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PERCEPTION AND PREFERENCE OF CONSUMERS ON THE QUALITY OF MUTTON-BASED ON THE TYPE OF FEED FED TO SHEEP IN GHANA

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ABSTRACT

Feeding livestock plays a significant role in the determination of meat quality. Consumers usually assess boiled meat quality based on tenderness, flavor and juiciness. Flavor and tenderness appear to be the vital sensory features that define meat quality. The objectives of this study were: i) To assess factors that influence consumers choice of meat and their awareness of organic livestock farming and ii) To evaluate the effect of diet on the quality of cooked mutton samples as perceived by respondents. Structured questionnaires were administered to one hundred respondents. Thirty-two ram lambs (14.16 ± 1.53 kg) were fed urea treated rice straw (UT), *Albizia lebbek* (AL), *Moringa oleifera* (MO), *Millettia thonningii* (MT), AL+MO, AL+MT, AL+MO+MT and MO+MT. After three months of feeding, one ram on each of the diets was randomly selected, dressed, labelled and frozen for a month. Mutton from each treatment was cut into pieces of about 30 g and boiled separately until it was well cooked. Then, the eight pieces of mutton were placed in eight different disposable cups and coded A to H. Each respondent consumed the eight mutton samples and provided answers to questions on meat quality in the questionnaire. Quantitative data were entered into Microsoft Excel Programme. Data were summarized and analysed using SPSS. Descriptive statistics such as bar charts were used. Data on preference of mutton were subjected to analysis of variance using SPSS. Most respondents representing 47 % enumerated the nutritional value of meat as the most important factor when purchasing meat. This was closely followed by safety and health factor. Taste was scored as a very important attribute with 72 % of respondents, closely followed by freshness of meat with 71 %. Respondents with moderate knowledge in organic livestock farming were the highest and the rest (high and no knowledge) were not different from each other according to the error bars. Mutton sample obtained from sheep fed MO+MT was the most preferred and MO was the least. It is recommended that, feeding combinations of browse leaves should be encouraged especially MO+MT. The study revealed the need to intensify education on organic livestock farming.

Key words: Browse leaves; meat quality; mutton; organic livestock farming, Ghana

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INTRODUCTION

The global consumption of mutton is around 2.5 kg per person per annum, while the total animal protein is 41.6 kg per person per annum [1]. However, these statistics will change as the worldwide projections point to an increase in the global production of mutton, especially in developing countries [2]. This is mainly due to adaptation to new habits of consumption of meat products based on health concerns. The rise in mutton consumption is due to its higher contents of omega-3 polyunsaturated fatty acids and polyunsaturated fatty acid biohydrogenation intermediate including conjugated linoleic acid, which are linked to potential beneficial effects on human well-being and health [3].

The population of small ruminants surpassed a total of two billion and are mostly dominant in developing countries where meat production is prime [4]. Feeding strategy is the predominant determinant for the production of quality meat [5, 6]. There is also an understanding of the impact of feed composition on muscle deposition which has been proven through the years [7]. Mutton composition varies and is affected by numerous factors, such as husbandry systems and slaughter weight [8, 9]. However, feeding plays a significant role in the determination of meat quality [6]. Some forages such as *Leucaena leucocephala* and *Gliricidia sepium* may have an injurious effect on various meat quality characteristics including sensory traits through the presence of anti-nutritional factors [10]. Some examples of anti-nutritional factors are tannins, saponins, phenolics and glycosides. However, meat from small ruminants is an important source of protein, minerals and vitamins for human nutrition [11].

Consumers are affected by many factors that can control their mental and emotional actions towards meat. The role of psychological influences on people's behaviour has been extensively investigated and described in scientific literature, especially in relation to the selection and purchase of different products [12, 13]. Consumer attitudes and beliefs about meat and meat products depend on the product itself as well as the features of the processor [14] or origin [9]. Even though the general public claims to be alarmed about issues such as animal welfare and strongly believes that it should be assured, in some cases they do not tend to think about that when purchasing meat especially in developing countries [15,16].

Preferences, perceptions and demand for meat with a focus on food safety have been the cardinal point of many studies [9, 17, 18, 19, 20, 21]. Organic livestock farming is gradually increasing due to its safety and health benefits. Countless factors affect meat quality. Factors such as breed, age and sex can be considered as intrinsic factors that affect meat quality, whereas diet, weather and slaughtering strategies can be considered as extrinsic factors [6, 22]. Consumers usually assess



boiled meat quality based on tenderness, flavor and juiciness. Flavor and tenderness appear to be the vital sensory features that define meat quality [13, 23, 24]. Consumers are prejudiced towards tenderness, flavour, and juiciness of meat [25]. Factors that influence consumers' decisions on meat preference, knowledge on organic livestock farming and the influence of feeds on mutton quality in Sub-Saharan Africa have not been extensively studied. Therefore, the objectives of this study were to assess factors that influence consumers to buy meat, consumers' awareness of organic livestock farming and the effect of diet on the quality of cooked mutton perceived by respondents after tasting mutton samples. This study sought to answer the following questions: i) Which factor was the highest in influencing the purchase of meat? ii) What factors determine meat quality and safety? iii) What causes leanness of meat? iv) How much were consumers willing to pay for organic livestock products? v) What were the levels of knowledge in organic livestock farming and standards? and vi) Which of the mutton samples were most preferred?

MATERIALS AND METHODS

Study area

This study was carried out at Livestock and Poultry Research Centre, University of Ghana, Legon (5°68'N, 0°10'W). Total annual rainfall ranges from 508 mm to 743 mm, with a bimodal pattern. The major and minor rains occur in March to June and September to October respectively. Temperature varies between 32.22 °C and 34.49 °C [26]. Relative humidity is from 36.60 % to 73.73 % [26].

