Research Result

A Study of the Effect of Butterfly Pea (Clitoria ternatea) Replacement for Alfalfa (Medicago Sativa) on some Meat Quality Attributes of Growing Lambs under Sudan Conditions

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ABSTRACT

The study was conducted to evaluate the effect of replacement of alfalfa hay (Medicago sativa) with Clitoria ternatea hay on meat quality of growing lambs. Twenty-four (24) lambs (desert sheep) aged 4 months and weighed 18.82 kg were used in these studies. The lambs were divided randomly into four groups; each group (6 lambs) in complete randomized design. The feed was provided adlibitum in the form of completed diet; with hay: concentrate ratio of 40:60. Group (A), hay composed of 100% Clitoria hay; group (B), hay composed of 50% Clitoria hay+50% Alfalfa hay; group (C), hay composed of 75% Clitoria hay+25% Alfalfa hay. While for group (D), hay composed of 100% Alfalfa hay. The total length of trial period was 77 days. A total of 12 lambs from the four groups were selected randomly (three from each group); were slaughtered at the abattoir of the Animal Production Researches (Kuku). Meat samples were taken from L. dorsi muscle, after 24 hours postmortem. Physical characteristics as water holding capacity, cooking loss and pH were measured and recorded. The results showed no significant differences between groups in meat water holding capacity, cooking loss and pH. Also meat chemical composition had no significant differences between groups. These findings suggested that clitoria has similar effect for alfalfa on lamb's meat quality attributes.

KEYWORDS

WHC, Cooking loss, Meat quality, Hay.

1. INTRODUCTION

The livestock is raised in almost all parts of the Sudan and is owned primarily by nomadic tribes. In 2018, the livestock population was estimated with about 31 million cattle, 40 million sheep, 31 million goats and 4.8 million camels [1]. Sheep are distributed all over Sudan but the majority is found in Kordofan, Darfur, Blue Nile and Gazira States [2]. Livestock in Sudan is suffering scarcity, due to the competition between the human food and animal feed. In addition, the lack of forage especially leguminous crops during the summer season where there is a severe shortage of fodders of protein sources for ruminant animals. In addition [3] reported that is butterfly pea is a tropical warm climate species, whereas alfalfa is a temperate cool climate species. *Clitoria ternatea* L. is perennial summer forage which can be used to solve the problem of shortage of forage in Sudan, especially during drought periods. *Clitoria ternatea* is good for short- and medium-term pastures, protein banks, and excellent for hay making [4]. *C. ternatea* yields forage with a potential nutritive value comparable to the traditionally cultivated forage legume crops (e.g., alfalfa or clover [5]. *C. ternatea* is a high-quality fodder for cattle and goats [6]; and it is an important and economic animal feed source with capacity to improve diets and ration quality for ruminants, [7]. [8] reported that this plant can be fed to ruminant as fresh forage or hay without any negative effect on growth performance. Meat physicochemical qualities pH, cooking loss and water holding capacity were not different between lambs that were reared under intensive and semi-intensive management system, [9]. In addition [10] reported no sensory or other meat quality trait differences were found between lambs fed on different forage types. The Objective of the study was to evaluate the effect of *Clitoria ternatea* replacement for Alfalfa on some meat quality attributes of growing lambs.

2. METHODOLOGICAL & EXPERIMENTAL PROGRAM

The study was conducted during the period from 16/10/2019 to 2/1/2020 at the research farm of the college's campus (Veterinary Medicine; Animal Production Science and Technology) (KUKU complex), Sudan University of Science and Technology. Twenty-four (24) lambs (male) of Sudanese desert sheep were used in this experiment, with average weights 18.82± 1.67 kg and aged 4 months. All animals were treated with the necessary medication against external and internal parasites. The animals were ear tagged, weighed and divided into four groups. A completely randomized design (CRD) of four treatments and six lambs (replications) per treatment were used. The trial period was 77 days, the first 14 days for adaptation of animals for diet and 63 days for data collection. The feed was provided *adlibitum* in the form of completed diet; with hay: concentrate ratio of 40:60. The diets were offered once a day, at 9:00 am. The hay of clitoria and alfalfa were dried under shade, then grinding before mixing with others ingredients. For group (A), hay composed of 100% *Clitoria ternatea*; group (B), hay composed of 50% *Clitoria ternatea* +50% alfalfa; group (C): hay composed of 75% *Clitoria ternatea*+ 25% alfalfa; group (D): hay composed of 100% alfalfa, table (1).

