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Wholesale Cuts and Meat Quality Attributes of Abo-Deleek Sheep under Intensive and Semi-Intensive Production Systems of Egypt

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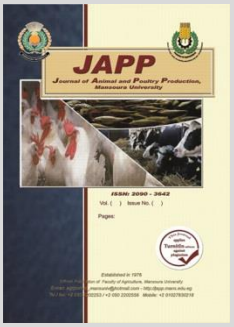

ABSTRACT

This research was carred out at Ras-Hederba-Valley area belonging to Desert Research Center. Where aimed to investigate the influence of the production systems (intensive and semi-intensive) on the carcass characteristic, quality, and sensory evaluation of Abo-Deleek meat. Fourteen Abo-Deleek lambs (seven in each group) aged approximately one year were slaughtered after raising for six months in two different production systems in terms of intensive (G1) and semi-intensive (G2) systems. Cold carcass and wholesale cuts were weighted. Meat samples were collected and conducting meat analysis and sensory evaluation. The main results obtained that, there was no significant differences between two groups according to cold carcass weight, all wholesale cuts, best ribs weight, dissection of best ribs (lean, fat and bone) and *longissimus dorsi (LD)* muscle area. Also, the chemical composition and physical traits of lambs meat were similar in both groups except water binding capacity where recorded a high value in the G2 (54.14 %) compared to G1 (48.01 %). While sensory evaluation traits were high in G2 compared to G1 ($p<0.05$). Moreover, there were a correlation between sensory traits and chemical content of meat particularly collagen and minerals ($p<0.05$). Therefore, the present study concluded that Abo-Deleek sheep could be reared under semi-intensive system which enhanced the palatability of meat and without any negative effects on wholesale cuts and meat quality.

Keywords: Abo-Deleek Sheep, Wholesale Cuts, Production System, Palatability.

INTRODUCTION

Sheep meat is a globally important commodity (Ponnampalam, *et al.*, 2016). Meat has a major part in the nutrition culture, actuality an vital source of protein and other micronutrients (Biesalski & Nohr, 2009). Differ in lambs production systems are used throughout the world, which offer different management options that determine the variances in the essential and extrinsic traits of mutton. (Sañudo *et al*., 2007). In the meantime, consumers pay more attention to meat quality by reason of the effects of meat composition on human health (De la Fuente *et al.*, 2009). Several causes influence the sensory qualities and acceptability of lamb meat, like gender, age, breed and feeding regimes (Beriain *et al.*, 2000). One of these causes is feeding systems have been shown to play an important role in regulating meat quality. Existing lambs feeding systems as well as outdoor grazing and indoor complementary feeding, where grazing is believed to be the cheapest way to produce lamb and can provide high quality meat seen by consumers (Carrasco *et al.*, 2009).

On the other hand, lambs subjected to only grazing management revealed lower production performance vs. to those fed a concentration diet because of lower nutrient values on pasture (Demirel *et al.*, 2006). Also, overgrazing decreases the yield of grasslands and harms the ecological balance, particularly in arid or semi-arid regions (Zhang *et al.*, 2014). While, extra feeding can increase the rate of live body weight and produce heavier carcasses *vs.* pasture animals (Del Campo *et al.*, 2008). Conversely, feeding lambs with concentrated animal feed in the regime leads to produce lower quality of meat, like higher content of cholesterol which develops the risk of atherosclerosis in humans (Vorster *et al.*, 1997). Add concentrate in animal diet can enhance some meat quality indicators like degree of meat lightness color value (Wiklund *et al.*, 2003 and Ekiz *et al.*, 2012). Additionally, meat flavor is a vital characteristic of meat quality, acting a major role effect consumer acceptance of meat (Li *et al.*, 2010).

Therefore, this study amid at investigate the influence of the production system (intensive and semi-intensive) on carcass characteristic, meat quality and sensory evaluation of Abo-Deleek sheep.

MATERIALS AND METHODS

This research was lead at Ras-Hederba-Valley area belonging to Desert Research Center. Fourteen Abo-Deleek lambs (seven in each group) aged approximately one year were slaughtered after raising for six months in two different production systems in terms of intensive (G1) and semi-intensive (G2) systems.

Lambs of G1 group were kept under intensive production system. Lambs were fed on concentrate feed mixture (CFM) contains about 12% protein in addition alfalfa hay *ad libitum*. Animals in group 2 were kept under semi-intensive production system. Lambs had free access to grazing on natural vegetation's. The grazing time extended as of sunrise till sunset. Lambs in G2 were fed on the same CFM, contains about 12% protein in the shed. However, quantities as CFM, used for both groups were changes every two weeks (According to changes in live body weight). Animals were allowed to drink water twice a day.