Administration of questionnaires and preference of mutton

A pre-test of the questionnaire was done prior to the actual test to assess the suitability of the questionnaire. Fifteen respondents were used in the pre-testing comprising of 5 staff members, 5 students and 5 farmer trainees at the conference room at Livestock and Poultry Research Centre, Legon. The pre-testing revealed that respondents were more comfortable with the provision of options to choose from and this was done. Closed-ended structured questionnaire in English language were administered face to face in July 2018 randomly to one hundred respondents comprising of second year Agricultural science students, Leventis Foundation farmer trainees and staff members of Livestock and Poultry Research Centre, all from School of Agriculture, College of Basic and Applied Sciences, University of Ghana. All the respondents came from the various regions of Ghana especially the farmer trainees were selected from the 16 regions of Ghana, providing a representation of the people of Ghana. The sample size of one hundred was determined based on the mutton samples obtained from each sheep selected.



Feeding, animal management and tasting of mutton samples

Thirty-two ram lambs (14.16 ± 1.53 kg) were blocked by weight into 8 groups and the groups were then randomly allocated into the following treatment diets: urea treated rice straw (UT), *Albizia lebbek* (AL), *Moringa oleifera* (MO), *Millettia thonningii* (MT), AL+MO, AL+MT, AL+MO+MT and MO+MT. The ram lambs were fed *ad libitum* for three months as described [27]. Chemical composition of feeds fed to sheep can be seen in Table 1. After, three months of feeding, one ram on each of the diets was randomly selected and humanely slaughtered and the carcass was coded (A to H) and then refrigerated for a month. Mutton obtained from the thigh of sheep from each treatment was cut into pieces of about 30 g and boiled at 100 °C for one hour separately for each treatment. Then, the eight pieces of mutton were placed in eight different disposable cups and coded. Each respondent tasted each of the eight different mutton samples and provided answers to questions on meat qualities in the questionnaire in the conference room at the Livestock and Poultry Research Centre, University of Ghana, Legon.

Statistical analysis

Quantitative data were compiled and analysed using SPSS [28]. Descriptive statistics such as frequencies, proportions, measures of central tendency and dispersion were used to summarize biodata of the respondents, their perceptions as well as factors influencing consumers to buy meat. Error bars were applied to the bar charts at an error amount at fixed value of 5. Data on preference for mutton were subjected to Analysis of variance (ANOVA) using SPSS [28]. Statistical Package for Social Sciences (SPSS) version 28.0 was used for data entry and analysis. Items with missing data were treated as discrete missing values and were excluded from the analysis. Continuous variables were described as mean and \pm standard deviation (SD). The homogeneity of variance was conducted using analysis of variance and the assumptions were met. One-way analysis of variance (ANOVA) test was employed to compare the continuous variables among three or more groups. The statistical significance was determined at $p \leq 0.05$ to identify the significance difference between groups.

RESULTS AND DISCUSSION

Biodata of respondent

Eighty-one (81) respondents out of the total sampled population, representing 81 % were males and 19 % representing females (Table 2). The majority of respondents fell between 18 and 30 years age bracket, forming 65 % of entire respondents. Seventy-eight percent (78 %) of this age group (18-30) were males. None of the respondents were above 60 years and the age group 51- 60 years recorded no female respondents (Table 2).



About 6 % of respondents interviewed were Muslims and the majority of the respondents representing 92 % were Christians (Table 2). Fifty percent (50 %) of the remaining 2 % represent Buddhist or respondents who did not disclose their religion (Table 2).

Most respondents (62 %) enumerated had tertiary education (Table 2). This was followed by those with senior high, ordinary or advance level of education with 23 %, junior high level was 10 % and the remaining 5 % shared among respondents with primary, non-formal and other levels of education. On occupation, 52 % of respondents indicated that they were students, 38 % were salaried workers and 10 % were for the remaining categories (Table 2). Sixty-three percent (63 %) of the 62 respondents with tertiary education were still students and 36 % engaged as salaried workers. Ninety-four percent (94 %) of respondents were either employed or students and 5 % were unemployed. All levels of education recorded respondents who were salaried workers (Table 2).

Thirty-seven (37) respondents representing 37 % were married while 61 respondents representing 61 % were not married and 2 % of respondents were divorced or separated (Table 2). Fifty-six (56) respondents out of the entire respondents belonged to household sizes between 1 and 5, 33 respondents belonged to household sizes between 6 and 10 individuals. Also, 6 of them belonged to household sizes between 11 and 15, 4 respondents belonged to household sizes between 16 and 20. One respondent failed to state his household size (Table 2).

Buying mutton

Most respondents representing 47 % enumerated the nutritional value of meat as the most important factor when purchasing meat (Figure 1). This was closely followed by safety and health factors representing 43 % (Figure 1). The place of slaughter was not regarded as a key factor from the responses gathered (Figure 1). Accessibility of meat recorded the highest number of respondents (30), who saw it as the least important factor, followed by leanness of meat (Figure 1).



