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FATTY ACID COMPOSITION OF LONGISSIMUS DORSI MUSCLE OF BLACK GOATS AND MERIZ KIDS AS INFLUENCED BY CASTRATION AND SLAUGHTER WEIGHT

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ABSTRACT

To investigate the effect of castration and live body weight at slaughter on fatty acid composition, a total of 48 entire male kids (24 Meriz and 24 Black goat) were selected at weaning (90-120 days of age) and weighing 10.99 and 11.21kg, respectively from commercial goat farm were used. After an adaptation period for a week, the kids of both breeds were randomly divided in to two groups, the first was castrated, whereas the second groups were left intact, and then were allocated to be slaughtered at 15,20 and 25kg live body weight. All kids were placed in individual pens and fed concentrate diet and weighed at weekly interval. After slaughtering and chilling the carcass for 24h fed. The L. dorsi muscle was removed from each carcass and utilized for fatty acid composition.

Results obtained revealed that saturated fatty acids (SFAs)have the highest contribution, followed by poly unsaturated fatty acids (PUFAs) and mono -unsaturated fatty acid (MUSFs). Kids goat had a significantly ($p<0.01$) higher content of each of C18, C14, C11, C18:2 and C18:3 than Meriz kids, whereas Meriz kids surpass significantly Black goat in C16, and the difference between the two-breed lacked significance in C18:1.Also, it was shown that castrated kids had significantly ($p<0.01$) higher proportion of all studied fatty acids as compared to intact kids, and all profiles of saturated fatty acids were significantly lower in kids slaughtered at 15kg live body weight compared to kids slaughtered at 20 and 25kg.

INTRODUCTION

In developing countries, an important source of meat is goat especially in regions where feed and water resources are limited to provide meat and dairy products most economically (Yalcintan et al.,2012). However, since consumers preference of red meat concern more on healthy meat, because of its high content of saturated fatty acid produced by hydrogenation of dietary unsaturated fatty acid in the rumen (Vanerveen,1996). Thus, more attention was directed to use goat meat chiefly because its low intramuscular fat as well as cholesterol and sensorial features (Madruga and Bressan.2011). Among different sources of red meat, goat meat is considered the leanest (James and Berry,1997). It has been demonstrated that many factors are affecting the fatty acid composition such as breed, sex, age, the quantity and quality of feed consumed and body weight (Rajkumar et al.,2015).

It is known that organoleptic properties of meat are affected by physical and chemical properties of fat and fatty acid composition (Webb and O'Neill,2008). Also, the ratio between saturated (SFA), monounsaturated (MUFA)and poly unsaturated (PUFA) fatty acids affect the chemical composition, sensory characteristics and the shelf life of meat product. Thus, the current investigation was designed to study the fatty acid profile of longissimus dorsi muscle of castrated and entire Black goat and Meriz kids slaughtered at different weights.

MATERIALS AND METHODS

STUDY SITE

The present work was carried out at Animal farm. Department of Animal production, College of Agricultural Engineering Science, University of Duhok during the period 4/7/2021 to 14/2/2022.

ANIMAL MANAGEMENT AND EXPERIMENTAL DESIGN

On the basis of weight and age, a total of 48 entire male kids (24 Meriz and 24 Black goat) were selected at weaning (90-120 days of age) and weighing 10.99 and 11.21kg, respectively from commercial goat farm. After the adaptation period for a week, the kids of both breeds were randomly divided into two equal groups, the first was castrated using rubber ring, whereas the second groups were left intact, and then were allocated to be slaughtered at 15,20 and 25kg live body weight. All kids were placed in individual pens. Concentrate in the form of pellets contained 15.5% crude protein and then later concentrate mixture contained 15.24% crude protein and 2854 kcal energy (Table 1) was offered daily at a ratio of 300gm, and then was adjusted weekly based on their live body weight. Clean water and mineral blocks were available constantly.

