PROXIMATE COMPONNENT AND FATTY ACID PROFILE OF MUTTON AND CHEVON

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Elaboration of Abbreviation

Abbreviation	Elaboration
%..	Percent
Et al……………………………………………	And his associate
Cvasu………………………………………	Chittagong veterinary and animal sciences university
DM…………………………………………….	Dry matter
CP……………………………………………..	Crude protein
EE……………………………………………..	Ether extract

Abstract

Chevon and mutton have long been utilized as protein sources, and their popularity in Bangladesh is growing. The study aimed to investigate the proximate composition and fatty acid profile of chevon and mutton including moisture, protein, ash and ether extract levels. The percentages of water, protein, ash, and ether extract in chevon were 71.79%, 21.79%, 0.95%, 5.60% and in mutton were 76.81%, 20.48%, 0.95%, and 5.9%, respectively. This study also shows that the saturated fatty acid of mutton is higher than the chevon and unsaturated fatty acid are lower than the chevon. As a result, goat meat is a healthier option than other types of red meat in the human diet.

Key words: Proximate composition, chevon, mutton, fatty acid.

Chapter 1

Introduction

Goat and sheep are significant to the world economy, where the demand for sheep is slightly higher today. The development of small ruminants such as sheep and goats play a vital role in the rural economy of many developing countries in ASEAN and Asia (MARD, 2010). They contribute as a source of farmers' income significantly and ensure livelihoods security. They also serve as insurance that minimizes crop failures, particularly for rural landless, small-scale, and marginal farmers of the rural community. They also form a valuable livestock resource that continues to increase through time. Goat and sheep farming requires low initial capital and guarantees a high return in two years at the earliest; hence, it is attractive for rural households. The greatest advantage of rearing sheep and goats is a significant supply of animal protein in milk and meat.

Meat is animal flesh that is an essential part of the human diet. It is one of the primary dietary protein sources, fat, vitamins, and minerals for the human populace. The global per capita meat intake (kg/person/year) grew from 23.1 kg to 42.2 kg between 1961 and 2011. (Ahn et al., 1998). Meat and animal products are in high demand worldwide, even though the market in the developing world has been shrinking (AMSA, 1995).

In contrast, demand in developed countries has and continues to occur at an increasing rate (Buege and Aust, 1978). The expansion of urban settlements, improved income, and increased population are the primary drivers in the developing world. Over and above facilitating a food revolution, the growing demand for meat and animal products in the developing world has generated an excellent opportunity for local smallholder producers to get into the ever-increasing market (FAOSTAT, 2013).

Aside from providing a concentrated source of energy, animal fats mediate the absorption of fat-soluble vitamins, hence reducing the risk of fat-soluble vitamin insufficiency. Red meat is high in saturated fat and cholesterol, despite its nutritional benefits (supply of high-quality protein, high-calorie density, and vitamin and mineral content) (Griffin et al., 1992). Excessive consumption of red meat and items produced from it has been linked to metabolic disorders such as obesity, insulin resistance, and metabolic dysfunctions due to its high saturated fat and cholesterol content. They're related to metabolic (type II diabetes, hypertension, atherosclerosis, metabolic syndrome, and cancer) diseases (Marta et al., 2013). Globally, consumers have become more health-conscious and are now aware and more equipped with pertinent information regarding the effect of the food, including the meat they consume. As a result of this increasing consumer knowledge, a new consumer category has emerged that wants healthy foods. Chevon has a lower fat, saturated fat, and cholesterol level than other red meats like beef and lamb (Mushi et al., 2008), but a more significant polyunsaturated fatty acid (PUFA) content (Rahman et al., 2012). This chemical composition makes chevon healthier than other red meats in terms of the fat content and rich acid profile. As a result, chevon has the potential to fill a specific market gap. The popularity of chevon on the worldwide meat market is growing as health-conscious consumers prefer leaner and healthier chevon as a direct result of its leanness and health-beneficial fatty acid composition (Sheridan et al., 2003).