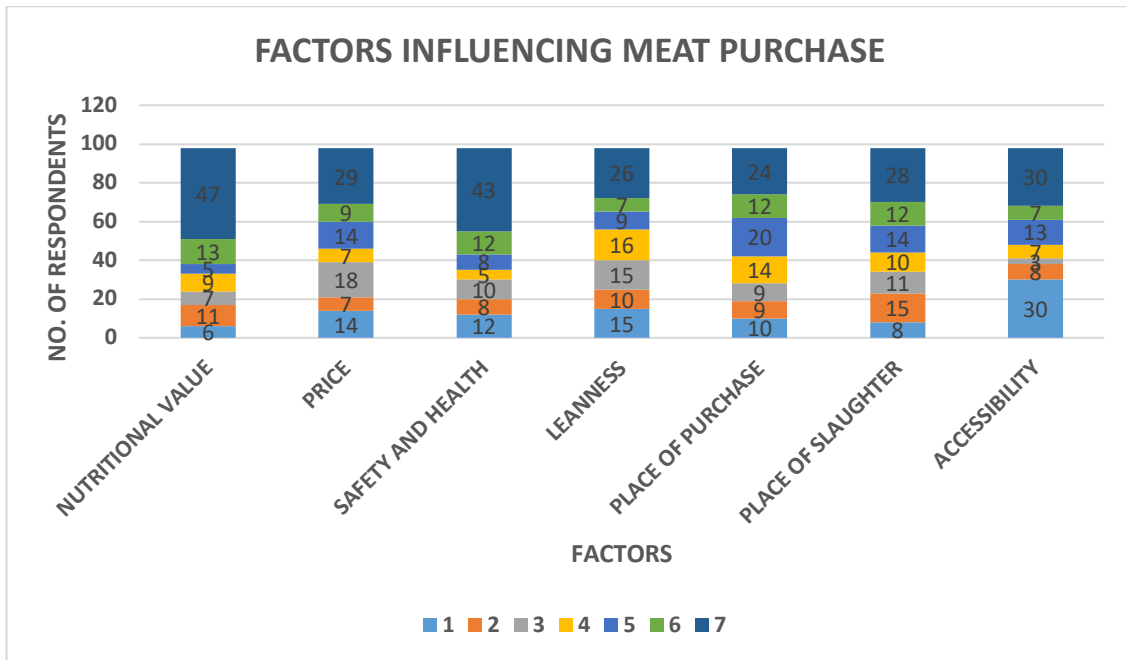


Figure 1: Factors Influencing Meat Purchase of Respondents

Note 1 - most important and 7 - least important

The study results showed that 69 % bought mutton while 29 respondents representing 29 % bought live sheep (Figure 2). Eighty percent (80 %) of respondents did not inquire from sellers about the type of feed fed to animals before slaughter or live animals before purchase, while 19 % of respondents did inquire about the type of feed fed to animals before slaughtering (Figure 2). Fifty-eight percent (58 %) cited meat shops as their preferred point of purchase and 30 % of them actually bought their mutton from meat shops. Four percent (4 %) indicated that they preferred buying mutton directly from the farm. Six percent (6 %) of respondents bought mutton from the abattoir even though 22 % preferred the abattoir as their mutton purchase point (Figure 2). Error bars on farm and meat shop showed that there were differences between preferred purchased point and place of purchase but the rest were not different (Figure 2).

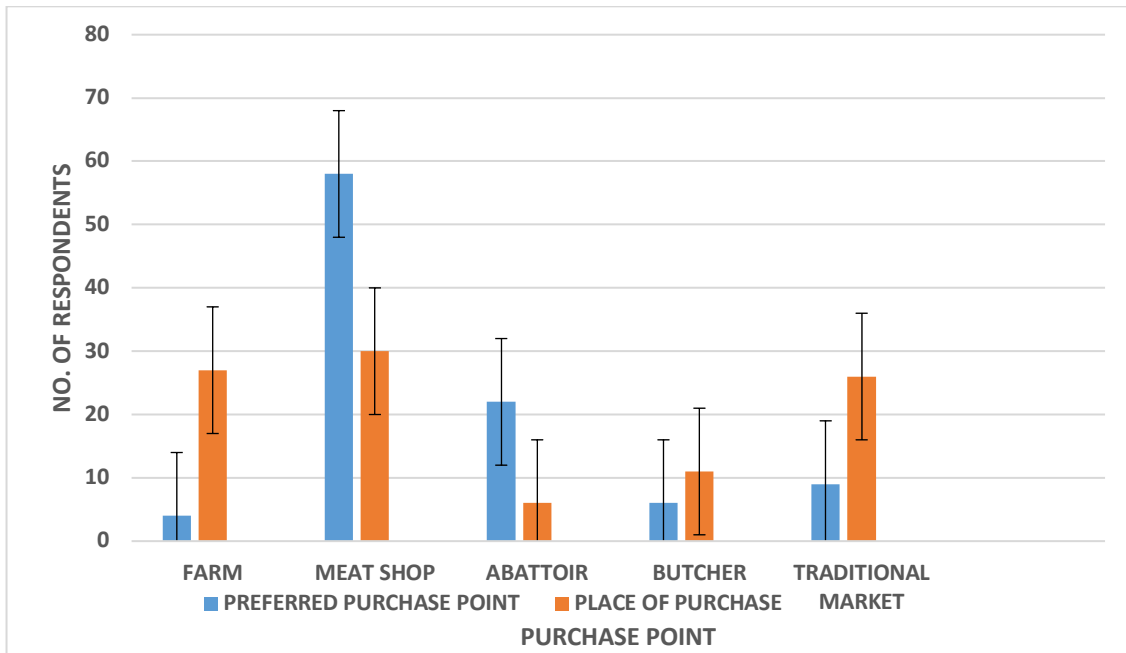


Figure 2: Graph of purchase point and preferred purchase point of respondent

Attributes of importance for assessing the quality of mutton

Respondents were asked to rank from ‘not important’ (1) to ‘most important’ (4) and to also state if they have ‘no idea’ (5) for the attributes stipulated. The highest and lowest for all attributes were extracted and results represented in figure 3.

