FATTY ACID COMPOSITION OF *L- DORSI* MUSCIE OF INTACT AND CASTRATED KIDS INDUCED BY ZERANOL IMPLANTATION

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ABSTRACT

To investigate the influence of zeranol administration by implantation and castration on fatty acids composition, 20 weaned kids (3-4 month old) with an average live weight of 17.3±0.23 kg were divided randomly into two equal main groups, the first was left intact as a control and the 2nd group was castrated. Each main group was then blocked randomly into two sub groups, the 1st was left as control and the 2nd implanted with Ralgro (12mg zeranol). Kids were fed a concentrate adlib and slaughtered after 70 days of fattening. After chilling for 24 hours, a homogenous samples of meat from *L.dorsi muscle* was blended for analysis of fatty acid composition. Results revealed that mono unsaturated fatty acid have the highest contribution towards fatty acid of goat meat, followed by saturated fatty acids and poly unsaturated fatty acids. Among individual fatty acids C18:1 contributed highest followed by C16:0, C18:0 and C18:3 Neither implanting kids with zeranol nor castration alter significantly the fatty acid profile or PUSF to SFA ratio or the proportion of C18+C18:1/C16.

Keywords: Fatty acid, meat, zeranol, castration, kids

مجلة العلوم الزراعية العراقية -2018 :49(2):205-210 القس وآخرون

مكونات الحماض الدهنية للعضلة العينية للجداء الاعتيادية والمخصية والمعاملة بالزيرانول

جلال ايليا القس ابراهيم اسود بكر خليل عبدالقادر اوري
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المستخلص:

يهدف دراسة تأثير الزيرانول والخصي على مكونات الاحماض الدهنية في الماعز. فلقد تم توزيع عشرون من جداء الماعز المحلي بعمر 3–4 أشهر وبمعدل وزن أبتدائي17.3 ± 0.23 كغم الى مجموعتين رئيسيتين متساويتين الأولى تركت كمجموعة سيطرة والثانية فلقد تم اجراء الخصي لها ومن ثم تم توزيعها الى مجموعتين ثانويتين أذ تركت الاولى كمجموعة سيطرة والثانية فقد تم غرز الزيرانول فيها (12 ملغ). غذيت الجداء على عليفة مركزة وبصورة حرة وذبحت بعد مرور سبعين يوما من تسمينها. بعد تبريد الذبائح لمدة 24 ساعة تم أخذ عينات من منطقة العظلة العينية وبعد ثرمها تم تحليل مكوناتها من الاحماض الدهنية. تشير النتائج الى أن الاحماض الدهنية غير المشبعة الاحادية قد شكلت النسبة الاعلى من مجموع الاحماض الدهنية في لحم الماعز، ويتبعها الاحماض الدهنية المشبعة ومن ثم الاحماض الدهنية المتعددة غير المشبعة. ومن ضمن الاحماض الدهنية فلقد كانت النسبة الاعلى لحامض الاوليك وتبعه بالماتيك وستياريك ولينولينك. لم يكن المعاملة بالزيرانول او الخصي تأثير معنوي على نسبة الأحماض الدهنية المشبعة وغير المشبعة.

الكلمات المفتاحية: أحماض دهنية، لحم، زيرانول، خصي، جداء

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INTRODUCTION

Interest in the fatty acid composition of meat stems, mainly from the fatty acids influence on the health of consumers is increased. Saturated fatty acids(SFAs) are bad because they are implicated in various diseases such as cardiovascular disease and cancer and unsaturated fatty acid (USFs) are good because their consumption is associated with lower risk of these conditions (28). Unfortunately ,the meat from ruminants has been criticized for its high content of saturated fatty acids(SFA) and low levels of mono and poly unsaturated fatty acids due to the biohydrogenation of dietary fatty acids by ruminal microorganism which results in a variety of fatty acids that reached the small intestine for absorption (17).

Nowadays, the tendency of consumer particularly in developed countries was increased to prefer lean meat with less fat and high quality meat (18). Moreover, goat meat has been gaining acceptance over the past years around the words especially in developed country ,mainly because of its low-fat content(7) . Also, it has been an increased in ways to manipulate the fatty acids composition of meat. Among new technologies, significant research have been conducted to improve the animal's anabolic responses and then increase the feed efficiency and growth of the animals. The few reports on the effect of growth- promoting implant on the fatty acid profile of meat are largely inconclusive. Regardless, of the importance of goat as a source of lean meat, compared to other species, there are limited studies dealing with fatty acid profile of goat meat and the factors affecting it. Therefore, the aim of this work was to study the fatty acid composition in muscle of intact and castrated kids induced by zeranol implantation.