Table (1): Ingredients of experimental diets (%)

Ingredients (%)	Ration A	Ration B	Ration C	Ration D
Sorghum	38.00	38.00	38.00	38.00
Wheat bran	7.00	7.00	7.00	7.00
Groundnut cake	4.00	4.00	4.00	4.00
Molasses	9.00	9.00	9.00	9.00
***Clitoria ternatea* hay meal**	40	-	-	-
Hay mixture (50%*Clitoria*+50%Alfala)	-	40	-	-
Hay mixture (75%*Clitoria*+25%Alfalfa)	-	-	40	-
Alfalfa hay meal	-	-	-	40
Salt	1.00	1.00	1.00	1.00
Lime stone	1.00	1.00	1.00	1.00
Total	100%	100%	100%	100%

2.1. Slaughter procedure and experiment samples:

A total of 12 lambs from the four groups were selected randomly (three of each group); and destined for slaughter. Lambs offered water but not feed for 12 hours before slaughter. The lambs were weighed before slaughter, at the abattoir of the Animal Production Researches (Kuku); then bleed for 10-15 minutes and skinned; then evisceration was performed. Meat samples were taken from *L. dorsi* muscle, after 24 hours postmortem (after chilling for 24 hours at 4°C) to measure some meat quality attributes.

2.2. Phsyo-chemical properties: -

2.2.1. pH determination:

For pH determination, 10 gram of meat sample was placed in a blender jar, and 100 ml of distilled water were added. The mixture was blended at high speed for one minute. The pH of mixture was measured using a pH- meter.

2.2.2. Water holding capacity:

A sample (one gram) was minced, then placed on humidified filter paper and pressed between two Plexiglas plates for 2 minutes at 25 kg load. Meat and moisture areas were measured with a compensating Plano–meter, the resulting areas covered by the meat and moisture were used to calculate a ratio of water holding capacity of meat. A larger ratio indicates a decrease in water holding capacity (W.H.C.) [11].

W.H.C =	loose water area –meat film area
	Meat film area

2.2.3. Cooking loss determination: Samples were cooked in the water bath at 80˚c for 90 minutes, samples weighed before and after cooking. Cooking loss was determined as the loss in weight during cooking and expressed as a percentage of precooking weight [11]

Cooking loss =	weight before cooking –weight after cooking Weight before cooking

2.3. Chemical analysis: Determination of moisture, protein, fat (ether extract) and ash percentages of meat samples were performed according to [12] methods.

2.4. Statistical Analysis: Data collected were presented as mean± standard deviation and were analyzed using SPSS (Version 17.0) (2008) computer software program as one-

way analysis of variance (ANOVA), treatment means were separated by the least significant difference (LSD) method.

3. RESULTS

3.1. Phsyo chemical properties: -

3.1.1. Meat pH:

The pH values were 5.81±0.08, 5.51±0.44, 5.87±0.05 and 5.78±0.07, for group A, B, C and D, respectively; with no significant differences (p>0.05) between mentioned groups (table 2).

Table 2 It shows the physical characteristics of growing lambs' meat:

Group	WHC	Cooking loss	pH
A	2.40±0.33	35.24±1.71	5.81±0.08
B	2.28±0.15	34.56±1.26	5.51±0.44
C	2.71±0.26	37.02±0.77	5.87±0.05
D	2.53±0.30	35.89±1.62	5.78±0.07
Sig	Ns	Ns	Ns

NS= No significant difference., WHC= water holding capacity

3.1.2. Water holding capacity (WHC):

The results showed no significant differences (p>0.05) between groups in water holding capacity (WHC). The highest value was recorded by group B (2.28±0.15), and lowest was obtained by group C (2.71±0.26), (table 2).