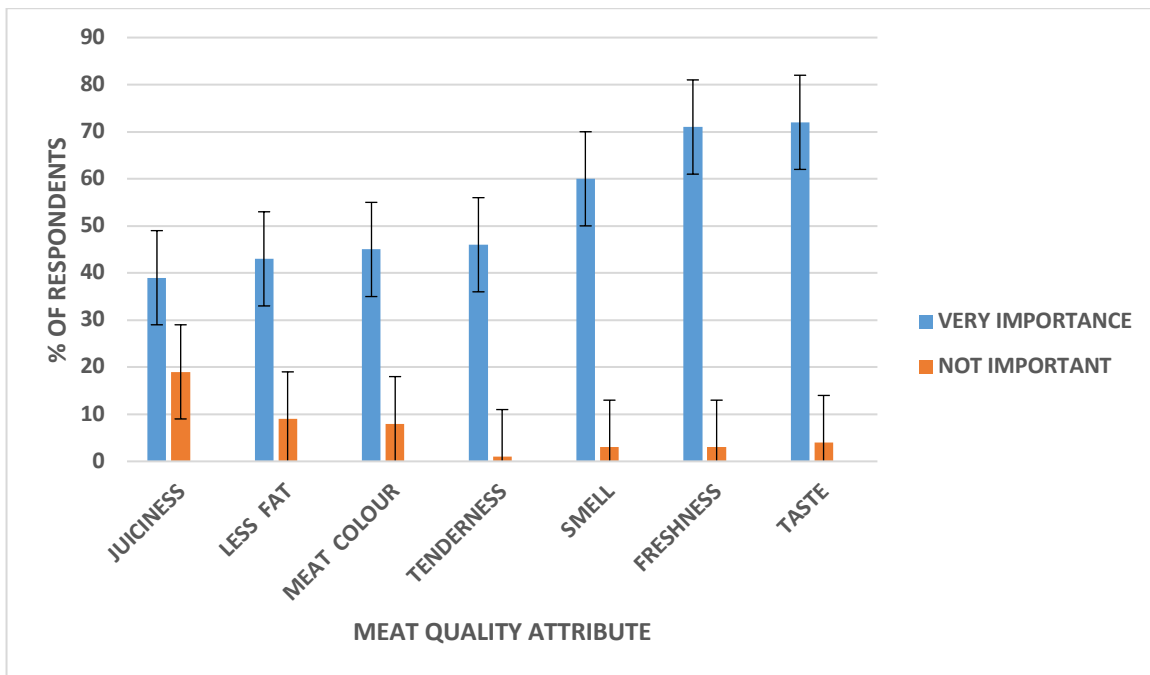


Figure 3: Attributes of importance for assessing the quality of mutton

The attribute with the greater number of respondents scoring 'very important' was 'taste' with 72 % of respondents, closely followed by freshness of meat with 71 % (Figure 3). The attribute which had the least respondents scoring 'very important' was juiciness with 19 % of respondents. Tenderness had the lowest score (1 %) among the attribute's respondents regarded as 'not important', while juiciness recording the highest number of respondents thus, 19 % (Figure 3). For all the meat quality attributes, 'very important' was higher than 'not important' (Figure 3).

Perception about safety

Freshness of meat was scored 66.3 % by respondents as 'very important' while 3 % indicated it as 'not important' and 23.5 % indicated that it was 'somewhat important' (Figure 4). As for the price of meat, a higher percentage of respondents representing 43.9 % scored it as 'very important' and followed by 39.8 % of respondents who said it was 'important'. The lowest percentage score in all factors was noted in respondents who indicated 'don't know' to some of the factors (Figure 4). In general, the trend of the factors showed an increase in respondents from 'somewhat important' to 'very important', then decreased toward 'not important' and 'don't know' apart from name of producer which was relatively stable till 'not important' and dropped at 'don't know' (Figure 4). Freshness was the highest at 'very important' according to the error bars (Figure 4).

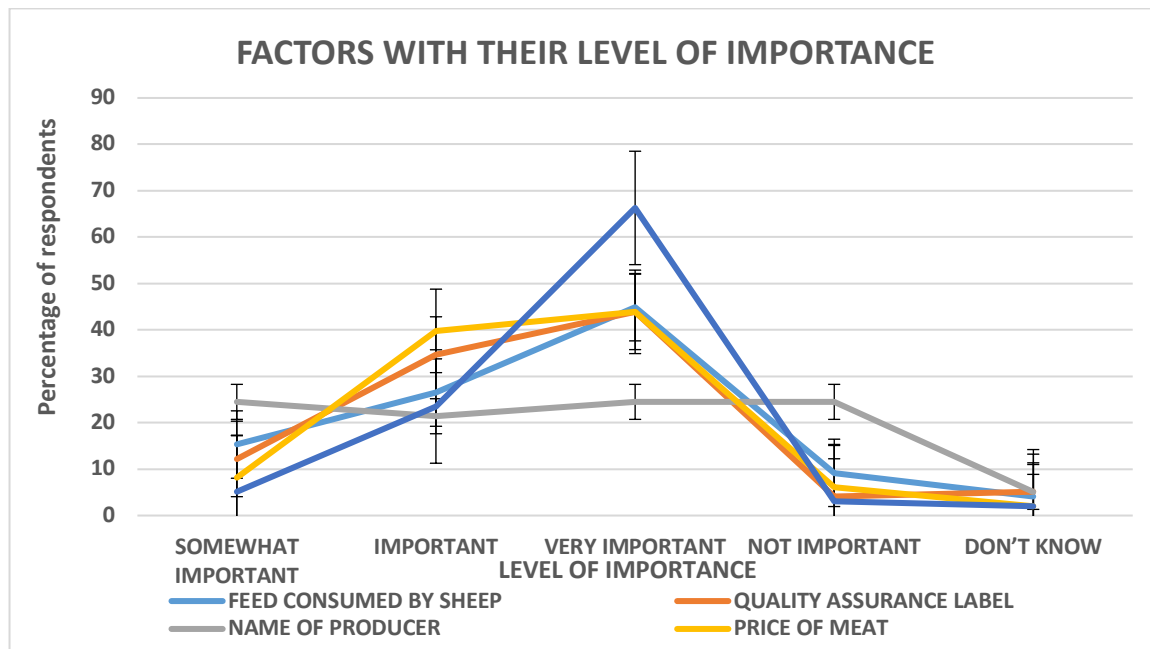


Figure 4: Factors affecting mutton (meat) safety

Causes of leanness in meat

Results obtained from the survey showed that a greater number of respondents, representing 56 % considered the 'type of feed' fed to animals as determinant for

leanness of meat (Table 3). Fourteen percent (14 %) of respondents said leanness was influenced by 'quantity of feed' fed to animals, while 9 % indicated that it was influenced by 'age' and 8 % believed it was a result of 'genetics'. Thirteen percent (13 %) suggested that leanness was not a result of one factor but a combination of two or more factors like age, genetics and type of feed (Table 3).