MATERIALS AND METHODS

A total of 20 weaned (3-4 month old) intact male kids with an average live weight body weight of 17.3± 0.23 kg raised at animal farm of animal production Department, Faculty of Agriculture, University of Duhok, were divided randomly into two equal main group (10 kids each); the first was left intact as a control and the second group was castrated using elastrator rubber rings. Each main group was then blocked randomly into two sub groups (5 kids), the first was left as control and the other was implanted with Ralgro (12mg zeranol). Each group was kept in a separate pen and offered a concentrate (13.9% crude protein and 2740 kcal/kg energy) ad libitum. All kid were slaughtered at 70 days of fattening, After the carcass was chilled at 4 ̊C for 24 hours, the homogenous samples of meat from the *L.Dorsi* muscle were collected, and the muscle tissue was blended using a small food processor. According to the method described by O'Fallon et al. (19) profiles of fatty acids were measured at Princes Margret laboratory/ Harper Adams University. Briefly, 500 mg of dry meat was placed into test tubes to which 1.0 mL of internal standard (0.5mg of C13:0/mL of methanol), 0.7 mL of 10 N KOH and 5.3 mL of methanol were added. The tubes were incubated in water bath at 55°C for 90 min with vigorous hand-shaking for 5 s every 20 min and 580 µL of 24 N H2SO4 was added after cooling the tubes. The tubes were then incubated for further 90 min in 55°C water bath with shaken by hand for 5s every 20 minutes. The tubes were cooled and 3 ml of hexane were added and vortexed. After centrifugation, the layer hexane was put into a vial GC. The composition of fatty acid of the FAME was measured by capillary GC on a CP-SIL88, 100 m × 0.25 mm × 0.20 µm capillary column was installed on a Hewlett Packard HP 6890 series gas chromatograph equipped, a detector of flame ionization, and split injection. The start temperature of the oven was 70°C, and it was held for 2 min, afterwards raised to 225°C at an average of 4°C/ min, and then saved for 15 min. at a flow rate of 2.1 mL/min, hydrogen was utilized as the carrier gas, and the pressure of the column head was 29.59 psi. At 250°C both the detector and the injector were set. The split ratio was 100:1. As described previously, the identification of fatty acids were done by comparing their retention times with the fatty acid methyl standards. Results were analyzed statistically by General linear model to study the effect of treatment and sex of kid on fatty acid composition (25).

RESULTS AND DISCUSSION

major component of meat quality and its nutritive value is the fatty acid composition of

the meat lipid (15). Mean values and standard errors for *L.Dorsi* muscle fatty acid composition (g/kg dry basis) are given in Table 1. It seems from the table that mono unsaturated fatty acids (MUFAs) have the highest contribution (54.87%) towards totals fatty acid of goat meat. This is followed by saturated fatty acid (SFAs) and poly unsaturated fatty acid (PUFAs) imparting about 39.54 and 5.56%, respectively. However, Rajkumar et al (23) indicated that saturated fatty acids have highest contribution towards total fatty acids of goat meat. Such differences could be due to mainly to breed differences in fatty acid composition (17). Far as individual fatty acids is concerned, oleic acid (C18:1) contributed the highest (52.13%) followed by palmitic acid (C16:0) (21.17%) stearic acid (C18) (14.17%) and linoleic acid (C18:3) (3.86%). Similarly, Rajkumar et al (23) found that the most plentiful fatty acid in the *L.Dorsi muscle* of Barbari goat was oleic acid. According to Machgoub et al (16) the largest proportions of fatty acid in the muscle tissue were palmetic (16:0), stearic (18:0) and oleic (81:1) acids (approximately 80%) with oleic acid being the most plentiful. Also, Potchoiba et al (22) noticed that fatty acid forming 74% in kid fed milk or concentrate with oleic acid (C18:1) being the most plentiful (28 to 50.53%). Similar trend have been reported by other workers (14,20). Fatty acid profile of both control and zeranol implanted kids did not show significant differences (Table 1). However, the few present studies on the influence of growth-promoting implants on the fatty acid profile of meat are largely inconclusive, the previous studies in beef cattle, have found that zeranol implantation causes some alters in the fatty acid profile and content of intramuscular cholesterol (16). In lambs, while Gonzalez-Rios (10) evaluated the effect of sexual condition and zeranol implantation noting that the major changes were due to sexual class and not to zeranol, Valenzuela-Grijalva et al (27) on other hand , concluded that it is possible to induce favorable changes in the fatty acids profile and cholesterol content using zeranol implantation of hair lambs.