Goat meat is more prevalent in Bangladesh. There is a significant price difference between sheep and goat meat. Lamb meat has more saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA) than goat meat, as well as equal levels of sugars and free amino acids, except for lysine and glycine, which are higher in goat meat (Marta et al., 2013). Lamb meat had a lower protein level and a higher fat content than goat meat. Lamb meat had 4 % lower proteins and 13% higher fat content than goat meats. Sensory panelists scored lamb meat fattier, juicier, and tendered than goat meats (Mushi et al, 2008).

The target of this study was to compare the nutritional analysis of mutton and chevon as well as some of the health benefits

Objectives of the study:

1. To determine the protein, fat, ash, moisture and ether extract content of collected chevon and mutton.
2. To determine the fatty acid content of chevon and mutton.

Chapter 2

Materials and Method

Study area and period

The study was carried out in the Department of Animal Sciences and Nutrition, Faculty of Veterinary Medicine, Chattogram Veterinary and Animal Sciences University, Khulshi, Chattogram-4202, Bangladesh during August to October, 2021.

Collection of samples

The meat has been collected from goats and sheep from different areas of Chattogram during Eid-ul Adha. Immediate after the collection, the sample was brought to the laboratory and ground to obtain a uniform size and kept in an airtight plastic bag and placed into the freezer to avoid bacterial contamination.

Proximate analysis

The proximate analysis of feeds showed the following composition: Dry Matter (DM), Moisture, Total Ash (TA), Crude Protein (CP), Crude Fibre (CF), Ether Extract (EE) in Animal Nutrition Lab in Chattogram Veterinary and Animal Sciences University, Chattogram.

Estimation of dry matter and moisture

In oven the petridish was dried which was regulated at 105°C and was cooled in a desiccator and weighted. 10 gm of meat sample was weighted into the petridish and kept into the oven for 24 hours. The petridish was removed from the oven with metal tong. After that it was cooled in desiccator and the final weight was taken after getting constant weight (AOAC, 2006).

$$\% \text{ DM} = \frac{\text{Initial weight (g)} - \text{Final weight (g)}}{\text{Sample weight (g)}} \times 100$$

%Moisture = 100 - % DM

Estimation of Ash

The crucible was dried in hot air oven. It was cooled in Dessicator. After that the weight of the empty crucible was taken. 5gm of meat sample was placed in the crucible and it was burned. Burning was done until no smoke was produced in heater. Then the sample with crucible was cooled and transferred to the muffle furnace. After that sample was ignited at 550-600°C for 6-8 hours until white ash is produced. The furnace was cooled at 150°C and the sample was transferred to the dessicator and weight was taken. (AOAC, 2006).

$$\% \text{ Ash} = \frac{\text{Wt. of crucible and ash} - \text{Wt. of crucible}}{\text{Weight of feed sample (g)}} \times 100$$

Estimation of Crude Protein (CP)

5 gm of meat sample was weighted and taken into a digestion tube. Then one spoonful of catalyzer mixer (KOH, NaOH, Se) was added there. 10 ml concentrated H2SO4 was also added and the digestion flask was placed in Kzeldhal Digestion Set. After that heat was increased gradually and continued until clear residue (45 min to 1 hr) is formed. The flask was removed from the digestion set and then cooled. 10 ml 2% boric acid solution, 2 drops mixed indicator were taken in a conical flask. The conical flask was fitted in the collection arm of distillation set. 50 ml distilled H2O was added in the digestion tube and fitted in the distillation flask. 40 ml of 40% NaOH was added there and the distillation was continued up to 100ml. Then it was titrated against 0.1 N HCl. Titration was continued until the color was changed into pink. Then the reading of titration was taken. (AOAC, 2006).

$$\% \text{ CP} = \frac{(\text{Titre} - \text{blank}) \times \text{Normality of HCL} \times 14.007 \times 6.25}{\text{sample weight (g)}} \times 100$$

Estimation of Ether Extracts (EE)