A report revealed that meat preferences were affected by price, taste, nutritional value, health situation and leanness or fat content [29]. The current study has confirmed the earlier report [28] that nutritional value and safety and health were the first two most important factors in determining the purchase of mutton. However, in the current study, price and leanness were considered as the least important factors in the purchase of meat, which is contrary to the report that price and leanness were very important [29] which suggests differences in how different communities perceive factors that influence food preferences. In the current study, food safety was recorded as the second most important factor affecting preference while a study showed that food safety was the most relevant attribute [16]. The difference in the rankings of food safety may be due to differences in age, level of education and income, religion and culture. However, this may imply that food safety is a worldwide health concern and not just a concern of consumers in the advanced world. According to a report from Albania, domestic mutton and the origin of meat were important factors to consumers [30]. In the current study, place of slaughter which could be closely linked to domestic mutton and origin of meat, was not so important to the respondents.

Colour is one of the important factors in the determination of foodstuffs quality [9, 31]. It indicates freshness and the presence or absence of any form of alteration. Fresh meat is a key feature affecting the purchase of meat by consumers [31]. Quality inferences are centered on meat colour [28, 30]. It was reported that taste and leanness were important factors affecting meat preferences [15, 28]. In the present study, all meat quality attributes such as taste, freshness, colour, tenderness and smell, were ranked as very important by the majority of the respondents. This has corroborated earlier reports [9, 29, 31, 32].

Several studies reported that taste, certification of food safety, freshness, origin, Halal-label and cleanliness were the most important attributes [9, 16, 32, 33]. In the current study, all the safety parameters such as feed, labels, producer, price and freshness peaked at very important. This is in line with the following reports [9, 16, 32, 33]. Brand or producer, label and freshness were of higher relevance to consumers with a higher level of education [16]. Freshness and food safety were also of higher importance for young consumers [16]. The current study has confirmed earlier studies because the safety parameters mentioned in the earlier



studies were similar and the respondents in the current study were mainly highly educated and young.

Organic livestock farming

Despite the fact that, a small percentage of respondents had high knowledge in organic livestock farming, a high percentage representing 84 %, were willing to promote organic livestock farming with 14 % not willing to promote it (Table 3). Two percent (2 %) of respondents failed to communicate their stand (Table 3).

Eighty-four percent (84 %) respondents were willing to convert portions or the entire existing farm for organic livestock farming (Figure 5). Interestingly, thirty percent (30 %) of respondents were ready to give out about 61-80 % of their land for that purpose, which represents the highest number of respondents. Twenty-one percent (21 %) of respondents were ready to convert 41-60 % of their farmlands for organic livestock farming and 16 % of respondents were willing to convert 21-40 % of their farmlands for organic livestock farming (Figure 5). This was followed by 15 % of respondents who were ready to convert 1-20 % and 81-100 % respectively. Three percent (3 %) of respondents failed to respond to this question (Figure 5). According to the error bars, 61- 80 % of land for organic livestock farming was highest but was not different from 41-60 % (Figure 5).

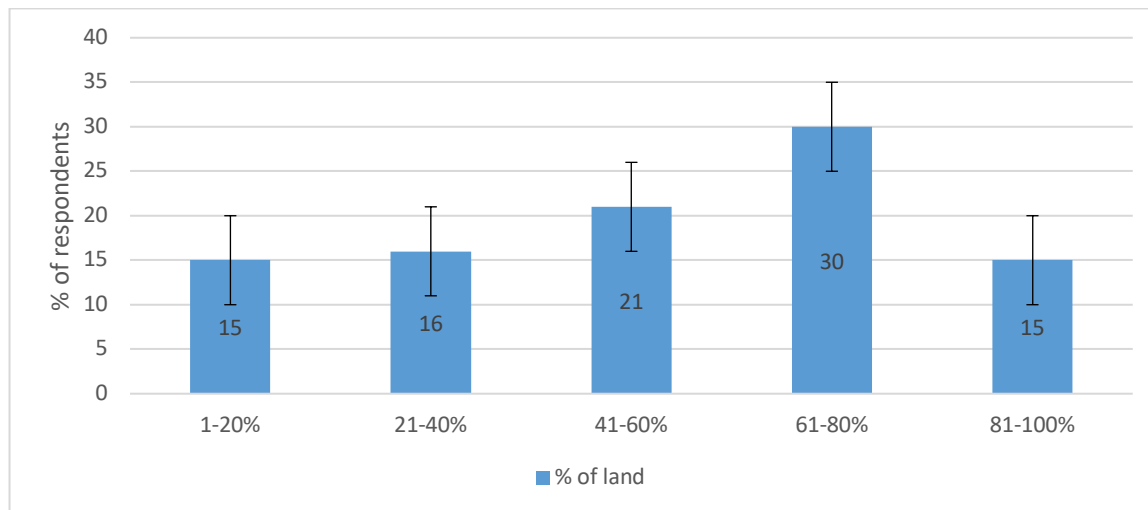


Figure 5: Percentage of respondents with land ready to be used for organic livestock farming

From the analyses below, 33 % of respondents were willing to pay between Gh¢1-5 as extra cash to get organic livestock meat (Figure 6). This was followed closely by respondents who were ready to pay extra Gh¢ 6-10 for meat produced organically. Seventeen percent (17 %) of them were ready to pay Gh¢ 11-15 while 14 % were willing to pay extra Gh¢16-20 for such kind of meat. Minimum numbers

of respondents representing 6 % were ready to pay more than Gh¢20 as extra money for organic livestock meat (Figure 6). According to the error bars, those willing to pay Gh¢1-5 were higher than the other categories apart from Gh¢6-10 (Figure 6).