Table (1): composition of feeding program is given in the following:

No.	**Composition of ration**	**%**
1	Barley	60 %
2	Wheat bran	17 %
3	Corn	10 %
4	SBM	12 %
5	Salt	0.5 %
6	Minerals	0.5 %
7	Total	100
8	Protein	**15.5 %**
9	Metabolizable Energy	2854 kcal. Kg diet

Slaughtering

Each kid was weighed and slaughtered when reached its target weight after fasting for 18h, with free access to water, following slaughtering, the hot carcass was weighed, then chilled for 24h. The longissimus dorsi muscle was removed from the right side of each carcass and utilized for fatty acid composition.

Extract of the fat

Fat was extracted using extractor (Soxholet) and then fat ester was carried out following the method of AOAC (1995).

Gc-ms analysis

GC-MS was performed at Ministry of science and Technology-Department of Environment and water - Baghdad; analyses were performed using a Shimadzu 2010 gas chromatography fitted with Agilent J&W SE-30 (100% dimethylpolysiloxane column, 30 m x 0.25 mm i.d.). The chromatographic conditions and column used for GC analyses. The FID detector was use for detection and operated by shimadzu software. Helium was used as the carrier gas at constant pressure 100 kpa. The injector and transfer line temperatures were set at 280 and 250 °C, respectively. The gradient column temperature started from 120-290 °C (10 C°C /min).

A diluted sample in hexane of 1 µl was injected in split less mode. Quantification of the components was performed based on their GC peak areas on the SE-30 column.

Data collection and statistical analysis

General linear model (GLM)within statistical program SAS (2018) was used to analysis the factors (Breed, Sex, Slaughter weight) on studied traits. Duncan multiple range test (1955) was used to detect significant differences between the level of each factor on studied traits.

RESULTS & DISCUSSION:

It has been demonstrated that the profile of fatty acid has a considerable role to meat quality and linked to meat aroma and their nutritional value (Yarali *et al.*,2014). Table (2) summarize the overall mean and standard errors for fatty acid composition in longissimus dorsi muscle. It seems from the Table (2) that saturated fatty acid (SFAs) have the highest contribution towards total fatty acid of goat meat. This is followed by poly unsaturated fatty acid (PUFAs), and monounsaturated fatty acid (MUSFs). Similarly, Rajkumar *et al.* (2015) indicated that saturated fatty acid has the highest contribution towards fatty acid of goat meat. Previously, working on Iraqi native goat, Alkass *et al* (2018) demonstrated that MUSFAs have the highest contribution toward total fatty acid of goat meat followed by SFAs and PUFAs. It appears from the Table (2) that the predominant saturated fatty acids (SFAs) were Palmitic acid (C16:0) (17.14±0.28), followed by Stearic acid (C18:0) (7.52± 0.15), Mysteric acid (C14:0) (3.85± 0.12) and Undecanoic (C:11) (2.02±0.09). Similarly, Gecgel *et al.* (2015) and Tufekci and Olfaz (2021) found that about 90% of SFAs are (C16:0, C18:0 and C14) in L. dorsi muscle fat in various genotype of lambs. Alkass *et al.* (2016) noticed that the predominant SFAs types was C16:0, C18:0 and C14:0 in Awassi and Karadi lambs. Such difference could be due to differences in age and body weight at slaughter and quality and quantity of feed consumed (Rajkumar *et al.*,2015)

Far as individual fatty acid is concerned, Linolic acid (C18:2) contributed the highest (22.45± 0.31) followed by Oleic (C18:1) (20.29± 0.32) and Palmatic (C16:0) (17.14± 0.28) (Table 2). Also, Alkass *et al.*, (2018) demonstrated that, Oleic acid contributed the highest followed by Palmatic and Stearic acid,in native kids. According to Rajkumar *et al*., (2015) and Mahgoub *et al.* (2002), the largest proportion of fat acid in the muscle tissue of goat was Oleic(C18:1). It is obvious from the result presented in Table (2) that, breed displayed a significant effect on the content of C18, C14, C11, C18:2and C18:3 which was significantly ($p<0.01$) higher in Black goat compared to Meriz kids. However, Meriz kids surpass significantly to black goat in palmitic acid(C16) and the difference between the two studied breeds lacked significance in Oleic acid(C18:1).

