	.2172492
Health_pumpkinfruit_vision	.1100428	.0527971	2.08	0.037	.0065625	.2135232
Health_pumpkinfruit_heart	.1149109	.0602046	1.91	0.056	-.003088	.2329097
Health_pumpkinfruit_weight	.1464882	.0603805	2.43	0.015	.0281446	.2648318

Appendix XIV: Heckman Two-stage Regression for Pumpkin Leaves (STATA Output)

```

Heckman selection model -- two-step estimates   Number of obs   =       427
(regression model with sample selection)        Selected       =       227
                                                Nonselected    =       200

                                                Wald chi2(6)    =       949.90
                                                Prob > chi2     =       0.0000

```

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
logQuantity_leaves						
logpriceperbundle_leaves	-.8580246	.034653	-24.76	0.000	-.9259432	-.790106
Pricesalt	.0017236	.0031263	0.55	0.581	-.0044038	.007851
logprice_cowpeas	-.0125475	.1107321	-0.11	0.910	-.2295784	.2044833
Propincom_leaves	.0540977	.0073673	7.34	0.000	.039658	.0685373
Total_male	.0584759	.0213864	2.73	0.006	.0165593	.1003924
Sens_food	.1030812	.0614172	1.68	0.093	-.0172942	.2234566
_cons	4.911436	.5588106	8.79	0.000	3.816187	6.006685
Source_leaves_bought						
Gender	-.1278846	.1385126	-0.92	0.356	-.3993643	.143595
Marital_Status_Married	.4497886	.1793076	2.51	0.012	.0983522	.801225
log_Age	.2541773	.2482019	1.02	0.306	-.2322894	.740644
log_Education	.0705128	.1493189	0.47	0.637	-.2221468	.3631724
log_distancetosupermarket	.3317607	.098404	3.37	0.001	.1388924	.5246291
Propincom_leaves	.1643239	.0221216	7.43	0.000	.1209663	.2076815
Total_male	-.0484858	.0538985	-0.90	0.368	-.154125	.0571534
Sens_food	-.1273618	.146139	-0.87	0.383	-.413789	.1590654
Health_seeds_immunity	.3940587	.1634631	2.41	0.016	.0736769	.7144404
Health_seeds_vision	.082233	.1642262	0.50	0.617	-.2396444	.4041104
Health_seeds_hearthealth	.043452	.1887016	0.23	0.818	-.3263964	.4133005
Health_seeds_weighthloss	.0046909	.1750756	0.03	0.979	-.338451	.3478328
_cons	-1.982004	1.029483	-1.93	0.054	-3.999754	.0357457
/mills						
lambda	.2578671	.1177523	2.19	0.029	.0270769	.4886573
rho	0.61789					
sigma	.4173377					

Appendix XV: Margins for selection model for pumpkin leaves (STATA Output)

	Delta-method					
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]	
Gender	-.0428026	.0461896	-0.93	0.354	-.1333325	.0477273
Marital_Status_Married	.150543	.0586231	2.57	0.010	.0356438	.2654421
log_Age	.0850724	.082664	1.03	0.303	-.0769461	.2470909
log_Education	.0236004	.0499316	0.47	0.636	-.0742638	.1214646
log_distancetosupermarket	.1110394	.0315945	3.51	0.000	.0491152	.1729635
Propincom_leaves	.0549987	.0062815	8.76	0.000	.0426872	.0673103
Total_male	-.016228	.0179795	-0.90	0.367	-.0514671	.019011
Sens_food	-.0426276	.0488071	-0.87	0.382	-.1382878	.0530326
Health_seeds_immunity	.1318903	.0536437	2.46	0.014	.0267505	.2370301
Health_seeds_vision	.0275231	.0548924	0.50	0.616	-.080064	.1351103
Health_seeds_hearthealth	.0145433	.0631356	0.23	0.818	-.1092003	.1382869
Health_seeds_weighthloss	.00157	.0585967	0.03	0.979	-.1132774	.1164174

Appendix XVI: Heckman Two-stage Regression for Pumpkin Seeds (STATA Output)

```

Heckman selection model -- two-step estimates      Number of obs      =          427
(regression model with sample selection)           Selected          =          210
                                                    Nonselected        =          217

                                                    Wald chi2(6)       =        384.87
                                                    Prob > chi2        =        0.0000

```

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
logQuantity_seeds						
logpriceperkg_seeds	-.3442412	.0190039	-18.11	0.000	-.3814881	-.3069942
logprice_salt	.086394	.1162487	0.74	0.457	-.1414492	.3142372
logprice_soybeans	.8780244	.1258722	6.98	0.000	.6313195	1.124729
Propincom_seeds	.0448004	.0082379	5.44	0.000	.0286543	.0609464
Total_male	-.0126635	.0164295	-0.77	0.441	-.0448647	.0195377
Sens_food	-.0562846	.0470458	-1.20	0.232	-.1484926	.0359234
_cons	-4.172266	1.237486	-3.37	0.001	-6.597694	-1.746837
Source_seedscons_bought						
Gender	.0283683	.1373065	0.21	0.836	-.2407474	.297484
Marital_Status_Married	.1384168	.1762073	0.79	0.432	-.2069432	.4837768
log_Age	.0465817	.2431456	0.19	0.848	-.429975	.5231383
log_Education	.0309335	.1518323	0.20	0.839	-.2666523	.3285194
log_distancetosupermarket	.3059903	.0975438	3.14	0.002	.1148079	.4971727
Propincom_seeds	.1511615	.0311456	4.85	0.000	.0901172	.2122057
Total_male	-.0719245	.0537173	-1.34	0.181	-.1772084	.0333595
Sens_food	-.2909949	.1468722	-1.98	0.048	-.5788591	-.0031308
Health_seeds_immunity	.5423099	.1635234	3.32	0.001	.2218099	.8628098
Health_seeds_vision	.43493	.1702475	2.55	0.011	.101251	.768609
Health_seeds_hearthealth	.4115144	.1936368	2.13	0.034	.0319933	.7910355
Health_seeds_weigthloss	.4225901	.1809029	2.34	0.019	.0680268	.7771533
_cons	-1.029994	1.01828	-1.01	0.312	-3.025786	.965799
/mills						
lambda	.1655096	.078654	2.10	0.035	.0113505	.3196687
rho	0.55158					
sigma	.30006312					

Appendix XVII: Margins for selection model for Pumpkin seeds (STATA Output)

	Delta-method					
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]	
Gender	.0094984	.0459677	0.21	0.836	-.0805967	.0995935
Marital_Status_Married	.0463454	.0588831	0.79	0.431	-.0690634	.1617541
log_Age	.0155967	.0814025	0.19	0.848	-.1439492	.1751426
log_Education	.0103573	.0508314	0.20	0.839	-.0892704	.109985
log_distancetosupermarket	.1024531	.0316442	3.24	0.001	.0404317	.1644746
Propincom_seeds	.0506126	.010054	5.03	0.000	.0309071	.0703181
Total_male	-.0240821	.0178394	-1.35	0.177	-.0590466	.0108824
Sens_food	-.0974323	.0484893	-2.01	0.044	-.1924696	-.0023951
Health_seeds_immunity	.1815788	.0528527	3.44	0.001	.0779894	.2851682
Health_seeds_vision	.1456253	.0557718	2.61	0.009	.0363146	.2549361
Health_seeds_hearthealth	.1377852	.0639488	2.15	0.031	.012448	.2631225
Health_seeds_weighthloss	.1414936	.0594613	2.38	0.017	.0249516	.2580357