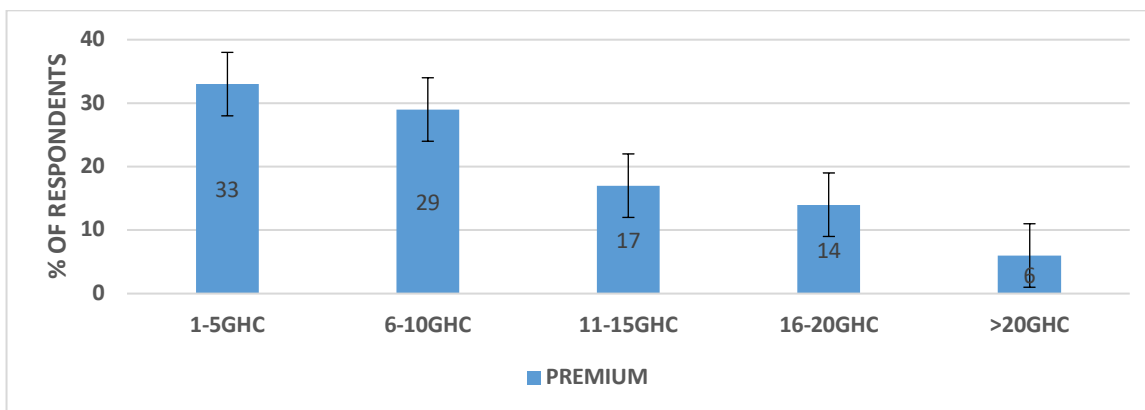


Figure 6: Premium on organically produced meat

Respondents were supposed to state their level of knowledge in organic livestock farming, Africa’s potential regarding exporting organic livestock products, guidelines of organic livestock farming, some practices of organic livestock farming and standards of organic livestock farming in terms of ‘little’, ‘moderate’, ‘high’ and ‘nothing’. Those who have some knowledge were supposed to state some of their knowledge (Figure 7). From data collected and analysed, 53 % of respondents said they have ‘moderate knowledge’ regarding organic livestock farming while 23 % have “little knowledge”. Fourteen percent (14 %) indicated no knowledge at all and 8 % represented the least proportion of respondents who had high knowledge (Figure 7). From the error bars, respondents with ‘moderate knowledge’ in organic livestock farming were the highest and the rest were not different from each other (Figure 7). However, respondents with no knowledge of organic livestock farming were highest in three out of five aspects of organic livestock practices and the ‘high knowledge’ respondents were the lowest in all five aspects of organic livestock practices (Figure 7).

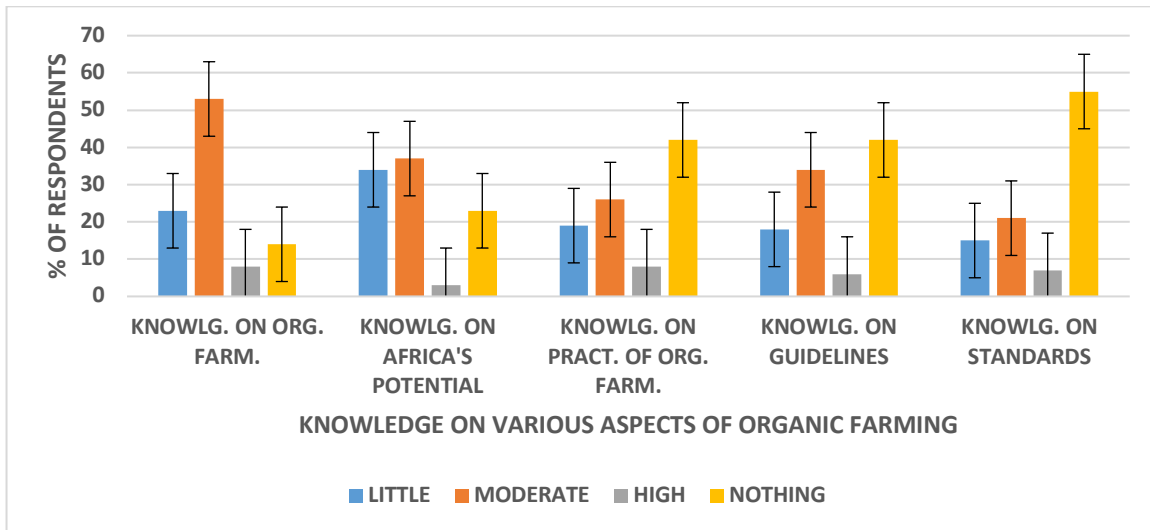


Figure 7: Knowledge of respondents on different aspects of organic farming

In terms of knowledge on Africa’s great potential on organic livestock farming, 37 % of respondents said they have moderate knowledge, closely followed by those with little knowledge with 34 %, 23 % have high knowledge while 3 % represents respondents with high knowledge (Figure 7). Respondents having moderate knowledge on Africa’s potential were higher than those with high knowledge but were not different from the others according to the error bars (Figure 7). Data also shows that 42 % of respondent had no knowledge when it comes to some practices of organic livestock farming with only 8 % of respondents claiming they had high knowledge when it comes to this subject matter. Nineteen percent (19 %) had little knowledge while 26 % had moderate knowledge. Forty-two percent (42 %) representing the maximum of respondents said they had no knowledge concerning some guidelines of organic livestock farming with 34 % having moderate knowledge. Six percent (6 %) of respondents indicated that they had high knowledge and 18 % had little knowledge (Figure 7). Error bars on knowledge of practices and guidelines showed that those without any knowledge were higher than the rest except for those with moderate knowledge (Figure 7). Those without any knowledge of the standards of organic livestock farming had the highest number of respondents representing 55 %. From figure 7, 15 %, 21 % and 7 % represent respondents who had little, moderate and high knowledge respectively. Most respondents who had some knowledge of the subject matter who were expected to state it failed to do so appropriately.

