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Unraveling the Shift: Exploring Factors Influencing Protein Preference and Consumption Patterns in Ga South Municipality of Ghana

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A R T I C L E   I N F O

A B S T R A C T

This study endeavors to elucidate the factors influencing protein preference and consumption patterns in the Ga South Municipality of Ghana. Understanding these determinants is pivotal for promoting environmentally sustainable and healthy dietary habits. Utilizing a random sampling approach, the study collected 150 meticulously structured questionnaires from a representative sample of municipality residents. It delved into the socio-cultural and economic factors shaping protein preferences and consumption behaviors, alongside investigating the impact of awareness, knowledge, and availability of protein sources on dietary choices. The findings unveiled that respondents partake of protein daily, albeit with variations in patterns based on sources: plant protein consumption occurred weekly, while animal protein was consumed daily. Moreover, respondents exhibited awareness of the nutritional benefits associated with protein consumption. While awareness for protein nutrition is high, the price remains a deterrent to accessing protein in Ga South Municipality. Calling on policymakers to support local food production and supply, invest in food literacy, and develop good transportation to reduce logistics bottlenecks that often create a massive difference between farm gate and market prices.

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Introduction

Protein plays a crucial role in maintaining optimal health and is essential for solving the global issue of malnutrition. Protein is a fundamental building block for the human body, playing a crucial role in various physiological functions (Watford & Wu, 2018). Not only does it contribute to the growth and repair of tissues and muscles, but it is also essential for the production of enzymes, hormones, and other vital chemicals in the body (Gurtner et al., 2008). Furthermore, protein is important for a strong immune system, as it aids in the production of antibodies that help fight off infections and illnesses (Spiering, 2015). Global population growth has resulted in significant food security issues, particularly in developing and underdeveloped nations. In solving the global issue of malnutrition, protein is a key component in providing nourishment to those who are lacking essential nutrients (Kiani et al., 2022). It is particularly important in addressing protein-energy malnutrition, as protein deficiency can lead to detrimental health effects such as stunted growth, weakened immune system, and impaired organ function. Although many nations have adopted

several strategies—Weak or strong--to address malnutrition, protein deficiency, and food security (FAO, 2018), sub-Saharan Africa is only second to Asia in undernourishment (Kaur & Kaur, 2016). Consuming adequate amounts of protein is essential for maintaining overall health and well-being (Wu, 2016). while the relationship between protein consumption, nutrition, and food safety is multifaceted and complex, our study seeks to unravel the pattern of protein preference and consumption in Ghana and determine the factors that influence it. Protein-rich foods such as meat, poultry, fish, eggs, dairy products, legumes, nuts, and seeds are important sources of essential amino acids (Wu, 2016). Ensuring a balanced diet that includes an adequate amount of protein is vital for meeting the body's nutritional needs (Watford & Wu, 2018). Sustainable protein production methods, such as plant-based proteins and alternative protein sources, are gaining attention due to their potential to reduce environmental impact and ensure long-term food security (Parisi et al., 2020). Incorporating a variety of protein sources into diets can help address specific nutrient

deficiencies that contribute to malnutrition (Parisi et al., 2020). For example, including both plant and animal protein sources of complete proteins such as meat, fish, eggs, and dairy, and plant-based protein sources like legumes, nuts, and seeds can provide essential amino acids that are vital for overall health and well-being. This can play a significant role in addressing malnutrition, particularly in regions where access to animal-based proteins is limited.

The rapid urbanization of sub-Saharan Africa has created changes in dietary behavior as food habits and food environments are highly linked to industrialization, marketization, and globalized food supplies (Agyemang et al., 2016; Holdsworth and Landais, 2019; Rousham et al., 2020). Baker et al. (2020) reported that changes in the nutrition landscape, commonly referred to as nutrition transition, have moved the global burden from communicable to non-communicable diseases (NCDs). It was estimated that 77% of the NCDs are found in low and middle-income countries (World Health Organization, 2021). Protein-energy malnutrition or protein undernutrition, as well as the undernutrition or deficiency of other micronutrients, are serious risk factors for infectious diseases that often coexist and exhibit complex interactions, thereby creating a vicious cycle of malnutrition and infections among people of different age groups (Bhaskaram, 2002). Understandably, low purchasing power owing to economic upheavals has caused substantial nutritional problems, people consume what they can afford not what they desire and understand to be of nutritional value (Leng et al., 2017). Owing to this fact, in Ghana, people depend on cheap and affordable carbohydrates or starchy sources of food such as cassava, yam, cocoyam, and rice are substituted for expensive protein sources like red meat and chicken, leading to a massive deficiency in protein intake. Galbete et al. (2018) reported that in Ghana, the primary source of energy is carbohydrate foods which consist mainly of plantains, tubers, roots, and cereals; however, the most consumed staple crop is cassava. (Andam et al., 2017) reported that the most frequently consumed among the cereal group are maize and rice and that rice consumption was three times higher per week among 60% of the households in Accra. According to a grain-analysis report by USDA-STAFF (2018), corn or maize represented 62% of the total grain output (rice 16%, sorghum 14%, and millet 8%), and it was the most significant staple crop as well as the mainstay of the diet for the majority of Ghanaians. The grain analysis report also revealed that rice was the second most important cereal after corn, and the per capita rice consumption in 2016-2017 was estimated to be around 35kg per year. In Ghana, the inclusion of protein-based foodstuffs in the diet, especially animal-based protein, is extremely low, and the primary cause of this problem is the high cost of protein-based foodstuffs. It was reported that in rural communities in Ghana, the dependency on rapidly digestible carbohydrates or starchy staple foods increased the prevalence of stunting, at 22.1% compared to the 14.8% observed in urban communities (Ghana Statistical Service, 2015), where diets generally have higher diversity and include some rich protein sources such as milk, eggs, and meats.

Furthermore, Liguori et al. (2022) reported that as non-communicable diseases account for over 40% of deaths in Ghana, the country has reached an advanced stage of nutrition transition. The recommended dietary allowance (RDA) for protein is 800 mg per kilogram of body weight (Havard Health Publishing Staff, 2022). However, the WHO Technical Report (2007) on amino acid and protein requirement in human nutrition stated that the best estimates for a population's average requirement are 105 mg nitrogen per kg body weight per day or 0.66g protein per kg body weight per day. In a survey conducted by Mingle et al. (2021), they reported that the average daily animal protein consumption in some selected cities (Accra, Kumasi, and Koforidua) in Ghana for chicken, pork, fish, beef, egg, and sausage was 657g/person/day, 412/person/day, 477/person/day, 410/person/day, 211/person/day, and 148/person/day respectively. According to a report published by FAOSTAT (2023), beans consumption per capita reached 6.04kg in 2020, which was 0.984% less than the previous year. The report also revealed that beans consumption per capita in Ghana was highest (9.62kg) in 2012 and lowest (0.130kg) in 1993. From the statistics, there is a disparity between the expected global protein consumption and the protein consumed on average in Ghana. This poses a big issue, as this deficit can result in several health outcomes (Longland et al., 2016).

Moreover, the latest report by USDA (2023) revealed that the per capita consumption of cowpeas or black eye peas in Ghana reached 10. kg during the 2022-2023 market year. McKay et al. (2016) reported that Ghana is an interesting case since it has experienced rapid economic growth and a reduction of poverty over the last two decades. This condition should cause a transition in nutrition and a rise in the consumption of protein-rich foods; however, protein intake in Ghana is still below the recommended level.

The pattern of protein consumption in Ghana differs from one region to another. For instance, in the Northern part of Ghana, the availability and consumption of millet, legumes (Bambara beans, red beans), guinea corn or sorghum (Adams & Ohene-Yankyera, 2014) and meat from guinea fowl is very high compared to the Southern or Western part of Ghana. However, In the southern, western, and Eastern parts of the country, black eye peas or waakye beans, pork, bush meat (grasscutter and squirrel), chicken meat, milk, and red meat are some of the most commonly consumed types of protein.

Many published survey articles regarding protein intake use the words "consumption and preference" interchangeably; however, they are very different. Consumption is the actual intake or purchase of a particular food item, and preference is the most desired between two food items but not necessarily the one consumed or purchased. In this survey, we aimed to find the differences between the most preferred and the most consumed types of protein by the respondents based on the definitions mentioned above.