It is has been noticed that variation among breeds in the content of different fatty acids exist for example, lowest content of SFA and highest of MUFA were shown for Saanen kids (Nitsan *et al*., 1987). In contrast, are the results for Alpine kids (Potchoiba *et al*., 1990). Also, differences between individuals within breed (Alpine) have been reported by Potchoiba *et al*. (1990); Park and Washington (1993). Also, Wattanachant (2018) and Madruga *et al*. (2009) found that breed had an effect of fatty acid profiles in meat and adipose tissue.

In the present work, fatty acids of castrated kids had significantly ($p<0.01$) higher proportion of all studied fatty acid. With regard the effect of sex on fatty acid profiles of meat, results from many investigations demonstrated that sex could influence on the amount and type of fatty acid composition of goat tissues, although the data were inconsistent and might depend on many factors such as feed, age and weight (Banskalieva *et al.*,2000 and Goetsch *et al.*,2011). However, it has been reported that castration significantly ($p<0.05$) decreased the Stearic acid content, and the amount of Oleic acid was significantly improved ($p<0.05$) due to castration. In the present study, amount of Linolic acid (C18:2) is the major component in the fatty acid profile of goat, which resembles other workers (Madruga *et al.,* 2001 and Rajkumar *et al*. (2017)). Previously, working on native goat, Alkass *et al.* (2018) demonstrated that castration had no significant in all fatty acid composition.

It has been shown that, Oleic acid decreases blood cholesterol and Palmatic acid increases blood cholesterol while Stearic acid has no effect. Rhee *et al.* (2000) and Banskalieva *et al*. (2000) suggested that the ratio of (C18:0+ C18:1)/ C16:0 which ranging from 2.1 to 3.6 for goat meat could be useful in describing the potential health effect of different types of lipids. In the current work, this ratio which ranging 1.57 for Meriz and 1.67 for Black goat, which was lower than the 2.20 reported for Australian feral goat (Werdi Pratiwi *et al.,* 2007) and 2.34 for Egyptian Baladi goat (Moawad *et al*.,2013).

In the current investigation, about the effect of slaughter weight on fatty acid composition, it seems from Table (2) that all profiles of studied fatty acids were significantly($p<0.001$) lower in kids slaughtered at 15kg live body weight compared to those slaughtered at heavier weight (20 and 25kg). Also, all fatty acids were significantly higher in 20kg live body than those slaughtered at 25 kg live body weight except undecanoic and linolenic acid. Similarly, Rajkumar *et al.* (2017) reported that C16:0, C18:1 and C18:2 increased with age. Also, it has been demonstrated by Banskalieva *et al.* (2000), Mahgoub *et al.* (2002) and Werdi Pratiwi *et al.* (2007) that fatty acid composition of goat fat depots tends to change with age. Werdi Pratiwi *et al.* (2007) However Paengkoum *et al.* (2013) noticed that either age at slaughter nor castration no had a significant effect on content of saturated fatty acid.

CONCLUSIONS

From the results presented in the text, it seems that breed effect on fatty acid composition was noticed being higher in Black goat compared to Meriz kids. Also, castrated kids had significantly higher proportion of all studied fatty acid than entire kids, and those kids slaughtered at 15 kg had lower proportion of all fatty acids profile than kids slaughtered at 20 and 25kg.