Two-gram meat sample was taken in an extraction thimble having porosity, then placed in the Soxhlet flask. The cork of thimble was above the syphon tube. A receiving flask was weighted and fitted with Soxhlet apparatus and was placed in water bath at 500 to 600 C. Ether extract was poured down in to the soxletflask. The flask was filled up to ¾th portion with ether and it was sured that water was running through the condenser. When extraction was over, the thimble with sample was removed and heated in the water bath to remove all the ether from receiving flask. The receiving flask was placed into the oven at105° C to eliminate left of the ether and water. After drying, the flask was taken out and weighted (AOAC, 2006).

$$\% \text{ EE} = \frac{\text{Initial weight (g)} - \text{weight after extraction (g)}}{\text{sample weight(g)}} \times 100$$

Meat fatty acid composition

The fatty acids compositions of chevon and mutton were determined by a direct method for fatty acid methyl ester (FAME) synthesis using a slight modification of the method described by O'Fallon et al. (2007). Briefly, 1 g of minced meat was placed into a 15-ml Falcon tube, after which 0.7 ml of 10 N KOH in water and 6.3 ml of methanol were added. The tube was then incubated in a 55°C water bath for 1.5 h with vigorous hand-shaking for 10 S every 30 min to properly permeate, dissolve and hydrolyze the sample. After cooling to below room temperature in a cold tap water bath, 0.58 ml of 24 N H2SO4 in water was added. The tube was then mixed by inversion, after which K2SO4 precipitated. The sample with the precipitate was incubated again in a 55°C water bath for 1.5 h with vigorous hand-shaking for 10 S every 30 min. After FAME synthesis, the tube was cooled in a cold water bath. Next, 3ml of hexane were added and the tube was vortex-mixed for 5 min on a multitube vortexer. The tube was then centrifuged for 5 min at 3000 × g (HANIL, Combi-514R, Korea), after which the top (hexane) layer containing the FAME was dehydrated through the anhydrous Na2SO4. The extracted and dehydrated hexane was concentrated to 1.5 ml and placed into a GC vial for analysis.

Statistical analysis

Recorded data were tabulated and rearranged in excel sheet. After that required analysis was performed using SAS statistical analysis system. $P \leq 0.05$ were considered as statistical significant.

Chapter 3
Results

The result of proximate composition of analyzed meat samples are shown in Table -1. The results showed that significant variation of crude protein, total ash and ether extract content was found ($p<0.05$) between sheep and goat meat. Moisture content was found numerically higher in sheep meat than the goat meat.

Table 1: Proximate composition of sheep and goat meat.

Name of species	Moisture %	Crude Protein %	Ash	Ether extract
Sheep	76.81	20.48	1.34	5.90
Goat	71.80	19.95	0.95	5.60
SEM	0.22	0.07	0.02	0.12
P value	0.0705	0.0307	<.0001	<.0001

Fatty acid content of chevon and mutton:

From table 2 and 3, it was found that fatty acid content of chevon and mutton significantly varied between chevon and mutton. In chevon the highest unsaturated fatty was recorded as elaidate (50.41%) whereas butyrate was second highest (21.33%). In case of mutton the highest unsaturated fatty acid recorded stearate (35.10%) and second highest was the hexonate (24.30%).

Table 2: Chevon fatty acid profile

	Name	Ret. Time	Area%
1	Butyrate	10.674	21.332
2	Decanoate	21.317	0.432
3	Laurate	25.661	0.392

4	Tridecanoate	27.713	0.084
5	Myrisate	28.689	0.35
6	Myristoleic acid methyl ester	30.985	1.097
7	Pentadecanoate	31.269	0.453
8	Cis-10 pentadecanoaic acid	32.742	0.111
9	Palmitate	32.943	0.113
10	Palmetoliate	34.204	2.245
11	Heptadecanoate	34.631	9.647
12	Cis-10 Heptadecanoic acid	35.865	0.68
13	Stearate	36.174	4.063
14	Elaidate	36.906	50.411
15	Linolaidiate	38.164	1.682
16	Linoleate	38.854	1.066
17	Arachidate	39.604	0.291
18	gamma Linolenic acid	39.985	0.119
19	Cis-11 Eicosenoate	40.323	0.154
20	Linolenate	40.603	0.17
21	Heneiicosenoate	40.911	3.165
22	Cis-11,14 Eicosadioenoicc acid	41.841	0.369
23	Behenate	42.535	0.094
24	Erucate	43.295	0.182

25	Cis-5,8,11,14 Eicosatrienoic acid	43.924	0.099
26	Cis-5,8,11,14,17 Eicsapentenoate	46.339	0.669
27	Nervonate	46.799	0.204
28	Docosahexaenoate	51.632	0.326
Total			100

Table 3: Mutton fatty acid profile.