Materıals and Methods

Study Area

The study was conducted in the Greater Accra Region, Ghana (latitude of 7.9465° N, and longitude of 1.0232° W). Specifically, the study was conducted in Galilea, a town in the Ga South municipality. Ga South Municipality is one of the 26 municipalities in the Greater Accra Region of Ghana. This area was selected for two reasons: the diversity of the region's occupation- which makes it a unique income stratum, and the diversity of the population in terms of the ethnic/tribe. The Greater Accra region has a population of 5,455,692, according to the 2021 Population and Housing Census (PHC, 2021). The Greater Accra region is the most urbanized in the country, with 87.4% of its population living in urban centers. The Eastern Region, the Volta Region, the Gulf of Guinea, and the Central Region all border the Greater Accra Region to the north, east, south, and west, respectively. It has the smallest total area of any region in Ghana and consists of 16 administrative parts. The zone has ample rainfall from May to June and lesser rains from August to September. The three main vegetation types are savannah in the plains, southern outlier forest in the Accra plains, and southern marginal forest from Accra westward. Civil service, business ventures, farming, fishing, and trading are the primary professions in the area.

Sample Size

According to the 2021 PHC, the population of Ghana and the Greater Accra region were to be 30,792,608 and 5,455,692, respectively. The total population of Ghana was subjected to a software called Raosoft program with a 99% confidence level and a 1% margin of error. The sample size for the entire country was generated as 650. Following this, the sample size for the study was generated as follows:

$$\text{Sample size} = \frac{\text{Region population}}{\text{National population}} \times 100$$

$$= \frac{5{,}455{,}692}{30{,}792{,}608} \times 100 = 17.71\%$$

$$= \frac{17.71}{100} \times 650 = 115$$

Therefore, a sample of 150 respondents was used instead. This is because larger sample sizes can provide increased precision in estimates, greater statistical power, generalizability of results, and confidence in the results. They also reduce the impact of random variability and increase the chances of obtaining statistically significant results.

Data Collection Method

Questions regarding the details of the respondents were entered in the KoBo Toolbox, which was downloaded on the respondents' Android-enabled smartphones. The questions consisted of 4 main parts; (1) the Demographic background of the respondents (sex, gender, occupation, income, and education), (2) General protein questions (do you add protein to your diet?, frequency of protein consumption, reasons for protein consumption), (3) Animal protein-specific questions (Consumption pattern of animal protein, animal protein source preference, animal protein consumption) and (4) Plant protein-specific questions (Consumption pattern of plant protein, plant protein source preference, plant protein source consumption). KoBo Toolbox is a free and open-source online data entry tool developed by the Harvard Humanitarian initiative with support from organizations like Brigham and Women's Hospital and USAID.

The application can run on any device, as long as they have Android or iOS. The users can freely download the KoBo Toolbox application onto their Android device and enter the questionnaire into it; the data collected through this questionnaire will be kept in cloud storage by the application. After downloading the application, the device (phone/tablet) can be handed over to the field worker, who collects data from house to house. If there is an internet connectivity or mobile data package available in the device, the cloud-stored data can be sent to the central database immediately, or else, this could be done as soon as one reaches the internet hotspot.

Currently, the KoBoToolbox is widely used during humanitarian crises like natural calamities and unnatural disasters, as it is quick and less time-consuming. It has also been used in other fields, like wildlife and fisheries, to understand their hunting, consumption, and migratory patterns. In our survey, each household's global positioning system (GPS) coordinates from which the data was collected were also marked using mobile phones. All the data thus collected, along with the GPS coordinates, were kept as cloud storage in the KoBo application and sent to the authors' Google Drive.

Data Processing and Analysis

Primary data from the study were analyzed. Descriptive statistics, such as frequency tables, pie charts, and bar charts, were used to examine the data. Chi-square analysis was used to quantify respondents' levels of agreement and to find cross-tabulations of essential factors connected to Protein intake. After the Chi-square analysis, only statistically significant parameters were reported. All analysis for this study was conducted using the SPSS 18 statistical tool.

Results and discussion

The gender distributions of the respondents are shown in Figure 1. It was revealed that the majority (78.7%) of the respondents were women, and 21.3% were men. The questionnaires were distributed randomly to ensure a fair chance of the number of males and females getting selected. The higher number of females could be explained by the fact that females dominate the population of Ghana. A report published by O'Neill (2023) revealed that Ghana's female population amounted to approximately 16.46 million, while the male population amounted to approximately 16.38 million inhabitants in 2021. It means that even though the questionnaires were administered randomly, the probability of approaching a female is higher than that of a male.
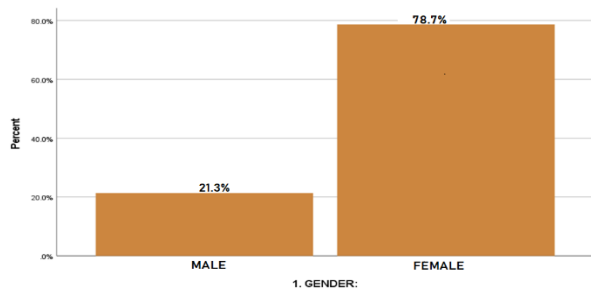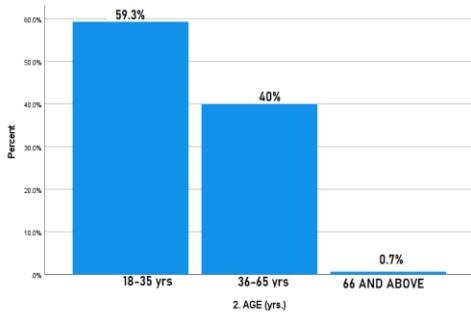
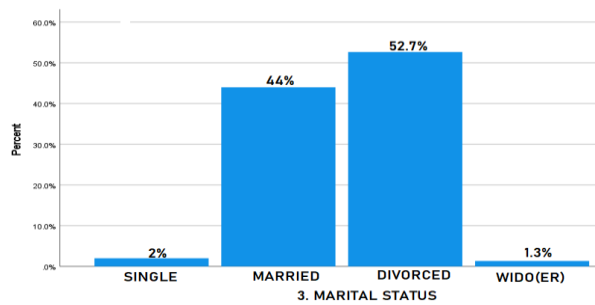Figure 1. Gender of respondents

Figure 2. Age of respondents

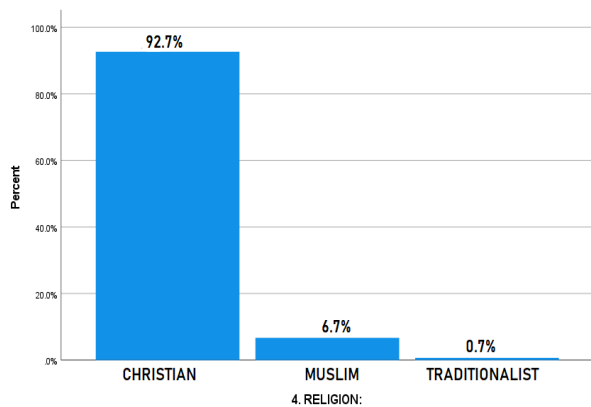Figure 3 Marital status of respondents

Figure 4. Religious background of respondents

Figure 2 is a representation of the age distribution of respondents in Galilea. It was revealed that the majority (59.3%) of the respondents were between the age group of 18-35 years, followed by 40% being between the age group of 36-65 years, and very few (0.7%) were 66 years and above. Similar to the pattern of age distribution observed in this survey, O'Neill (2023) reported that the population of Ghana in 2021 was characterized by a large number (59.27%) of individuals between the ages of 15-64 years,

37.25% between the age group of 0-14 years, and very (3.48%) being 66 years or older. According to the PHC, the highest percentage of the Ghanaian population is between the age group of 15-64, while the youth (18-35) are the majority, explaining the higher representation of that age group in the survey of the region.

The marital status of the respondents is shown in Figure 3. The majority (52.7%) of the respondents were divorced, followed by 44% being married, with 2% and 1.3% being single and widow(er), respectively. It reveals that the divorce rate in Ghana, particularly in the survey area, is gradually increasing, and many socio-economic factors may cause this gradual increase in the divorce rate. The 2021 population and housing census (PHC, 2021) conducted by the Ghana Statistical Service revealed that 553,065 people have their marriages dissolved while 405,090 have separated. 362,233 out of the 553,065 were women, and 190,832 were men, with a percentage of 65.5% and 34.5%, respectively. It may explain the number of divorced people observed in this survey compared to the other marital groups.