Table 1. Fatty acid profile of castrated and intact kids implanted by zeranol(g/kg dry basis)

Trait	Mean	Treatment		sex		Significant	
		Control	Zeranol	Intact	castration	T	S
N0:		8	7	6	9	ns	ns
C14	2.34±0.14	2.38±0.21	2,29±0.19	2.44±0.23	2.27±0.18	ns	ns
C16	29.46±0.48	29.79±0.58	29.07±0.80	28.90±0.93	29.83±0.51	ns	ns
C16-1	3.81±0.20	3.67±0.15	3.97±0.41	4.15±0.28	3.59±0.26	ns	ns
C17	3.15±0.27	3.09±0.40	3.23±0.40	3.37±0.55	3.01±0.29	ns	ns
C18	19.72±0.89	19.54±0.66	19.92±1.85	18.52±0.78	20.52±1.37	ns	ns
C18-1	72.55±0.98	72.47±1.42	72.63±1.48	72.25±0.75	72.65±1.61	ns	ns
C18-2	5.38±0.34	5.39±0.34	5.36±0.65	5.73±0.62	5.14±0.40	ns	ns
C18-3	0.12±0.04	0.08±0.05	0.18±0.06	0.03±0.03	0.19±0.06	ns	ns
C20	0.34±0.03	0.39±0.02	0.29±0.05	0.31±0.07	0.37±0.02	ns	ns
C20-4	2.15±0.14	2.26±0.18	2.02±0.22	2.37±0.27	2.00±0.14	ns	ns
C20-5	0.08±0.04	0.08±0.06	0.08±0.05	0.14±0.09	0.05±0.03	ns	ns
TFA	139.15±0.43	139.20±0.53	139.09±0.75	138.25±0.65	139.76±0.51	ns	ns
SFA	55.03±1.08	55.22±1.08	54.82±2.06	53.56±1.22	56.01±1.57	ns	ns
MUFA	76.36±1.05	76.15±1.43	76.61±1.66	76.40±0.92	76.34±1.69	ns	ns
PUFA	7.75±0.48	7.83±0.51	7.66±0.90	8.28±0.90	7.39±0.55	ns	ns
n-6	7.53±0.46	7.65±0.49	7.39±0.87	8.10±0.84	7.15±0.54	ns	ns
n-3	0.21±0.05	0.17±0.08	0.27±0.08	0.17±0.08	0.24±0.08	ns	ns
MUFA/SFA	1.39±004	1.38±0.04	1.41±0.06	1.43±0.04	1.37±0.06	ns	ns
PUFA/SFA	0.14±0.009	0.14±0.008	0.14±0.01	0.15±0.01	0.13±0.01	ns	ns
C18+C18:1/C16	3.14±0.06	3.09±0.09	3.19 ±0.08	3.15±0.08	3.13±0.09	ns	ns

TFA=Total fatty acid, SFA=saturated fatty acid, MNFA= monounsaturated fatty acids; PUFA= Poly unsaturated fatty acids:ns =Nonsignificant