	Name	**Ret. Time**	**Area%**
1	Butyrate	10.979	23.103
2	Hexonate	12.814	24.304
3	Laurate	25.664	0.344
4	Myrisate	29.66	2.675
5	Myristoleic acid methyl ester	30.948	0.49
6	Pentadecanoate	31.508	0.634
7	Cis-10 pentadecanoaic acid	32.704	0.21
8	Palmitate	33.02	0.234
9	Palmetoliate	34.377	0.649
10	Heptadecanoate	34.461	0.82
11	Cis-10 Heptadecanoic acid	35.753	0.218
12	Stearate	36.654	35.091
13	Elaidate	36.943	0.362

14	Linolaidiate	38.058	0.704
15	Linoleate	38.792	0.366
16	Linoleate	38.94	0.214
17	Arachidate	39.56	0.285
18	Linolenate	40.564	0.291
19	Heneiicosenoate	40.872	0.62
20	Cis-11,14 Eicosadioenoicc acid	41.817	0.378
21	Behenate	42.64	0.587
22	Erucate	43.277	0.33
23	Cis-5,8,11,14Eicosatrienoic acid	44.242	5.795
24	Cis-5,8,11,14,17 Eicsapentenoate	46.327	0.269
25	Nervonate	47.901	0.432
26	Docosahexaenoate	50.408	0.594
Total			100