The religious background of the respondents is represented in Figure 4. Most (92.7%) of the participants were Christians, followed by 6.7% being Muslims and 0.7% Traditionalists, respectively. The population of Ghana is dominated by Christians belonging to various denominations. The PHC conducted by the Ghana Statistical Service in 2021 revealed that Christians in Ghana are 71.3%, with Muslims making up 19.9% of the total population (PHC, 2021).

The educational background of the respondents is shown in Figure 5. The majority (35.33%) of the respondents had high school education, with 33.33% having primary education, 11.33% with tertiary education, 6.67 having vocational/technical education and 13.33% uneducated. Education is free in Ghana's government-based primary and high schools, reflecting the higher percentage observed among these categories in the survey area. Tertiary education is the most expensive and difficult for parents due to the economic and financial crisis in the country. The increase in economic hardship and high rate of unemployment among educated and uneducated people over the last decade has created a high lack of interest in education, and many students tend to drop out while in high school or do not pursue higher education after high school. Due to financial constraints, others also pursue non-formal vocational careers like carpentry, fishing, or sewing at a very young age, thereby completely discarding any hope for formal education.

Figure 6 represents the employment history of the respondents. Most (49.33%) of the participants in the survey area were self-employed, with 40% being employed in the private or government sector and 10.67% being unemployed. The economy of Ghana has experienced sudden decline and instability over the past few years, which has rendered the government incapable of employing a large number of the population in the various government sectors leading to an increase in the unemployment rate. It has forced many civilians to open up small self-owned businesses such as tailoring, poultry farming, crop production, food vending, catering service, and travel agencies. This reason may account for the high percentage of self-employed respondents among the other

groups. Furthermore, Ghana is said to be faced with 12% youth unemployment and more than 50% underemployment, both higher than the overall unemployment rates in Sub-Saharan African countries (The World Bank, 2020).
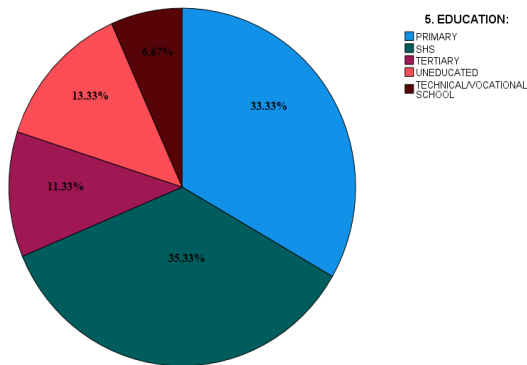

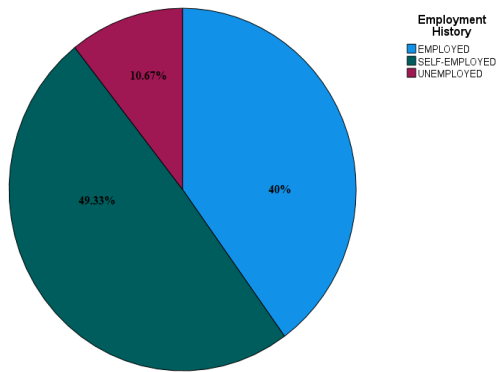Figure 5. Educational background of respondents
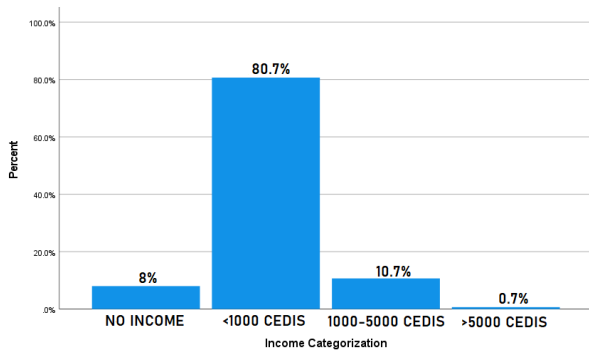

Figure 6. Employment history of respondents

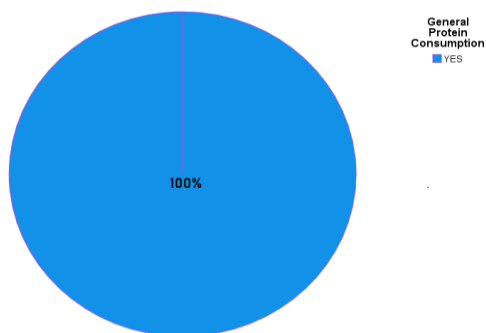Figure 7. Income status of respondents

Figure 8. General protein consumption

The income distribution of the respondents in Cedis (Ghanaian currency) is shown in Figure 7. Huge number (80.7%) of respondents earned less than 1000 Cedis per month, with 10.7% earning between 1000-5000 Cedis per month. 8.0% of the respondents have no monthly salary, and only 0.7% earn more than 5000 Cedis monthly. A report published by Anonymous (2023) revealed that Ghana's (highest, average, and lowest) monthly salary is 22,733, 5028, and 1438 Cedis, respectively. However, many self-employed or employed people, especially those working in small private enterprises, hardly earn 1000 Cedis per month. Moreover, the private sector is taking advantage of the high unemployment rate to obtain cheap labor, and they usually determine the employee's monthly salary, which is far below the expected figures published by the government or other Non-Governmental Organisations NGOs). For others, they are unemployed with no regular source of monthly income.

The participant's response regarding including protein (plant or animal-based) in their diet is shown in Figure 8. All the respondents chose 'YES,' indicating that they add protein to their diet. It agreed with apriori expectation as different types of affordable and expensive protein sources are consumed in Ghanaian households.

Information regarding the frequency of protein consumption as evaluated by the respondents is presented in Figure 9. Majority (64.67%) of the respondents consumed protein daily, with weekly and monthly consumption amounting to 32.67% and 2.67%, respectively. The availability of different types of protein, affordability, nutritional requirements, and cultural influences in Ghana have almost made it impossible to avoid the consumption of protein-based foodstuffs for a longer duration. Although carbohydrate foodstuffs are consumed in higher amounts, some traditional foods are prepared especially with protein-based foodstuffs and are highly patronized and consumed in large quantities.

Fig. 10 provides information about the reasons for the respondents' inclusion of protein in the diet. Most (76%) of the respondents added protein to their diet because of its health benefits, while a few (24%) added protein to their diet to add taste to the prepared dish. The growing concern about nutrition in Ghanaian society over the past years has gradually increased. Especially among growing infants, there has been a gradual educational campaign by the government to encourage parents to increase protein consumption to eradicate one of the child-killer diseases, kwashiorkor. Also, among the youth and the adults, for proper growth and development, there has been an educational campaign on television by the government. It has created awareness of the health benefits of protein inclusion in diet and the importance of consuming a balanced diet leading to some increase in protein consumption.

Figure 11 shows the nutritional status of the different types of protein as evaluated by the respondents. Most (37.3%) of the respondents chose plant protein as the most nutritious, followed by 30.0% responding that animal protein was the most nutritious however, 32.7% of the respondents did not know which type of protein was the most nutritious.
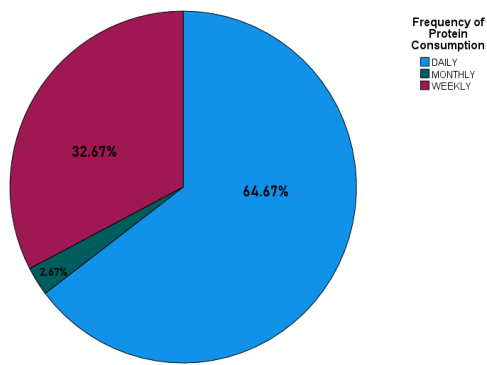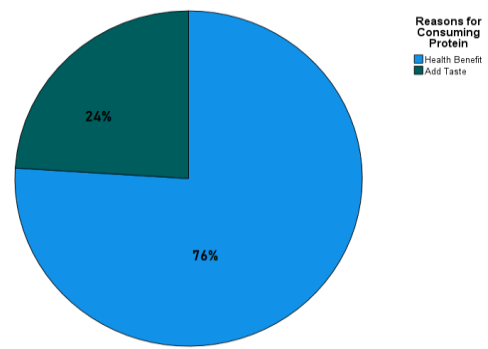
Figure 9. Frequency of protein consumption