It is well documented that a higher concentration of long chain saturated fatty acid rises plasma cholesterol, while mono un saturated and poly un saturated fatty will decreased it (11).Thus P/S and n-6/n-3 poly unsaturated fatty acid ratios are accepted as dietetic indicators for meat quality (6). It appears from Table (1) that although there is few differences in fatty acid composition due to castration of kid, however, such differences were not significant($P>0.05$). It seems from the results demonstrated in Table (1) that C18:1 was the most represented fatty acid accounting for approximately 95% of the MUFAs in both intact and zeranol implanted kids. This result was similar to those reported by other investigators (9,29) The relative proportions of MUFA to SFAs were not modified by the implantation plan ($P>0.05$) presenting percentages of 1.38 and 1.41 for intact and implanted kids, respectively. Discrepancy to this results, Ibrahim et al (13) evaluating zeranol implants and Dixon (8) used the estradiol benzoate implantation in steers, noticed an increase in the relative proportion of SFAs. In the current investigation, the minor fatty acid within PUFAs is linolenic acid (C18:3) with a mean value of 0.12± 0.04 g/kg (Table 1). Such lower value could be due to the fact that animals are incapable of synthesizing them and therefore is introduced to the diet (1).However, a non-significant (>0.05) increase in the content of linolenic acid (C18:3) was noticed in zeranol implanted kids as compared to intact kids (0.18vs.0.08 g/kg). The relative proportion of PUSF to SFA was not modified by implantation with zeranol ($p>0.05$) with an overall average 0.14 for both intact and implanted kids. Also, Valenzuela-Grijalva et al (27) indicated that the proportion of SFA to PUFA was not influenced by treated hair lambs with zeranol. This value is lower to that found in lambs (0.20 -0.25) by Alfaia et al (2) and Valenzuela-Grijalva et al (27). The value of the PUFAs/SFAs ratio in the present study is outside the range suggested by the Department of Health (6). However, the value of PUFAs/SFAs obtained in this work are above than those found by Hoffman et al (12) who proposed that 0.12 is the lower limit value of this ratio considered healthy. The unsaturated fatty acids from the ruminant diet that are hydrogenated by rumen microorganism are the major cause of low levels of PUFA/SFA ratio in ruminant meat (5). The blood cholesterol has been increased by increasing C16:0 increases, while, decreased by increasing C18:1 and C18:0 has no effect (21). Thus Banskalieva et al (3) suggested that the ratio (C18:0+C18:1)/C16:0 could be useful for describing the potential health effects of different types of lipids. In the current work ,values reported for this index ranged between 3.09 for control to 3.19 for zeranol treated kids with an overall mean of 3.14 for all animals, which was slightly higher than the values concluded by Santos et al (24) in different genotypes and similar to those found by other workers (4,21,26). The finding obtained in the present work refer to that neither treated kids with zeranol nor castration had a significant influence on fatty acids composition. in goat meat Oleic acid (C18:1) contributed highest followed by palmitic acid (C16:0), stearic acid (C18:0) and linolenic acid (C18:3). Furthermore, MUFAs had higher proportion of total fatty acids.

REFERENCES

1. Addis, M., M., Fiori, C., Manca, G., Riu, M.F,and Scintu, .2013. Musclecolor and chemical and fatty acid composition of"Agnello di Sardegna" PGI suckling lamb. *Small Rumin.Res*.115, 51–55

2. Alfaia, C.M,P.J Ribeiro, M.J., Trigo, A.J, Alfaia,M.L, Castro, C.M., Fontes, R.J., Bessa, J.A., and Prates, . 2007. Irradiation effect on fatty acid composition and conjugated linoleic acid isomers in frozen lamb meat. *Meat Sci*.77:689-695

3. Banskalieva, V.,T., Sahlu, and A.L.,Goest. 2000. Fatty acid composition of goat muscles and fat depot: a review. *Small Ruminant Res*. 37:255-268

4. Belo, A.T.,M.S., Pereira, H., Babo andC.C., Belo . 2009. Meat fatty acids profile of kid goats from Serpentina breed. Changes in sheep and goat farming systems at the beginning of the 21st century. Options Méditerra - néennes A 91:245-249

5. Choi, N.J.,M., Enser, J.D., Wood andN.D. Scollan, . 2000. Effect of breed on the deposition in beef muscle and adipose tissue of

dietary n-3 polyunsaturated fatty acids. *J Anim Sci* 71 :509–519

6. Departement of Health. 1994. Report on health and social subject No.46, Nutritional Aspect of Cardiovascular Disease. HMSO, London

7. Devendra, C., 1990. Comparative aspects of digestive physiology and nutrition in goats and sheep. pp 45-60 in: C. Devendra and E. Imazumi (eds.) Ruminant Nutrition and Physiology in Asia. Japan Society of Zootechnical Science ed., Sendai, Japan

8. Dixon, S.N.1983. The efficacy, mode of action and safety of non-steroidal non-antimicrobial growth promoters. *Vet Res Commun* 7:51–57

9. Gecgcl, U.,I., M., Yilmaz, T., Ozder, D., Sezenler, Soysal, and , E. K.,Gurcan. 2015. Fatty acid profile of turkish crossbreed, Karacabey Merino multiplier and Karacabey Merino nucleus lambs raised in the same intensive production system. *Small Rumin.Res*,125:10-14

10. Gonzalez-Rios, H. 2009. Manipulacion del comportamiento productivo, la calidad de la canal y la carne de corderos de pelo en confinamiento, mediante la castracion y un promotor del crecimiento. PhD Dissertation, Universidad Autonoma de Chihuahua, Mexico

11. Grundy S.M, and M.A., Denke. 1990. Dietary influences on serum lipids and lipoproteins. *J Lipid Res* 31:1149–1172

12. Hoffman, L. C., M., Muller and S.W.,Cloete.2003. Comparisons of sex crossbreed lamb types: sensory, physical and nutritional meat quality characteristics. *Meat Sci* 65:1265-1274

13. Ibrahim,R.M.,J.A., M archello and G.C., Duff. 2006. Effects of implanting beef steers with zeranol on fatty acid composition of subcutaneous and intramuscular Fat. Profesl. *Anim Sci* 22 :301–306

14. Johnson D,J., Eastridge ,D Neubauer and C.,McGowan . 1995. Effect of sex class on nutrient content of meat from young goat. *J Anim Sci*, 73: 296–301.