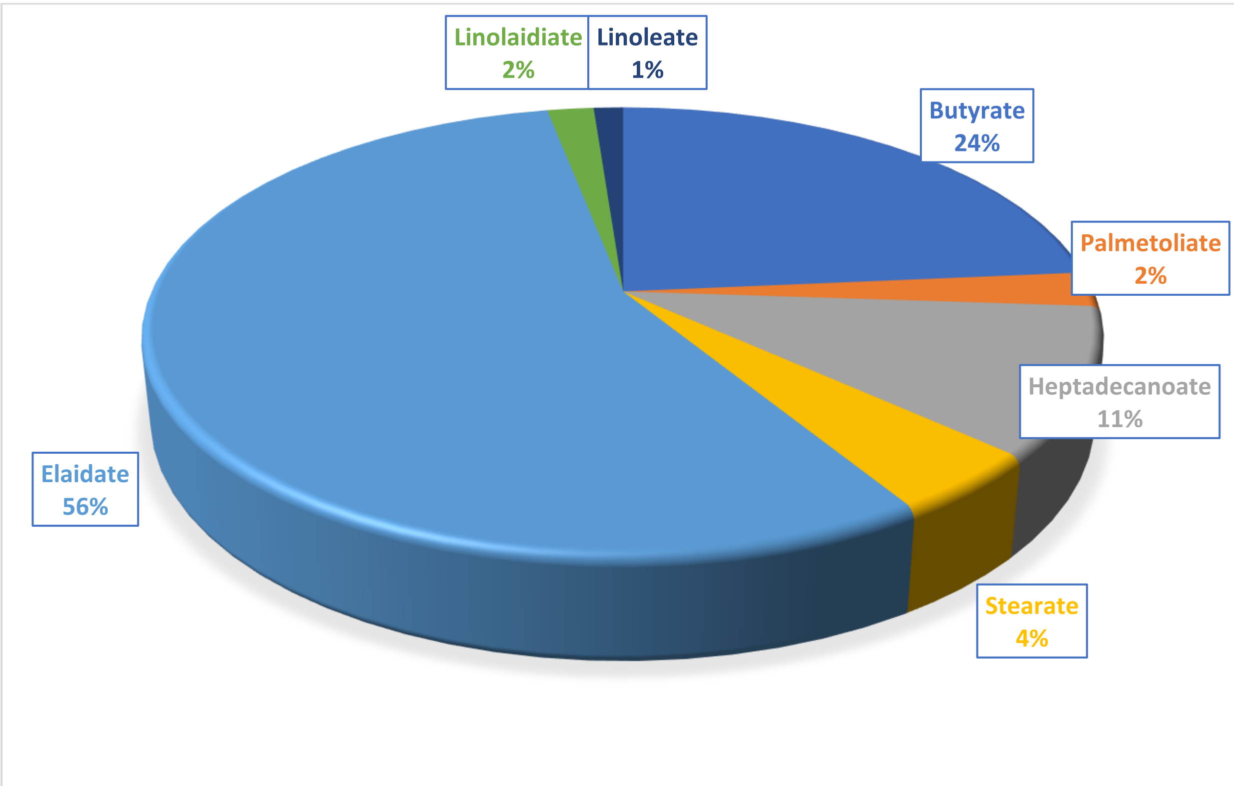

Figure 1: Major fatty acid profile of chevon

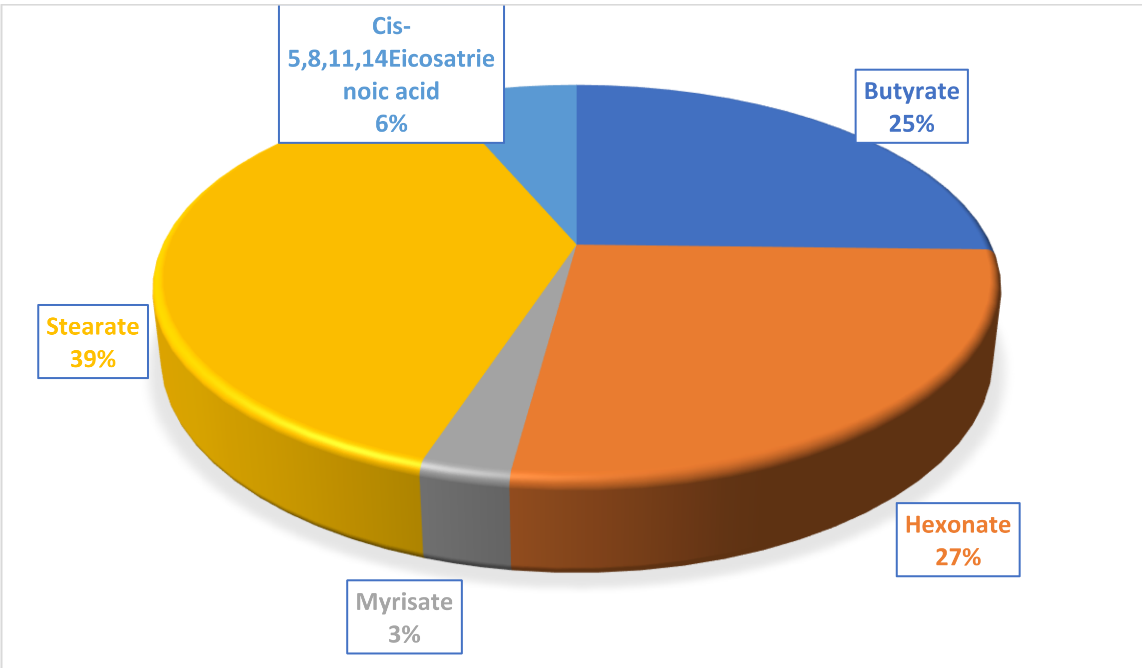

Figure 2: Major fatty acid profile of mutton.

Chapter 4

Discussion

The nutritional component of chevon and mutton was determined in this study. The proximate results are presented in Table 1 above.