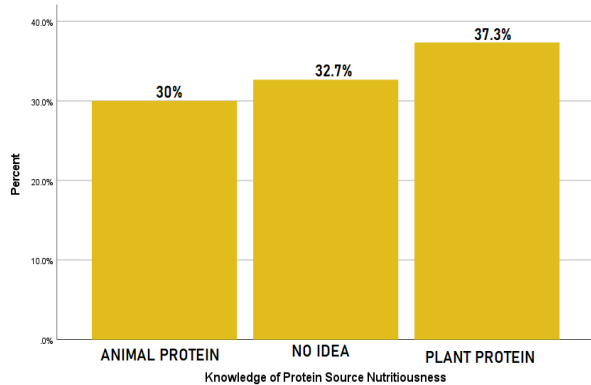Figure 10. Reasons for protein consumption

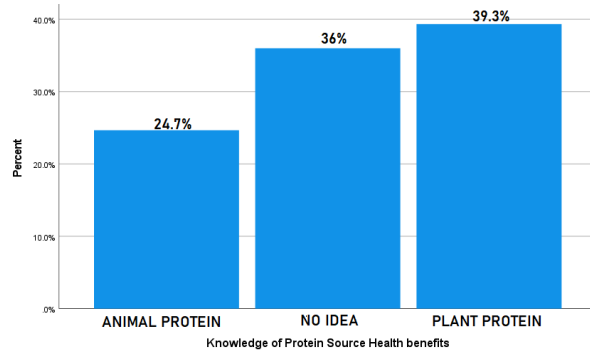Figure 11. Knowledge of protein source nutritiousness

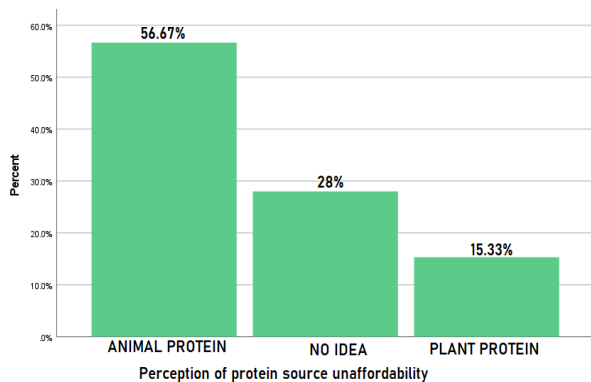Figure 12. Knowlege of protein source health benefits

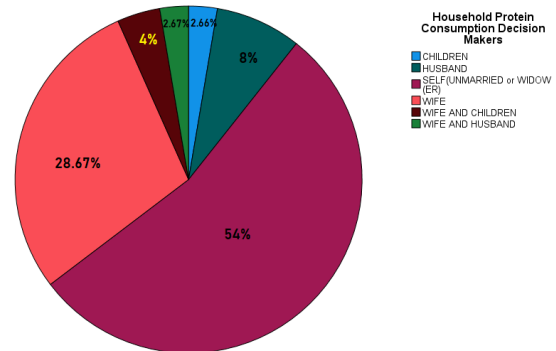Figure 13. Perception of protein source unaffordability

Figure 14. Household protein consumption decision makers

Generally in Ghana, beans, especially red beans, Bambara beans, and cowpea, are considered the staple legumes, and these beans are prepared in different delicious ways such as beans stew, waakye (rice and beans cooked together), gari and beans, which is commonly sold by food vendors or catering services, affordable and most preferred by Ghanaians especially, the youth with a poor history of employment.

The health benefits of the different protein sources as evaluated by the respondents are shown in Figure 12. It was revealed that most (39.3%) of the respondents indicated that plant protein is the most beneficial in terms of health, while 24.7% of the indicated that animal protein is the one with the most health benefits. However, 36% of the respondents did not know which type of protein was the best regarding health benefits. Over the past few years, there have been gradually increasing concerns among many people, especially older adults, about diseases and other health issues associated with

consuming poultry, egg, and red meat due to their cholesterol content. This realization has affected the consumption of animal protein, especially among the elderly. Studies like Bender, (1997), Larsson and Wolk (2006), and Richi et al. (2015) have shown and confirmed that higher meat consumption correlates to the incidence of conditions such as coronary vascular disease, diabetes type 2, cerebrovascular diseases, stroke, and colorectal cancer. Furthermore, high animal protein intake was positively associated with cardiovascular mortality, and high plant protein intake was inversely associated with all-cause and cardiovascular mortality (Song et al., 2016).

The respondent's perceptions of protein source unaffordability are resented in Figure 13. Majority (56.67%) responded to animal protein as the most expensive; 28% of respondents did not know which type of protein was the most expensive. However, 15.33% chose plant protein as the most expensive. Generally, the price of

many animal proteins, especially red meats, is twice that of most plant proteins in Ghana. However, some animal proteins, such as fish, are significantly cheaper than some plant proteins, such as soybeans and soy products.

Information about the decision makers on household protein-consumption status is shown in Figure 14. It was revealed that most (54%) of the respondents made the purchasing decision themselves, 28. 67% responded that the wife or mother makes the purchasing decision, 8% stated that the husband or father makes the decision, 2.67% responded to both wife and husband, and 4% stated both wife and children made the decision. Only a few respondents (2.66%) stated that the children made protein-purchasing decisions. In an average Ghanaian household, the wife or mother makes the purchasing decision for many food items and food preparation. The wife or mother, to some extent, may consult the husband or father since he is the head of the family and probably the primary provider for the family. The involvement of children in decision-making is shallow; however, in modern-day Ghanaian families, the parents gradually consider the children's opinions. Furthermore, the majority of the respondents were unmarried, indicating that they may be a high probability that they leave without partners or children.

Information regarding the most consumed types of protein is presented in Figure 15. Animal protein was the most (62.4%) consumed compared to plant protein (37.6%). Recently in Ghana, the domination of the broiler meat market by the cheap imported frozen chickens and the affordability of various types of fish coupled with the increasing prices of legumes is gradually shifting the interest of consumers from plant protein to these cheap animal proteins.

Furthermore, the reason for frequent consumption of the selected type of protein is presented in Figure 16. Majority (73.2%) of the respondents selected health benefits as the reason for the frequent consumption of the selected type of protein. In comparison, 20.1%, 2.0%, and 4.7% chose taste, affordability, and availability of the selected type of protein as the main reasons for consumption, respectively. Although the respondents knew the health implications of consuming more animal protein, its consumption was still higher than plant protein. Over recent years, the continuous rise in the prices of plant-based protein compared to some animal proteins, such as fish and imported frozen chicken, has increased the total consumption of animal-based protein.

Information regarding the respondents' most preferred type of protein is shown in Figure 17. The Majority (64.7%) of the respondents preferred animal compared to plant protein (35.3%). The higher preference for animal protein over plant protein could be attributed to its gradual increase, making it more expensive than some animal protein, mainly imported frozen chicken. The preference for animal protein was higher than the percentage of consumption (62.4%, Figure 15), indicating that there may be some economic or production factors limiting the accessibility of animal protein in the survey region.

The reasons for the preference of the selected type of protein are presented in Figure 18. The majority (72.7%) of the respondents preferred their selected type of protein due to its nutritional benefits, 25.3% of the respondents were influenced by taste, and only 2% preferred the selected type of protein due to its price.

Respondent's pattern of animal protein consumption is shown in Figure 19. Fish (58%) was the most consumed among the respondents, followed by chicken meat (18.67%), egg (17.33%), red meat (4%), and milk (2%) respectively. None of the respondents considered cheese a regularly consumed animal protein (0%).
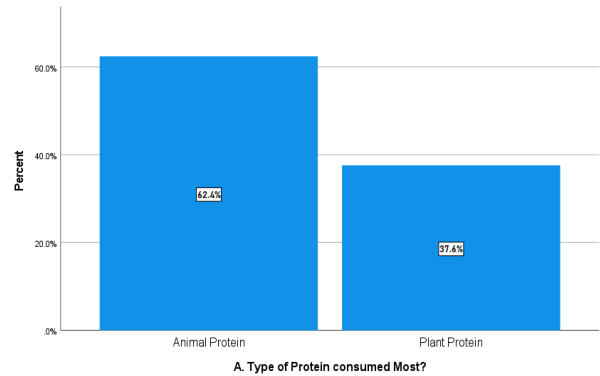