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Slaughter data:

Fourteen lambs were slaughtered at the end of investigate (after180 days). Follows the stranded procedure (Frild *et al.,* 1963), where the slaughter weight between G1 (37.63 ± 1.05 kg) and G2 (36.88±1.36 kg) groups. Best ribs *LD*, were taken from the carcass of Abo- Deleek lambs to assess the meat quality traits**.**

Wholesale cuts and dissection of best ribs:

Cold carcass was split into seven standard lambs wholesale cuts adapted to (Hamada, 1976). Cold meat cuts be located pondered to estimate the fractions based on cold carcass weight. The best ribs cut was divided into lean meat, fat and bone tissues.

Meat quality analysis:

Chemical composition analysis of lamb's meat was conducted by meat analyzer device, where one hundred gram of meat was used to apply the analysis. The output included moisture, intramuscular fat, protein, and collagen. Minerals were estimated by burning the samples according to Vecvagars *et al.* (2018).

Meat color was assessed using Chroma meter. Color parameters involved brightness, chroma, and hue according to Zayed *et al.* (2022). Area of the cross section of *Longsimus dorsi* (*L.D*) muscle was determined regarding to Zayed *et al.* (2022). Water binding capacity was calculated through equation WBC = 100 - expressible fluid (EF) %. EF was estimated by weighing about 30 mg of meat (Wt1) in filter paper and exposed to pressure of one kg for 10 mins. After that, it was weighed again (Wt2). The EF was estimated by the following equation: EF % = [(Wt1-Wt2)/W1] x 100. Shear force was conducted on cooked cuts using Instron Universal Testing Machine according to Zayed *et al.* (2022). The pH value of meat was concluded by pH meter after slaughter.

Sensory assessment:

Cooked samples were taken from loin cut of each lamb. Following that, samples were rule on for sensory evaluation by ten panelists to evaluate tenderness, flavor, aroma, juiciness, and palatability. These parameters had five grades (one to five) this grade represent in very poor, poor, fair, good, and very good, respectively.

Statistical analysis:

All data were analyzed by SPSS 24 software, using procedure one way analysis of variance (ANOVA), a general linear model. The fixed linear model used to analyze the studied traits was as follows: $Y_{ij} = \mu + MS_i + e_{ij}$ Where: Y_{ij} = the observations, μ = the overall mean, MS_i = the effect due to i^{th} type of production system, i = 1 and 2 for intensive system and semi-intensive system, respectively, e_{ij} = random error. The significant differences were tested at 5 %.

RESULTS AND DISCUSSION

Wholesale cuts:

Least squares means of cold carcass weight and wholesale cuts were described in Table (1). Wholesale cuts expressed as weight and percentage did not appear any significant differences between intensive and semi-intensive production systems (Figure 1). However, those results are within the same range that reported by L. Majdoub-Mathlouthi *et al.,* (2013). In the same context, the obtained results are disagreed with Borton, *et al.* (2005) who reported that loin ratio was greater for lambs fattened on concentrate than those fattened on fodders.

Lean, fat and bone of rib cut:

According to the current results shown in Table (1), lean, fat, and bone percentages of best ribs were similar (p>0.05) between two groups. However, these results disagreed with Shehata *et al.* (2013) that noticed a significant differences (P<0.05) among all traits in lean and fat %.

Table1. Best ribs discistions of Abo Deleek lambs raised in intensive vs. grazing system

Trait	Intensive ± SE	Semi-intensive ± SE
The best ribs cut weight (Kg)	0.78 ±0.04	0.90 ±0.1
Dissection of best ribs (%) [1]	4.68 ±0.1	5.10 ±0.3
Lean meat %	59.01 ±2.0	59.46 ±1.8
Fat %	17.48 ±2.2	18.91 ±1.5
Bone %	23.51 ±0.7	21.63±1.0
Longissimus dorsi muscle area (cm^2)	15.15 ±1.4	15.40±1.0

1: Based on cold carcass wt.

Means followed by different superscript letters within the same row are significantly different at P<0.05.