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CONFLICT OF INTEREST

We declare that we don't have affiliation or entity with any organization regarding the financial a non- financial interest in this subject matter discussed in this article

تركيب الاحماض الدهنية للعضلة العينية لجداء الماعز الأسود والمرعز وتأثير كل من الخصي والوزن عند الذبح عليها

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الخلاصة

بهدف دراسة تأثير كل من الخصي والوزن عند الذبح في تركيب الاحماض الدهنية، فلقد تم شراء 48 جدي (24مرعز و24 ماعز اسود) مفطومة (90–120يوم) وبوزن 10.99 و11.21كغم على التوالي. من الاسواق المحلية. وبعد فتره تأقلم لمدة اسبوع تم توزيع جداء كل سلالة الى مجموعتين عشوائيا، حيث تم خصي المجموعة الاولى بينما تركت المجموعة الثانية كسيطرة ولتذبح عند اوزان 15 و20 و25كغم وتم ايواء الحيوانات في حظائر منفردة وغذيت على العلف المركز وكان يتم وزنها اسبوعيا. وبعد الذبح وتبريد الذبائح لمدة 24ساعه تم فصل العضلة العينية لاستخدامها في تحليل الاحماض الدهنية.

تشير النتائج بان مساهمة الاحماض الدهنية المشبعة من مجموع الاحماض الدهنية فكانت اعلاها تلتها الاحماض الدهنية الغير المشبعة والاحماض الدهنية الأحادية غير المشبعة وتبين بأن كل من C18 و14C و11C و218C و318C: كانت اعلاها معنويا ($p < 0.01$) في الماعز الاسود مقارنة بالمرعز. في حين كان الحامض الدهني C16 اعلى معنويا في المرعز ولم تكن الفروقات معنوية بين السلالتين في C18:1. كما واتضح بان جميع الاحماض الدهنية كانت اعلى معنويا ($p < 0.01$) في الجداء المخصية مقارنة بجداء السيطرة. كما تبين بان جميع الاحماض الدهنية قيد الدراسة ادناها معنويا في مجموعة الجداء المذبوحة عند وزن 15كغم مقارنه بتلك المذبوحة عند اوزان 20 و25 كغم.

الكلمات المفتاحية: الاحماض الدهنية، الماعز الاسود، المرعز، الخصي.

Table (2): Effect of breed, castration and slaughter weight on fatty acids longissimus dorsi muscle.

Overall Mean		NO.	Palmatic	Stearic	Mysteric	Undecanoic	Oleic	Linoleic	Linolinic
Mean		45	17.14±0.28	7.52±0.15	3.85±0.12	2.02±0.09	20.29±0.32	22.45±0.31	0.87±0.06
Breed	**Meriz**	22	17.44±0.52a	7.14±0.24b	3.27±0.12b	1.62±0.03b	20.33±0.64a	21.90±0.55b	0.60±0.03b
	Black goat	23	16.85±0.26b	7.90±0.16a	4.41±0.13a	2.40±0.15a	20.25±0.16a	22.98±0.27a	1.12±0.08a
Sex	**Intact**	23	16.14±0.25b	7.04±0.18b	3.58±0.16b	1.82±0.10b	19.17±0.22b	21.29±0.36b	0.80±0.08b
	Castrated	22	18.19±0.43a	8.03±0.20a	4.14±0.17a	2.22±0.16a	21.46±0.52a	23.67±0.36a	0.93±0.08a
Slaughter weight	**G1 15KG**	16	15.53±0.20c	6.69±0.14c	3.24±0.14c	1.59±0.05c	18.72±0.30c	20.82±0.37c	0.60±0.02c
	G2 20KG	15	18.30±0.53a	8.12±0.21a	4.25±0.13a	2.11±0.10b	21.75±0.63a	23.69±0.44a	0.93±0.07b
	G3 25KG	14	17.75±0.39b	7.84±0.29b	4.13±0.26b	2.41±0.25a	20.52±0.41b	22.99±0.52b	1.11±0.15a

Sig. Means with different letters within each factor are differ significantly

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