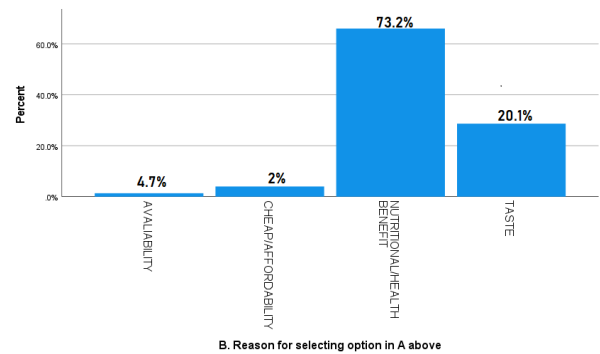Figure 15. Most consumed type of protein

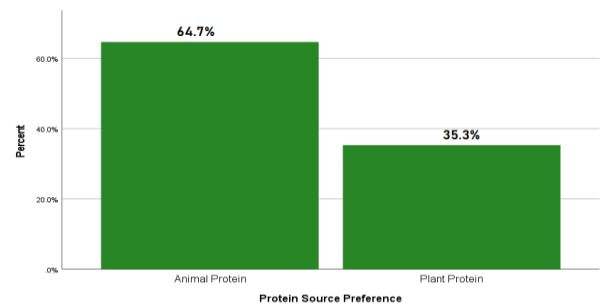Figure 16. Reasons for consumption of the above selected protein type

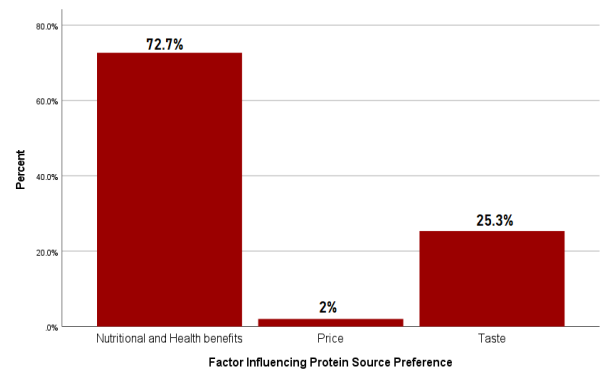Figure 17. Respondents protein source preference

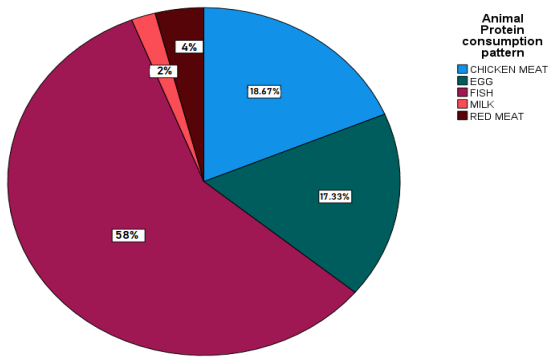Figure 18. Factors affecting protein source preference

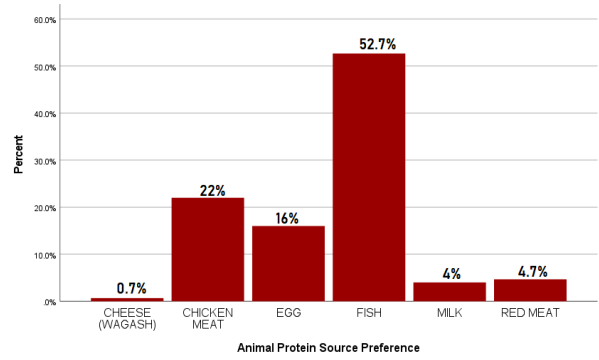Figure 19. Respondents animal protein consumption patterns

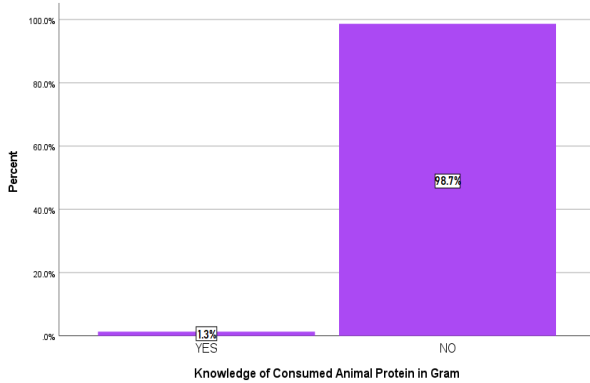Figure 20. Respondents' animal protein source preference

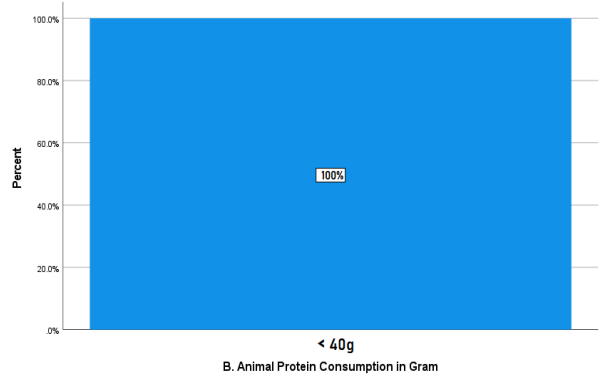Figure 21. Knowledge of the amount consumed animal protein

Figure 22. Respondents animal protein consumption (in grams)
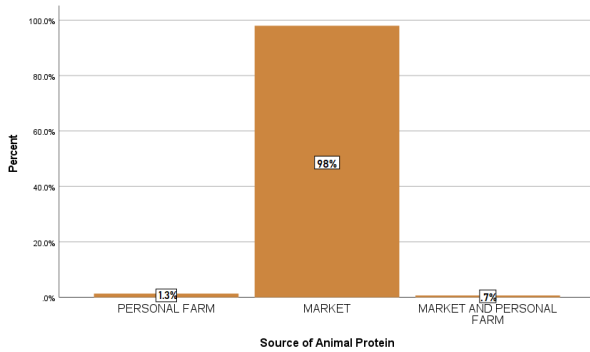
Figur. 23. Respondents' source of animal protein
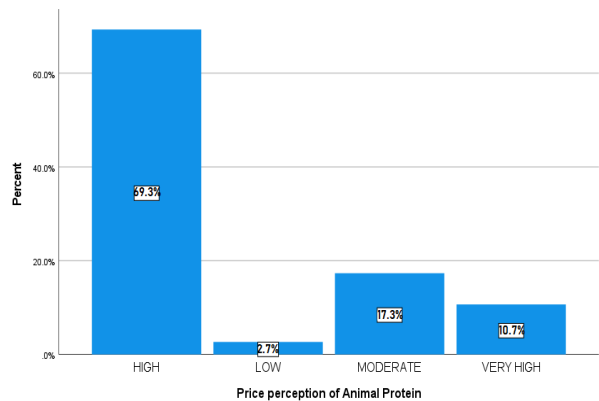
Figure 24. Respondents price perception of animal protein

Generally, in Ghana, fish is considered a cheap source of animal protein which is also more affordable by the large dominant poor population group. Furthermore, part of the Densu River stretches to the survey region, where people can perform fishing activities. It makes fish more accessible and affordable to people living in the survey area. Similar to our findings, Komatsu & Kıtanıshı (2015) also reported that fish was the primary source of animal protein in Southern Ghana. In Ghana, the per capita meat consumption was 9.2kg, supplemented by relatively higher fish consumption (26.2kg/capita/year) compared to the global average of 38kg (Speedy, 2003). Contrary to our findings, Mingle et al. (2021) reported higher chicken meat consumption than fish. The consumption of chicken meat is gradually increasing due to the availability of cheap imported frozen chicken meat in the Ghanaian market. Generally, red meat (beef, chevon, and mutton) is meager

among the average Ghanaian household except during festive seasons such as Eid and Christmas. Milk and other dairy products, such as cheese, are the least consumed in Ghana, especially in rural areas where their availability is meager.

Figure 20. represents the pattern of animal protein by preference by the respondents. Fish was still the most preferred animal protein with a percentage of 52.7 followed by 22%, 16%, 4.7%, and 4% and 0.7% for chicken meat, egg, red meat, milk, and cheese (wagashi), respectively. The number of respondents who consumed fish (58%, Figure 19) was lower than the number that preferred it. However, the number of respondents who preferred chicken meat was higher than the number who consumed it (18.67%, Figure 19). In a survey conducted by Sumberg et al. (2017), the authors reported that fish is becoming less critical, and poultry more important in

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Ghana. Furthermore, the number of people who preferred red meat, cheese (wagashi), and milk was higher than the number of people who consumed it. It indicates that the preference and consumption of a particular animal protein are affected by several factors.