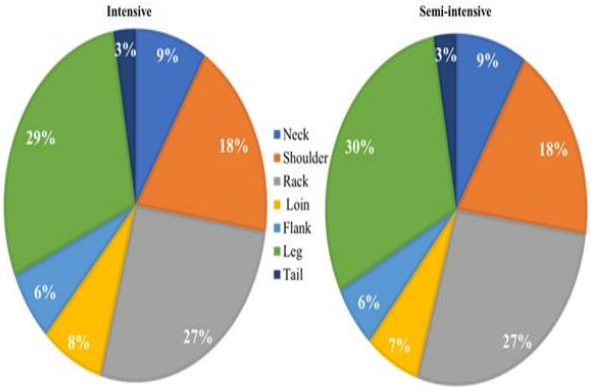

Figure 1. Wholesale cuts % of Abo Deleek lambs raised in intensive vs. grazing system

Meat quality traits:

Least squares means in Table (2) showed that chemical composition, shear force and pH traits were similar (p>0.05) between groups. In the present study, the brightness, chroma and hue were similar in both studied groups which agreed with findings that reported by de Andrade *et al.* (2016) and Majdoub-Mathlouthi *et al,* (2013). Analysis of difference between two production systems for meat pH values were similar to those results of variances between Lowland and Mountain groups of lambs described by de Andrade *et al.* (2016). Almitiairy *et al.* (2011) found that pH and color of meat were not affected by different feeding system. While WBC was higher in semi-intensive group (54.14 %) compared to intensive group (48.01 %), these results were disagreed with finding of Rossatti *et al.* (2019).

Chemical composition:

Table (2) shown that chemical content of meat, where there were no significant differences between both production systems (p> 0.05). Results agreed with Romero-Bernal *et al.* (2016) who reported that no significant difference among all dietary groups in moisture, protein, and ash %, but the fat was observe the differences (p<0.05).

Table 2. Physicochemical properties of *Longissimus dorsi* muscle for Abo-Deleek lambs raised in intensive vs. grazing system.

Trait	Intensive ± SE	Semi-intensive ± SE
Moisture	72.88±0.3	71.74±0.4
Protein	21.29±0.1	21.33±0.2
Intramsucular fat	4.82±0.3	4.51±0.5
Conective tisuss	1.47±0.04	1.71±0.1
Minerals	1.10±0.1	1.25±0.04
Water binding capacity %	48.01^{b}±1.3	54.14^{a}±0.7
Shear force (kgf/cm)	4.90±0.8	5.11±0.7
Color		
Britness	41.57±0.6	41.02 ±0.7
Chroma	17.08 ±0.5	16.96 ±0.4
Hue	13.80 ±0.9	15.76 ±2.1
pH0	6.19 ± 0.1	6.30 ± 0.1

Means followed by different superscript letters within the same row are significantly different at P<0.05.

Sensory properties:

The current study declared that semi-intensive production systems enhanced (p < 0.05) aroma, flavor, tenderness, juiciness, and Palatability and are accepted by clients than intensive one (Figure 2). These results are in agreement with Costa *et al.* (2018) who noted that Licuri cake in the regime of lamb could be enhanced (P < 0.05) meat evaluation traits. In contrary, Alves Cirne *et al.* (2017) decided that till 25% mulberry hay instead of concentrate fed had no effect on meat sensory characteristics, indicative of that this feedstuff could be good alternative to supply feed for fattening lambs. Moreover, Grabež *et al.* (2019) repotted that the flavor components re-counting grass and bitter flavor could be used to discriminate animals of different production systems.

Correlation analysis between sensory evaluation traits and chemical composition:

There was a positive correlation showed in (Table 3) between sensory traits (the aroma, flavor, tenderness, juiciness and Palatability) and chemical composition of meat in particularly collagen and minerals (p<0.05)

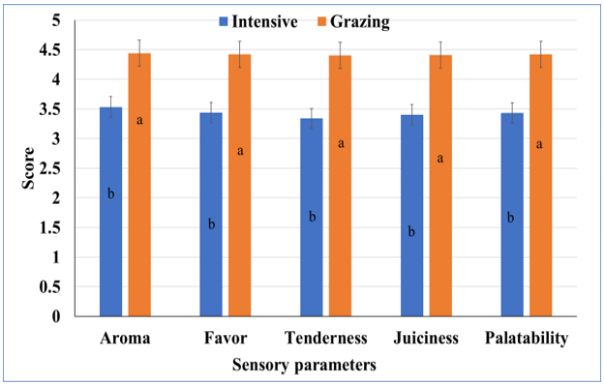

Figure 2. Sensory evaluations for Abo Deleek lambs raised in intensive vs. semi-intensive system.

Means followed by different superscript letters are significantly different at P<0.05.