Almost all respondents were willing to convert portions or entire farmland for organic livestock farming and this may be due to the fact that most of the respondents were tertiary students or farmer trainees in the discipline of Agriculture. All respondents were willing to pay a premium for organic livestock products but majority wanted to pay between Gh¢1-10 (which is less than 1 USD). This present study is similar to a

study that revealed that consumers were willing to pay extra premium for locally produced mutton [32]. Respondents with no knowledge were highest in three out of five aspects of organic livestock practices and high knowledge respondents were the lowest in all the five aspects of organic livestock practices. This means that knowledge and practices of organic livestock farming among the respondents are not encouraging. This is corroborated by the Food and Agriculture Organization report that organic livestock farming is less emphasized in humid tropics than in the temperate and arid zones [34]. Therefore, there is a greater need to intensify education on organic livestock farming and its practices at all levels of education. New and innovative teaching methods such as the combination of flipped classroom and peer-assisted learning can be used to enhance learning [35]. Also, agricultural extension officers should teach farmers on the importance of organic livestock farming and the various practices and certification process. Students and farmers in turn, will be able to convince customers and the general public about the benefits of organic livestock products.

Preference for mutton obtained from sheep fed different diets

Respondents ranked their preference of mutton from 1 - most preferred to 5 – least preferred. The highest ranks for all parameters were picked and represented for all meat samples (Table 4). Meat sample 'A' was from sheep fed *Albizia lebbek* only. Thirty percent (30 %) of respondents ranked its taste as '1' thus most tasty and 27 % and 25 % ranked its leanness and appeal '3' respectively (Table 4). Tenderness of this meat sample came out with two highest ranks in '1' and '3'. Juiciness had the lowest percentage of respondents ranking it at '2' (Table 4).

Meat sample 'B' was from sheep fed *Moringa oleifera*. None of the respondents scored any of the parameters '1' for meat sample 'B' (Table 4). However, leanness was ranked '2' by 24 % of respondents, 29 % of respondents scored 'tasty' and 'appeal' '5'. Tenderness and juiciness were both ranked '3' by 25 % and 29 % of respondents respectively (Table 4).

Meat sample 'C' was obtained from sheep fed *Milletia thonningii*. The entire parameters were ranked between only two categories thus '4' and '3' (Table 4). Thirty percent (30 %) of respondents ranked its tenderness as '3', followed by 29 % ranking its juiciness as '3'. Twenty-six percent (26 %) and 25 % ranked its taste and leanness respectively as '3'. Appeal had the lowest rank at '4' (Table 4). Meat sample 'D' represents sheep fed on urea treated rice straw. No respondent scored any of the parameters '1' (Table 4). However, appeal and taste came close with 26 % of respondents scoring '2' for each parameter. Twenty-seven percent (27 %) of respondents scored or ranked its tenderness and juiciness '3', with 23 % of them scoring its leanness '4', the lowest (Table 4).



Meat sample E was obtained from sheep fed a combination of all three browse leaves (*Albizzia lebbek*, *Moringa oleifera* and *Milletia thonningii*). Twenty-five percent (25 %) of respondents said the meat was appealing hence scored it '1' (Table 4). Twenty-four percent (24 %) of them ranked its tenderness '2'. Twenty-five percent (25 %), 23 % and 21 % of respondents ranked its juiciness, taste and leanness respectively, a score of '3' (Table 4). Meat sample 'F' was from sheep fed on *Albizzia lebbek* and *Moringa oleifera* browse combination. None of the parameters scored the highest rank (Table 3). Taste and leanness were scored by 28 % and 21 % of respondents respectively as '4', the lowest among its ranks. Appeal was ranked '2' by 25 % of respondents. Tenderness had 22 % of respondents scoring both '2' and '3' while, 26 % of respondents ranked juiciness '3' (Table 4).

Meat sample "G" was obtained from sheep fed a combination of *Albizzia lebbek* and *Milletia thonningii*. Twenty-eight percent (28 %) of respondents ranked its juiciness '3' while 27 % of respondents ranked its appeal also '3' (Table 4). Its taste was ranked '2' and '4' by 24 % of respondents while 23 % and 24 % of respondents ranked its tenderness and leanness respectively '4' (Table 4). Meat sample "H" was obtained from sheep fed on *Moringa oleifera* and *Milletia thonningii* combination. The highest scored parameters were all ranked between rank '1' and '4' (Table 4). Thirty-one percent (31 %) of respondents ranked its taste '1' that is "most" preferred. Appeal and juiciness were ranked '1' by 24 % and 20 % of respondents respectively. Leanness and tenderness had the lowest with 23 % and 20 % respectively of respondents scoring them '4' (Table 4). The order of the rankings of the five meat parameters assessed from most to least preferred in meat samples were MO+MT, AL, AL+MO+MT, UT, AL+MO, AL+MT, MT and MO respectively. The differences observed in the mutton preference study were not significant ($p>0.05$).

Diet plays an important role in both ruminant and monogastrics production [36]. Feed resources that are high in polyunsaturated fatty acids could contribute to the appearance of off-flavors in beef [36, 37]. The innate flavor of a meat can be affected by factors such as diet and fat content [6, 14]. Diets have a profound influence on the taste of meat as different tastes were identified in guinea fowls fed different diets [16]. This is confirmed by the current study that recorded different preferences of meat qualities such as taste, tenderness, juiciness, leanness and appeal by respondents after tasting eight different mutton samples from sheep fed eight different diets. From the current study, samples of mutton obtained from sheep fed *Moringa oleifera* (MO) and *Milletia thonningii* (MT) were the least ranked in terms of the meat qualities after tasting and this may be due to the presence of secondary metabolites in these two browse leaves which may have imparted unpleasant flavors in the meat.

However, the mutton obtained from the combinations of these two browse leaves (MO+MT) were more preferred by the respondents than the individual browse leaves. This may be because feeding on more than one specific diet is similar to what happens in the natural environment and may have produced flavors that the respondents were already familiar with because most sheep in Ghana graze in the natural environment having access to various diets. In general, all the mutton samples obtained from sheep fed combinations of the browse leaves were more preferred than the individual browse leaves except those fed *Albizzia lebbek*. It may be possible that *Albizzia lebbek* leaves when fed to sheep were able to produce pleasant flavor comparable to the flavor produced by the combinations of the browse leaves. Interestingly, mutton samples from sheep fed *Moringa oleifera* and *Millettia thonningii* had their best ranks by respondents in leanness. It is likely that consumers highly interested in lean meat will prefer this and may be willing to pay a premium for it because of its health benefits.