Respondent's knowledge of their daily animal protein intake (in grams) is shown in Figure 21. Most (98.7%) of the respondents did not have any knowledge of the amount of animal protein they consume per day; however, 1.3% of the respondents knew the amount of animal protein they consumed daily. In general, many Ghanaians do not know how much protein they consume daily, except for the elite elderly group (55 years and above) keen on their diet to avoid the risk of exposure to certain illnesses such as diabetes.

Furthermore, the respondents' daily animal protein intake (in grams) is shown in Figure 22. All the respondents consumed less than 40g of animal protein per day.

The sources of the respondent's animal protein are shown in Figure 23. Most (98%) of the respondents bought their animal protein from the market, 1.3% had their animal protein from their farms, and only 0.7% bought it from the market and their farms. In Ghana, especially in the rural communities, many families live in compound houses with backyard farms for rearing cattle, sheep, goats, and poultry for either income or personal consumption. However, in big towns like Galilea, where people live in apartments, they rely more on the market for foodstuffs.

Price perception of animal protein is shown in Figure 24. The Majority (69.3%) of the respondents evaluated the price of animal protein as high, 10.7%, 17.3%, and 2.7% evaluated the price as very high, moderate, and low, respectively. The general price of animal protein for the average Ghanaian with a poor employment history is high. It is because meat from locally reared chickens, bush meat, beef, mutton, and chevon is costly apart from the imported frozen chicken and fish.

The frequency of animal protein consumption is presented in Figure 25. Most (48%) of the respondents consumed animal protein daily, 44.67% weekly, and only 7.33% consumed animal protein monthly. Animal protein sources are widespread in Ghana, ranging from low to very high in terms of prices, so for even the average poor Ghanaian, there is some regular animal protein intake, although its consumption may be limited.

Respondents' consumption patterns of the various types the plant protein are listed in Figure 26. The majority (61.33%) of the respondents consumed waakye (cowpea or black eye peas), 20% consumed groundnut, 12.67% consumed Agushie while the consumption of Bambara, soybeans and red beans was only 2% for each. Waakye (cowpea or black eye peas) is the most consumed legume in Ghana, especially in the southern and western parts of the country. USDA (2023) reported that the per capita consumption of cowpeas or black-eyed peas in Ghana reached 10. kg during the market year 2022-2023. Groundnut is also consumed together alone or with a Banana as a snack in large quantity, which most Ghanaians prefer. However, in southern Ghana, Bambara and red beans are not well known to the people, and soybeans are too expensive, making them not very common in the market. It may explain the lowest consumption among these groups of legumes.

Figure 25. Respondents frequency of animal protein consumptions

Figure 26. Respondents pattern of plant protein consumption

Figure 27. Respondents pattern of plant protein preference

Figure 28. Respondents knowledge of plant protein consumption (in grams)
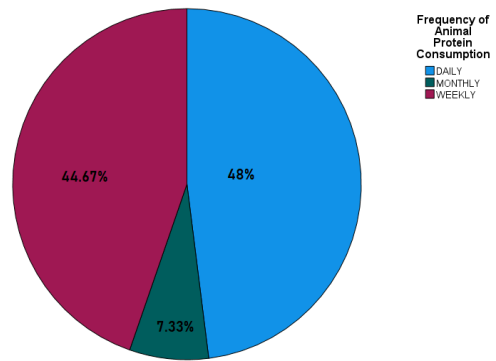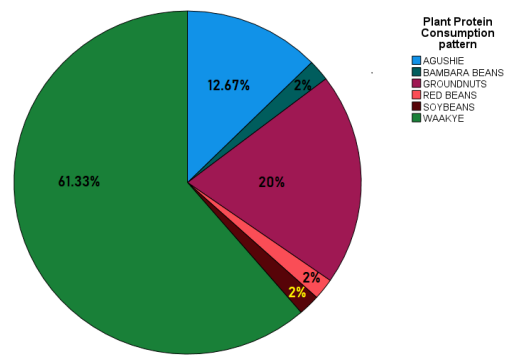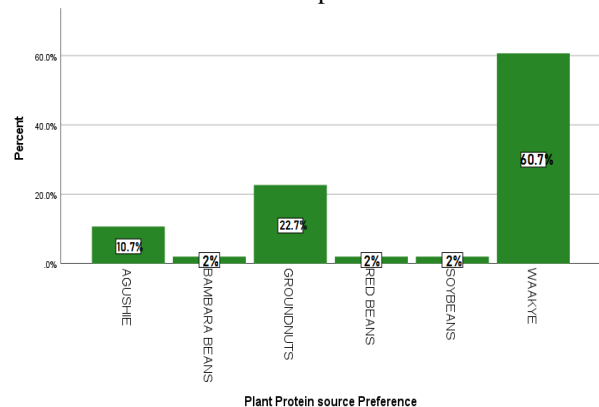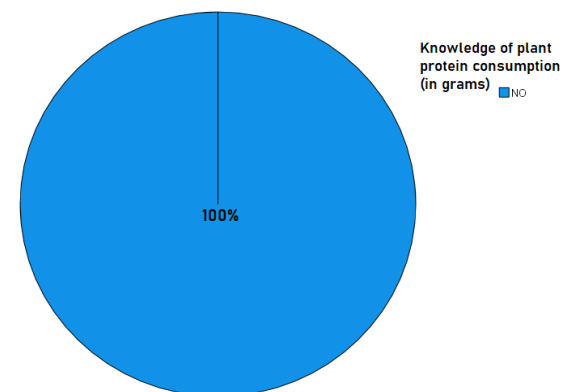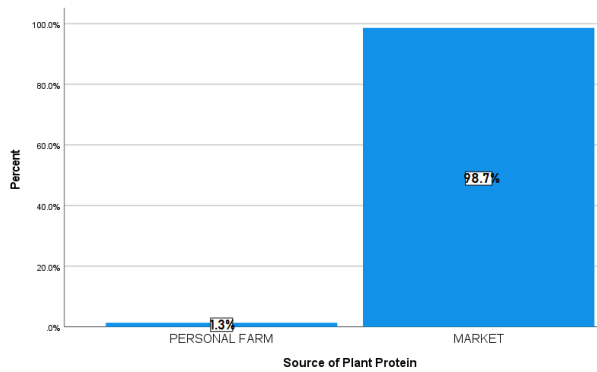
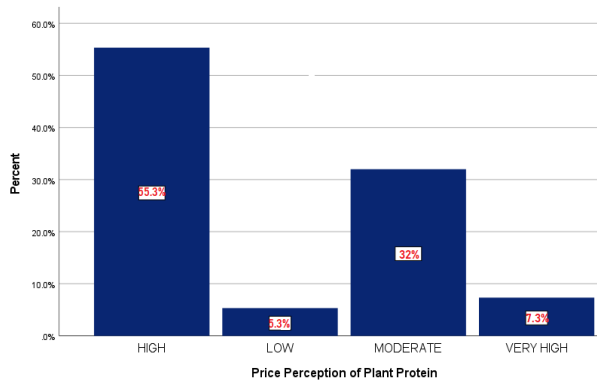Figure 29. Respondents' source of plant protein

Figure 30. Respondents' price perception of plant protein
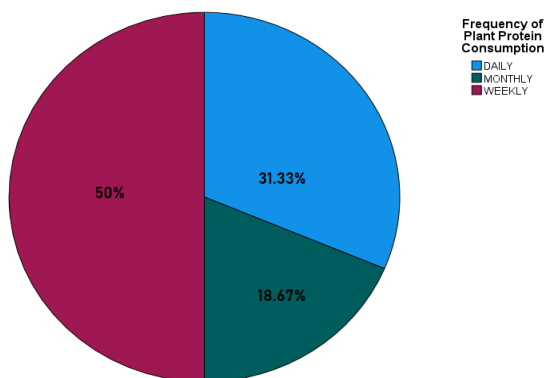

Figure 31. Frequency of plant protein consumption by respondents

Figure 27 represents the pattern of the respondents' plant protein preference. The preference for waakye was 60.7%, followed by 22.7% and 10.7% for groundnut and Agushie, respectively. The preference for red beans, Bambara beans, and soybeans was 2% for each commodity. The preference for waakye beans was slightly lower (0.63%) than the consumption; however, the preference for groundnut was 2.7% higher. There was no numerical difference between the preference and consumption of red beans, Bambara beans, and soybeans. This may be attributed to the uncommonness of these commodities in southern Ghana, and the lack of interest in consuming them, especially in the survey community.