Table 3. Correlation analysis between sensory evaluation and chemical composition traits

Trait		Aroma	Flavor	Tenderness	Juiciness	Palatability	Collagen	Intramuscular fat	Moisture	Protein	Minerals
Flavor		.951**									
	Sig.	0.000									
Tenderness		.967**	.974**								
	Sig.	0.000	0.000								
Juiciness		.911**	.949**	.955**							
	Sig.	0.000	0.000	0.000							
Palatability		.974**	.987**	.993**	.973**						
	Sig.	0.000	0.000	0.000	0.000						
Collagen		.591*	.609*	.540*	0.431	.551*					
	Sig.	0.026	0.021	0.046	0.124	0.041					
Intramuscular fat		0.237	0.288	0.295	0.189	0.257	0.108				
	Sig.	0.414	0.318	0.306	0.518	0.375	0.712				
Moisture		-0.453	-0.466	-0.456	-0.345	-0.437	-0.224	-.927**			
	Sig.	0.104	0.093	0.101	0.227	0.118	0.442	0.000			
Protein		0.136	0.040	-0.005	0.046	0.053	0.108	-.692**	0.396		
	Sig.	0.643	0.892	0.986	0.876	0.857	0.713	0.006	0.162		
Minerals		.571*	.549*	.579*	.551*	.573*	0.231	0.118	-0.225	-0.154	
	Sig.	0.033	0.042	0.030	0.041	0.032	0.427	0.688	0.439	0.598	
pH		0.260	0.306	0.300	0.238	0.280	0.123	-0.245	0.146	0.167	0.503
	Sig.	0.370	0.287	0.297	0.413	0.333	0.677	0.399	0.619	0.568	0.067

**** Correlation is significant at the 0.01 level**

*** Correlation is significant at the 0.05 level**

CONCLUSIONS

The current study concluded that Abo-Deleek sheep could be reared under semi-intensive system which enhanced the palatability of meat and without any negative effects on wholesale cuts and meat quality.

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القطعيات التجارية و صفات جودة اللحوم لأغنام أبو دليك في ظل أنظمة الإنتاج المكثف وشبه المكثف في مصر

محمد على زايد، منى محمدى إبراهيم ومحمد فرج شحاتة

شعبة الإنتاج الحيوانى والدواجن- مركز بحوث الصحراء- المطرية- القاهرة

الملخص

تم إجراء هذا البحث في منطقة وادي رأس حدربة التابعة لمركز بحوث الصحراء. حيث هدفت إلى دراسة تأثير نظام الإنتاج (المكثف وشبه المكثف) على خصائص الذبيحة وجودة اللحوم والتقييم الحسي لأغنام أبو دليك. تم ذبح أربعة عشر حملا من أبودليك (سبعة في كل مجموعة) بعمر عام تقريبا بعد تربيتها لمدة ستة أشهر في نظامين إنتاجيين مختلفين من النظام المكثف (المجموعة الاولي) وشبه المكثف (المجموعة الثانية). تم وزن الذبيحة المبرد و القطعيات التجارية للحوم. تم جمع عينات اللحوم وإجراء تحليل وتقييم حسي للحوم. أظهرت النتائج الرئيسية عدم وجود فروق ذات دلالة إحصائية بين المجموعتين حسب وزن الذبيحة الباردة، كل القطعيات التجارية للحوم، قطعية افضل الضلوع ، تشفية منطقة قطعية أفضل الضلوع (اللحم الاحمر ، الدهون والعظام). كما أظهرت نتائج التركيب الكيميائي والصفات الطبيعية للحم الضأن تشابه في كلا المجموعتين ولكن القدرة على الاحتفاظ بالماء سجلت قيمة عالية في المجموعة الثانية54.14) ٪ (مقارنة بالمجموعة الاولي48.01). ٪ (بينما كانت خصائص التقييم الحسي مرتفعة في المجموعة الثانية مقارنة بالمجموعة الاولي ($P < 0.05$).علاوة على ذلك ، كان هناك ارتباط بين الصفات الحسية والمحتوى الكيميائي للحوم خاصة الكولاجين والمعادن .($P < 0.05$) لذلك خلصت الدراسة الحالية إلى أنه يمكن تربية غنم أبو دليك في نظام شبه مكثف مما أدى إلى تحسين استساغة اللحوم وبدون أي آثار سلبية على القطعيات التجارية للحوم و جودتها.

الكلمات الدالة : أغنام أبودليك- القطعيات التجارية- نظم الإنتاج- الإستساغة