Moisture content

According to Mursheda et al. (2014) the moisture percentage of the goat breed is 76.66%. This study shows that the moisture content of the goat breed is 71.79, which is lower than the recommended value. However, compared to the results obtained in this study, (Abdullah and Musallam, 2007) stated that the energy level in goat meat diets affects the moisture content, which is at a lower value of 71.2% to 72.3%. The result obtained was found in the range as reported by (Abdullah and Musallam, 2007). Another study done by Dhanda et al. (1999) have reported that the results of moisture of Thoracic longissimus muscle of different genotype of goat were in the range of 70%-72%. Table 1 also reported the moisture content for the chevon was 71.80.

According to Mursheda et al. (2014) the moisture percentage of sheep breeds is 72.01%. This study shows that the moisture content of sheep breed is 76.8135% which is higher than the recommended value. Water is one of the important components of meat that affects its look, texture and flavour, as well as determining its appeal or acceptability, level of freshness, and endurance (shelf-life). Because muscle protein has a hydrophilic nature, which acts as a binder of water molecules in meat (Judge et al., 1989), moisture in muscles has a significant association with meat protein. Muscles contain roughly 75% water, with a range of 68-80%. When the meat's water content surpasses the typical threshold (75%), the meat's quality suffers. This study shows that the moisture percentage of mutton meat exceeds the normal value, and the quality of the meat is reduced.

Protein content

Table 1 shows the protein content of goat meat was found at 21.78%. According to Mursheda et al. (2014) the protein content of goat meat was found 24.54%, which is higher than the present study. Variations in the protein content of meat can be influenced by breed, age, species, the location of muscles, feed, maintenance management (Judge M D et al., 1989). The present study also shows which also can be influenced by the breed, age, species, the location of muscles, feed, maintenance and management.

The protein content of sheep meat was found at 20.48%, which is slightly lower than the previous study (Mursheda et al., 2014). This is due to the variety of breed, management and feeding practices of Bangladesh.

Ash content

Table 1 shows the ash content of goat meat was found at 0.95%. The ash content of the present study was similar to the previous study (Mursheda et al., 2014). The ash content of sheep meat was found on (Table 1) is slightly higher than in the previous study (Mursheda et al., 2014). This is due to the variety of breed, management and feeding practices of Bangladesh.

Ether extract

Table 1 shows the ether extract of goat meat was found 5.6%, and the ether extract of sheep meat was 5.8%. The present study is slightly higher than the previous study (Mursheda et al., 2014). This is due to the variety of breed, management and feeding practices of Bangladesh.

Fatty acid profile of mutton and chevon:

According to Anaeto et al. (2010) the same author, polyunsaturated fatty acids prevalent in goat meat, and the diet rich in unsaturated fatty acids is correlated with a reduced risk of stroke and coronary disease. This study also shows that the goat meat contains unsaturated fatty like elaidate (50.411%) which is higher than the sheep meat (0.362%) and saturated fatty acid like stearate (4.063%) is lower than the sheep meat (35.091%).

Limitation

- In the proximate analysis, we estimate total N_2, not the ultimate protein & NPN (Non-Protein Nitrogenous Substance)
- Again, it estimates % CP from N_2 multiplying by 6.25 assuming that all protein contains 17-19% N_2. So over & under estimation of N_2 can be happened
- Any deprivation in results may be due to environmental or experimental error

Chapter 5

Conclusion

Meat quality and features of sheep and goat meat were found to be almost identical. Sheep meat is less expensive and less popular in Bangladesh than goat meat. It may be determined from this experiment that goat meat is superior to sheep meat after studying the chemical composition.

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Biography

I am Shayantan dutta, son of Samar Chandra dutta and Kakali dutta. I passed my Secondary School Certificate (SSC) examination from Chattogram Collegiate School, Chattogram in 2012 and Higher Secondary Certificate (HSC) examination from Hazi Mohammad Mohsin college, Chattogram in 2014. I enrolled for Doctor of Veterinary Medicine (DVM) degree in Chattogram Veterinary and Animal Sciences University (CVASU) Bangladesh during 2015-16 session. I have immense interest to work in the field as a veterinarian and do social work with different organization to improve the condition of our sector.