Respondent's knowledge of their plant protein daily plant protein intake is shown in Figure 28. None of the respondents had any idea of their daily plant protein intake. It is prevalent in Ghana, where most people ignore their diets. Food consumption in Ghana among the majority of the average poor population is purposely to quench hunger.

The source of respondents' plant protein is presented in Figure 29. 98.7% of the respondents obtained their plant proteins from the market, while 1.3% obtained theirs from their farms. With the survey community being an urban part of Ghana with giant supermarkets and small farming activities, it was apparent that most respondents would acquire their proteins from the market; however, few of the respondents had personal backyard farms where legumes grew for personal usage and sale.

Figure 30 is the price perception of plant protein evaluated by the respondents. The majority (55.3%) indicated that plant protein was high, with 7.3%, 32%, and 5.3% rating the price as very high, moderate, and low, respectively. Plant proteins, except soybeans, are generally cheaper; however, the current economic crisis has increased the price of food commodities, thereby increasing the price of plant proteins, but not higher than the general price of animal protein.

The respondent's frequency of plant protein consumption is shown in Figure 31. The percentage of respondents who consumed plant protein daily was 31.33%, followed by 50% and 18.67% consuming plant protein weekly and monthly, respectively. Comparing the frequency of plant protein consumption to the frequency of animal protein consumption, it was observed that the daily consumption of animal protein was numerically (16.67%) higher than the daily consumption of plant protein among the respondents. It indicates that the current rise in the market price of plant protein is gradually shifting the intake of protein sources more towards to animal protein consumption.

The connection between gender and knowledge of protein source nutritiousness is reported in Table 1. The connection was observed to be significant (P=0.018). Out of the total number (32) of male respondents, 4 had no idea which type of protein was the most nutritious. While 14 of the male respondents indicated that animal protein was the most nutritious, the remainder 14 respondents indicated that plant protein was the most nutritious. Most (45) of the female respondents had no idea which type of protein was the most nutritious. However, 42 female respondents indicated plant protein was the most nutritious, while 31 indicated animal protein was the most nutritious. It reveals that the male respondents in this survey had more knowledge about protein's nutritiousness than the female respondents, and this could be attributed to a higher number of men pursuing higher education than women in Ghana.

The connection between gender and knowledge of protein source health benefits is shown in Table 2. The connection was significant (P=0.002). Most males chose plant protein as the healthiest however, very few had no idea which protein was the healthiest. Most females had no idea which type of protein was the healthiest. However, 41 female respondents indicated plant protein as the healthiest, while 26 indicated animal protein as the healthiest, indicating plant protein as having higher health benefits than animal protein. Similarly, we can conclude that the men in the survey region had more knowledge about the health benefits of protein compared to the women, and this could be because men are the ones who are more likely to be educated in Ghana than women.

Table 1. Gender and knowledge of protein source nutritiousness

		Gender * knowledge of protein source nutritiousness cross-tabulation			
		Knowledge of protein source nutritiousness			
		Animal Protein	No Idea	Plant Protein	Total
Gender	Male	14	4	14	32
	Female	31	45	42	118
Total		45	49	56	150

$\chi^2=8.077$, degree of freedom=2 probability=0.018 (significant)

Table 2. Gender and knowledge of protein source health benefits

		Gender * Knowledge of protein Source Health benefits Cross tabulation			
		Knowledge of Protein Source Health benefits			
		Animal Protein	No Idea	Plant Protein	Total
Gender	Male	11	3	18	32
	Female	26	51	41	118
Total		37	54	59	150

$\chi^2=12.524$, degree of freedom=2 probability=0.002 (significant)

Table 3. Gender and price perception of animal protein

		Gender * Price Perception of Animal Protein Cross Tabulation				
		Animal Protein Consumption Pattern				
		High	Low	Moderate	Very High	Total
Gender	Male	20	3	7	2	32
	Female	84	1	19	14	118
Total		104	4	26	16	150

$X^2=8.367$, Degree of Freedom=3 Probability=0.039 (Significant)

Table 4. Educational level and pattern of animal protein consumption

		Educational categories * Animal Protein consumption pattern Cross-tabulation					
		Animal Protein consumption pattern					
		Chicken Meat	Egg	Fish	Milk	Red Meat	Total
Education categories	Primary	10	9	29	1	1	50
	Shs	10	12	28	0	3	53
	Tertiary	6	1	8	0	2	17
	Uneducated	1	3	16	0	0	20
	Technical/Vocational School	1	1	6	2	0	10
Total		28	26	87	3	6	150

*SHS: Senior High School; $\chi^2=32.402$; degree of freedom=16; probability=0.009 (significant)

The connection between gender and price perception of animal protein is reported in Table 3. The link between the parameters was significant (P=0.039), indicating that the gender of the respondents influenced their price perception of animal protein. The majority of the males indicated the price of animal protein was high, followed by being moderate or low, and very few indicated the price was very high; respectively, however, the majority of the females indicated the price was high, followed by being moderate, very high with very few indicating that the price was low respectively. The differences in categorization may be because men are the most employed gender in Ghana and are more likely to get paid more than women, even if they may be employed in the office.

The link between the educational level and the pattern of animal protein consumption was analyzed, and the result is reported in Table 4. It was observed that the connection was significant (P=0.009), indicating that the educational background of the respondents influenced their pattern of animal protein consumption. Fish followed by chicken meat were the most consumed among the majority of the educational groups respectively and the least consumed were milk and red meat. This indicates that all the respondents irrespective of their educational level will still go for the cheap or affordable animal protein available in the market to cut down costs.

The connection between income categories and the pattern of animal protein consumption is shown in Table 5. It was revealed that the connection between them was statistically significant (P=0.001), indicating that the income of the respondents influenced the pattern of animal protein consumption. Fish was the most consumed for those earning less than 1000 Cedis however, for the respondents with no salary, egg consumption was the highest. The consumption of chicken meat was highest for respondents that earned between 1000-5000 Cedis, and the outlier; was the only respondents that earned more than 5000 Cedis consumed fish. Looking at this consumption pattern, it can deduced that for poor people in the survey community, fish is the most appropriate source of protein however, people with slightly higher income may prefer meat and the cheapest they can afford is chicken meat.

The connection between income category and price perception of animal protein is shown in Table 6. It was observed that the connection was significant (P=0.018), indicating that the income of the respondents influenced their purchase of a particular type of animal protein.

Table 5. Income Categorization and Pattern of Animal Protein Consumption

Income Categorization * Animal Protein consumption pattern Cross-tabulation							
		Animal protein consumption pattern					Total
		Chicken Meat	Egg	Fish	Milk	Red Meat	
Income level	No Income	1	5	4	2	0	12
	Less Than 1000	20	17	77	1	6	121
	1000-5000	7	4	5	0	0	16
	More Than 5000	0	0	1	0	0	1
Total		28	26	87	3	6	150

$\chi 2$=31.848; degree of freedom=16; probability=0.001 (significant)

Table 6. Income Categorization and Price Perception of Animal Protein

Income categorization*Price perception of Animal Protein						
		High	Low	Moderate	Very High	Total
Income Categorization (Cedis)	No Income	9	0	1	2	12
	Less Than 1000	86	2	20	13	121
	1000-5000	9	2	5	0	16
	More Than 5000	0	0	0	1	1
Total		104	4	26	16	150

$\chi 2$=19.973; degree of freedom=9; probability=0.018 (significant)

Table 7. Educational Categories* Knowledge of the amount (grams)of Animal Protein consumed per day

Educational categories* Knowledge of the amount (grams)of daily Animal Protein Intake Cross tabulation				
Knowledge of the amount (grams)of Animal Protein consumed				
		Yes	No	Total
Educational Categories	Primary	0	50	50
	Shs	0	53	53
	Tertiary	2	15	17
	Uneducated	0	20	20
	Technical/Vocational	0	10	10
	Total	2	148	150

*SHS: Senior High School; $\chi 2$=15.859; degree of freedom=4; probability=0.003 (significant)

Table 8. Employment History and price perception of animal protein

Price Perception of Animal Protein						
Employment history and price perception of animal protein						
		High	Low	Moderate	Very High	Total
Employment History	Employed	47	1	10	2	60
	Self-Employed	48	1	11	14	74
	Unemployed	9	2	5	0	16
	Total	104	4	26	16	150

$\chi 2$=19.334; degree of freedom=6; probability=0.004 (significant)

All the income categories except those earning more than 5000 Cedis per month rated the price of animal protein as high with very few respondents who rated the price as low, moderate, or very high. This means that the increase in the prices of food items has affected everyone almost equally irrespective of their income category. The findings agree with Popkim et al.,(2012), Al Sayed et al. (2019), Yu & Shimokawa (2016), Yaseen et al. (2014), and Adreoli et al. (2021) who agree that the duality effect of income and price play a significant role in shaping the preference and consumption of protein intake in developing countries.