Meat preference is affected by taste and leanness or fat content [29]. Sheep and goats meat quality is related to its sensory characteristics, such as tenderness, juiciness, taste, and odor [38, 39]. Tenderness is the principal attribute largely defining the overall intake by consumers [32]. It has been established that tenderness plays a pivotal role in the acceptability of meat by consumers [39]. Appearance plays a vital role on how consumers categorize quality and immensely affects purchasing decisions [40]. These meat qualities highlighted by these reports have been confirmed by the current study. However, taste was highly ranked and tenderness, juiciness, appeal and leanness were moderately ranked by the respondents.

There were some limitations of this study. The questionnaires were administered to respondents who had a similar background in agriculture such as students, farmer trainees and members of staff. Therefore, the study did not cover respondents having different backgrounds. Also, due to the preference study which used mutton, the mutton samples determined the number of respondents which restricted the number of respondents to only one hundred.

CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

The two most important factors that influence consumers to buy mutton were nutritional value together with safety and health. Freshness and taste were the two most relevant attributes in assessing the quality of mutton. The majority of respondents chose freshness as a very important quality of safety. Almost all the respondents have moderate knowledge on organic livestock farming but majority did not have any knowledge of the practices, guidelines and standards employed for this system of production. This reveals a greater need to intensify organic livestock



education in Ghana. All respondents were willing to pay a premium for organic livestock products at different rates. Diet fed to sheep influenced varied responses from respondents but mutton obtained from sheep fed combinations of *Moringa oleifera* (MO) and *Millettia thonningii* (MT) was ranked the best in the five meat parameters assessed by tasting. It is recommended that, feeding combinations of browse leaves should be encouraged especially MO+MT. The study revealed the need to intensify education on organic livestock farming. Also, future research with larger sample size and more diverse populations is recommended.

Ethical approval

The use of animals, humans and all other practices were approved by the Noguchi Institutional Animal Care and Use Committee of the University of Ghana, Legon, Accra (Protocol number 2017-02-2R).

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Conflict of interest

The authors have no conflict of interest.



Table 1: Chemical composition of feeds fed to sheep

Feeds	DM (g/kg)	CP (g/kgDM)	Ash (g/kgDM)	CT (g/kgDM)	ADF (g/kgDM)	NDF (g/kgDM)	Lignin (g/kgDM)
AL	898.7	287.9	74.1	1.35	345.8	455.4	186.2
MO	869.9	328.5	159.1	1.03	198.0	194.5	104.9
MT	893.5	234.1	109.6	1.1	410.5	536.8	127.8
UT	917.1	99.8	200.0	-	520.9	552.2	380.7
AL+MO +MT	889.0	286.8	117.2	1.2	301.5	418.6	143.2
AL+MO	885.4	304.0	127.3	1.13	261.4	320.4	147.9
AL+MT	894.9	266.2	94.6	1.2	351.2	477.5	181.7
MO+MT	885.9	286.4	135.6	1.07	356.9	287.2	123.9

DM: Dry matter; CP: Crude protein; CT: Condensed tannins; ADF: Acid detergent fibre; NDF: Neutral detergent fibre; AL: *Albizzia lebbek*; MO: *Moringa oleifera*; MT: *Millettia thoninngii*; UT: Urea treated rice straw

Table 2: Demographic characteristics of respondents (%)

Age group (years)	%		Household size	%	Religion	%
	Males	Females				
18-30	51	14	1-5	56	Christian	92
31-40	11	4	6-10	34	Muslim	6
41-50	10	1	11-15	6	Buddist	1
51-60	9	0	16-20	3	No response	1
>60	0	0	Not Applicable	1		

Education	%	Occupation	%	Marital Status	%
Non-Formal	2	Unemployed	6	Married	36
Primary	1	Farmer	3	Single	61
JHS/MSLC	10	Self-employed	1	Divorce	2
SHS/O& A Levels	23	Salary worker	38	Separated	1
Tertiary	62	Students	52		
Others	2				

JHS: Junior High School; MSLC: Middle School Leaving Certificate; SHS: Senior High School; O Level: Ordinary Level; A Level: Advance Level

Table 3: Causes of leanness in meat and willingness to promote organic livestock farming

Causes of Leanness	%	Willingness to promote organic livestock farming	%
Type of feed	56	YES	84
Amount of feed	14	NO	14
Genetics	8	Not Applicable	2
Age	9		
Combinations of the above	13		

Table 4: Preference of mutton by respondents

Mutton Sample	Diet	Meat Quality	Ranks	% Respondents
A	<i>Albizzia lebbek</i> (AL)	Taste	1	30
		Tenderness	1	25
		Juiciness	2	24
		Appeal	3	25
		Leanness	3	27
B	<i>Moringa oleifera</i> (MO)	Leanness	2	24
		Tenderness	3	25
		Juiciness	3	29
		Appeal	5	28
		Tasty	5	29
C	<i>Millettia thonningii</i> (MT)	Leanness	3	25
		Tenderness	3	30
		Juiciness	3	26
		Tasty	3	26
		Appeal	4	25
D	Urea treated rice straw	Appeal	2	26
		Tasty	2	26
		Tenderness	3	27
		Juiciness	3	27
		Leanness	4	23
E	AL+MO+MT	Appeal	1	25
		Tenderness	2	25
		Leanness	3	21
		Tenderness	3	23
		Juiciness	3	25
F	AL+MO	Appeal	2	25
		Tenderness	2	22
		Juiciness	3	26
		Leanness	4	21
		Tasty	4	28
G	AL+MT	Tasty	2	24
		Juiciness	3	28
		Appeal	3	27



		Tenderness	4	23
		leanness	4	24
H	MO+MT	Appeal	1	24
		Juiciness	1	20
		Tasty	1	31
		Tenderness	4	20
		Leanness	4	23
P value			0.260	

Footnote: Rank 1- Most preferred quality and Rank 7- Least preferred quality

P value greater than 0.05 indicates that the differences are not significant ($p > 0.05$)

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