3.1.3. Cooking loss:

The result recorded no significant differences (p>0.05) between groups, in cooking loss. The highest cooking loss in meat was recorded by group C (37.02±0.77), while the lowest value was recorded by group B (34.56±1.26).

3.2. Chemical analysis:

Data presented in table (3) showed the proximate analysis of the *longismus dorsi* muscle of the slaughtered lambs fed on different levels of *Clitoria ternatea* hay, The values of moisture, protein, fat and ash percentage of the meat obtained from experimental lambs were similar and no significant differences (p>0.05) were found.

The Moisture percentages ranged from (73.41±0.66) to (74.24±0.59). Protein content ranged between (20.63±0.25) and (21.00±0.18). Meat fat % values were ranged between (1.81±0.11) and 2.06±0.26). Ash percentage ranged between 1.06±0.08 and 1.15±0.05.

Table (3): Meat chemical composition of slaughtered lambs in experimental groups: -

Composition %	Group (A)	Group (B)	Group (C)	Group (D)	Sig
Moisture	73.84±0.09	73.62±0.30	73.41±0.66	74.24±0.59	NS
Protein	20.83±0.04	21.00±0.18	20.99±0.37	20.63±0.25	NS
Fat	1.86±0.04	1.98±0.12	2.06±0.26	1.81±0.11	NS
Ash	1.13±0.01	1.13±0.03	1.15±0.05	1.06±0.08	NS

NS= No significant difference.

4. DISCUSSION

pH values were agreed with [13], who reported that there was no significant difference in pH (1and 24 h) between groups fed different diets. This present result of pH was within the range of normal sheep meat pH. This was agreed with [14] and [15], who reported that the pH values should range from 5.5 to 5.8 at 24 hours after slaughter. The highest value in water holding capacity (WHC) was recorded by group B and lowest was obtained by group C. This variation may be due to the associated effect of pH on WHC. In this study the pH was lower in group B and higher in group C. This was agreed with [9], who recorded the pH of meat influences the WHC. The lesser of pH raised the meat WHC, and higher WHC of meat generally reduces the cooking loss. The highest cooking loss in meat was recorded by group C, while the lowest value was recorded by group; this result may be due to higher WHC in group B than group C. This was justifying by [9], who reported the meat with high WHC will hold more water that had resulting in low cooking loss. Also, this result of no significant differences between groups in cooking loss of meat; this result was matched with [13], who recorded dietary feeding systems did not have any influence on the cooking loss of lamb meat. Also, this result is in the same line with [16] who reported that dietary feeding did not influence cooking loss in chevon.

The Moisture percentages approximately similar to [17] and [18] whose recorded that the moisture percentages in meat were 75% and 75.6±0.45. Same results was obtained by [19] who recorded moisture of (74.14%) in meat, also [20] signed (74.02±0.18) percent moisture in meat. Protein content was higher than that of [17], [19] who recorded (18.05%) meat protein content and [20] who stated value of meat protein of (19.08±0.10) percent. But it was similar to the finding by [18] of 20.6±0.23 Percent protein content in meat.

Meat fat % was higher than the result obtained by [18] of (1.20±0.09) fat % in meat ; but was lower than [17] (2.5%) and [20] of (4.97±0.28) meat fat% .A similar results to present study was recorded by [19] who found that the fat % was (2.08%). Ash percentages was lower than that of [19] (4.48%); and similar to that obtained by [18] (1.02±0.02) and [20] (1.12±0.01).

5. CONCLUSION

Clitoria ternatea can be use as mixture with alfalfa. Also, can be use as alternative to alfalfa without any negative effect on physical chemical properties of the lambs' meat.

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