The link between educational categories and knowledge of the amount of animal protein consumption in grams is presented in Table 7. The connection was significant (P=0.003). None of the respondents from the various educational categories had any idea of their daily protein intake however, very few (2) of the respondents with tertiary education knew the amount of animal protein they consumed daily and this could be due to the increased awareness of nutrition-health implications among people with higher educational background. This findings agrees with the work of Jackson et al., (2022) who asserted that nutrition education combined with a per-meal protein prescription and diet coaching has been effective in enhancing protein intake and muscle health in adults.

The relationship between employment history and price perception of animal protein is shown in Table 8. It was observed that the connection between the two variables was significant (P=0.004). The respondent's employment status influenced their price perception of animal protein. Most respondents in the various employment categories rated the price of animal protein as high with very few rating it as low. This means that irrespective of the employment status of the respondent, some may find it difficult to purchase animal protein regularly or respondents might not be willing to incur the extra cost associated with the daily intake of animal protein.

The connection between the educational categories and the pattern of plant protein consumption is reported in Table 9. The connection was observed to be significant (P=0.006). The most consumed plant protein for all the educational groups is waakye beans or cowpea and groundnut respectively, with red beans, bambara beans, soyabeans and agushie being the least consumed. We can conclude that people in the survey region irrespective of their educational background may have some resilient towards the consumption of red beans, bambara, beans compared to cowpeas and are also be willing to pay for the higher prices of soyabeans.

Information about the connection between income categories and patterns of plant protein consumption is shown in Table 10. The connection was significant (P=0.046), with waakye or cowpea being the most consumed among all the income categories except for the respondent, earning more than 5000 Cedis. We observed that irrespective of the income category, most respondents were more willing to consume cowpeas compared to the other plant proteins as they associate it with being the most delicious.

The connection between Educational categories and the price perception of plant protein is shown in Table 11. The connection was significant (P=0.009), indicating that the educational level of the respondents influenced their price perception of plant protein. Most respondents with high school and tertiary education rated the price moderate. However, the majority of the uneducated respondents and those with primary education rated the price as high. The uneducated respondents and those with primary education are those likely to be earning the least monthly income which may have a higher influence on their purchasing power especially if they are married respondents.

The connection between employment categories and price perception of plant protein is reported in Table 12. The connection was observed to be significant (P= 0.033). Most of the respondents in the various employment categories, except the unemployed respondents, rated the price of plant protein as high. This reflects the high economic hardship in the country which is being felt by almost everyone in the country either rich or poor.

Table 9. Education Categories and Pattern of Plant Protein Consumption

		Education categories * Plant Protein Consumption pattern Cross-tabulation						
		Plant Protein Consumption Pattern						Total
		Agushie	Bambara Beans	Groundnuts	Red Beans	Soybeans	Waakye	
Education categories	Primary	12	0	12	0	1	25	50
	Shs	2	1	10	0	0	40	53
	Tertiary	2	0	3	2	0	10	17
	Uneducated	3	2	4	1	1	9	20
	TVS	0	0	1	0	1	8	10
Total		19	3	30	3	3	92	150

*SHS: Senior High School; χ2=39.662; degree of freedom=20; probability=0.006 (significant); TVS: Technical/Vocational School

Table 10 Income Categorization and Plant Protein Consumption Pattern

		Income Categorization * Plant Protein Consumption pattern Cross-tabulation						
		Plant Protein Consumption Pattern						Total
		Agushie	Bambara Beans	Groundnuts	Red Beans	Soybeans	Waakye	
Income Categorization (Cedis)	No Income	0	0	2	2	0	8	12
	Less Than 1000	17	3	25	1	3	72	121
	1000-5000	1	0	3	0	0	12	16
	More Than 5000	1	0	0	0	0	0	1
Total		19	3	30	3	3	92	150

χ2=25.290; degree of freedom=15; probability=0.046 (significant)

Table 11 Educational Categories and Price Perception of Plant Protein

		Education categories*Price Perception of Plant Protein				
		Price Perception of Plant Protein				Total
		High	Low	Moderate	Very High	
Education categories	Primary	34	5	9	2	50
	Shs	23	1	26	3	53
	Tertiary	6	1	7	3	17
	Uneducated	16	0	2	2	20
	Technical/Vocational School	4	1	4	1	10
Total		83	8	48	11	150

*SHS: Senior High School; χ2=36.6649; degree of freedom=12; probability=0.009 (significant)

Table 12. Employment categories and Price Perception of Plant Protein

| | | \multicolumn{4}{c}{Price Perception of Plant Protein} | Total |
		High	Low	Moderate	Very High	
Employment categories	Employed	34	3	21	2	60
	Self-Employed	43	5	17	9	74
	Unemployed	6	0	10	0	16
	Total	83	8	48	11	150

χ2= 13.729; degree of freedom= 6; probability= 0.033 (significant)

Table 13 Gender and frequency of plant protein

| Gender*Frequency of Plant Protein Consumption |
		Daily	Monthly	Weekly	Total
Gender	Male	16	4	12	32
	Female	31	24	63	118
	Total	47	28	75	150

χ2= 6.623; degree of freedom= 2; probability= 0.03 (significant)

The relationship between gender and the frequency of plant protein is reported in Table 13. The connection was observed to be significant (P=0.036). It was observed that most females consumed plant protein weekly, followed by 31 and 24 respondents consuming plant protein daily and monthly, respectively. However, the majority of the men consumed plant protein daily, with 12 and 4 respondents consuming plant protein on a weekly and monthly basis, respectively. The higher daily consumption of plant protein among men could be attributed to the fact that men are the most employed gender in many Ghanaian households and working sectors giving them the advantage of being able to afford cheap protein sources regularly.

Conclusion

This study reveals that protein intake (both plant and animal) is deficient in the survey region (Ga South Municipality), with remarkably few people having an idea about their daily protein intake. Based on the findings of this survey, there is an urgent need for an educational campaign through electronic and printout media to educate people in the survey region and Ghana in general about the importance of protein benefits and its deficiency. This educational campaign should be available in English and local dialects if possible. Subsidies should be provided to the local farmers to encourage them to produce more and reduce the production cost, reducing the rising prices of the locally reared or grown produce. Knowledge about the daily, weekly, and monthly recommended plant and animal protein levels for healthy growth and avoiding health risks should be available to the public. Any native misconceptions or myths associated with consuming a particular type of protein should be cleared or given scientific proof. Furthermore, The nutritional problem or protein deficiency in Ghana, especially among children in the survey region, can be solved by encouraging the natives in that region to increase the production and consumption of red beans, Bambara beans, and Agushie, which are the cheapest sources of plants however not abundant or consumed in large quantities in the southern regions. It will help fight kwashiorkor, a disease marked by severe protein malnutrition among infants and children.

Additionally, to eradicate price-related problems that reduce access to protein, policymakers should promote local production, and encourage and support local production of protein-rich foods to reduce dependency on imported protein sources. Incentives and subsidies aimed at implementing targeted policies that provide incentives and subsidies for producing, distributing, and consuming affordable protein sources should be pursued. Transportation-related problems and logistics are often culprits that bloat the prices of food, such issues should be addressed and effective alternatives should be sought on how to move food from the farm to market in a cheaper manner. Nothing passes education, the government and concerned individuals should conduct educational campaigns to increase consumer awareness about the benefits of protein-rich foods and the range of affordable protein alternatives available. Finally, policymakers must consider regulatory measures to prevent price gouging and ensure fair pricing of protein products. This can involve monitoring and regulating the pricing practices of protein suppliers, particularly in cases where monopolies or oligopolies exist.

Declarations

This research was presented at the 3rd International Congress of the Turkish Journal of Agriculture - Food Science and Technology, Malatya, Turkiye, held on 13 and 16 September 2023 (as an oral presentation).

Ethic Report
The ethic report for this survey was granted by the ethic committee of Cukurova University, Adana, Turkiye on 07.03. 2024 (22/03/2024-967016)

Conflict of Interest
The authors declare no conflict of interest.

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