15. Kazala, E. C.,F.J., P.S., Lozeman, A., Mir, Laroche, D., R.J., Bailey, and Weselake, . 1999. Relationship of fatty acid composition to intramuscular fat content in beef from crossbred Wagyu cattle. *J Anim Sci* 77: 1717–25

16. Mahgoub, O.,A.J., Khan, R.S., Al-Maqbaly, J.N., Al-Sabahi,K., Annamalai, K. and N.M.,Al-Sakry . 2002. Fatty acid composition of muscle and fat tissues of Omani Jebel Akhdar goats of different sexes and weights. *Meat Science* 61: 381–87

17. Mambro Ribeiro, C.V.D., D.E.,Oliveira, S.O., Juchem, T.M., Silva and E.S.,Nalerio .2011. Fatty acid profile of meat and milk from small ruminants: a review. R. Bras. *Zootec.v* 40, 121-137

18. Mushi, D.E.,L.O., Eik,M.S., Thomassen, O., Sorheim, and T.,Adnoy . 2008. Suitability of Norwegian short-tail lambs, Norwegian dairy goat and Cashmer goat for meat production-crass ,mea.chemical and sensory characteristic. *Meat Sci*.80, 842-850.

19. O'Fallon, J, V.,J.R., Busboom, M.L., Nelson and C.T.,Gaskins . 2007. A direct method for fatty acid methyl ester synthesis: Application to wet meat tissues, oils, and feedstuffs. *J. Anim. Sci*.85:1511–1521

20. Park, Y. W and A.C., Washington. 1993. Fatty acid composition of goat organ and muscle meat of Alpine and Nubian breeds. *J. of Food Sci* 2: 245–48

21. Peña,F., M., Juárez,A., Bonvillani,P., Garcia,O., Polvillo and V., Domenech .2011. Muscle and genotype effects on fatty acid composition of goat kid intramuscular fat. Italian ***J. Anim Sci***.Vol 10:e 40

22. Potchoiba, M., Lu, C., F.,Pinkerton and T., Sahlu . 1990. Effects of all-milk diet on weight gain, organ development, carcass characteristics and tissue composition, including fatty acids and cholesterol contents, of growing male goats. *Small Rumin. Res* **3**: 583–92

23. Rajkumar,V.,A.K., Verma,A.K., Das,B., Kumar,S.,Apurv and M., Umar . 2015. Quality and fatty acid profile of high and low value cuts of barbari goat meat. *Indian J Anim Sci*. 3: 311-315

24. Santos, V.A.C., A.O.,Silva, J.V.F., Cardoso, A.J.D., Silvestre, S.R., Silva, C., Martins and J.M.T.,Azevedo . 2007. Genotype and sex effects on carcass and meat quality of suckling kid protected by the PGI "Cabrito de Barroso". *Meat Sci*. 75:725-736

25. SAS Institute. 2002. SAS®/STAT Software, Release 6.12. SAS Institute, Inc., Cary, NC

26. Todaro, M., A.,Corrao, C.M.A., Barone, R., Schinelli, M., Occidente, P., and Giaccone . 2002. The influence of age at slaughter and litter size on some quality traits of kid meat. *Small Rumin Res*. 44:75-80

27. Valenzuela-Grijalva, N. V., H.,González-Rios, T.Y., Islava, M., Valenzuela, G., Torrescano, J.P., Camou and F.F.,Núñez-González. 2011. Changes in intramuscular fat, fatty acid profile and cholesterol content induced by zeranol implantation strategy in hair lambs. *J. Sci. Food Agric*. 92:1362-7

28. Wood, J. D.,M., Enser, A.V., Fisher, G.R., Nute, P.R., Sheard, R.I., Richardson, S.I., Huges andF.M., Whittington . 2008. Fat deposition, fatty acid composition and meat quality: a review. *Meat Sci*. 78:343-358

29. Yakan, A., and N., Unal . 2010. Meat Production traits of a new sheep breed called Bafra in Turkey. 2. Meat quality characteristics of lambs. Trop. Anim. Health Prod. 42: 743–750.