

## Nutritional and bioactive properties of black goat meat (#112)

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### Introduction

Goat meats have been consumed since the beginning of human civilization. Goat can be grown even poor weather and also be raised by using agricultural byproducts and native grass as a feed. Goat meat tends to be colour of darker red and possesses a rough texture, with a perceptibly distinct flavour and aroma from lamb and mutton. Studies on black goat meat in Korea have largely focused on quality and physicochemical properties of its loin cuts, and methods to extract black goat meat for medicinal use. However, there are limitations in research for evaluating nutritional values in different cuts of black goat meat and bioactive properties of them.

### Methods

The black goat loin and rump meat (14-month-old male black goats,  $n=3$ ) used in this study were obtained from the local meat market after 24 h post mortem. To evaluate the nutritional value of loin and rump meat in black goat meat, proximate composition, collagen, mineral contents, and fatty acid composition were analyzed. Proximate composition was evaluated using Official Methods of Analysis stipulated by the Association of Official Agricultural Chemists (AOAC). The contents of bioactive compounds in loin and rump meat were measured such as L-carnitine, creatine, creatinine, and dipeptide (carnosine and anserine). Ferric reducing antioxidant power (FRAP) activity, 2,2-azinobis (3-ethyl-benzothiazoline-6-sulfonic acid) (ABTS) radical scavenging activity, and oxygen radical absorption capacity (ORAC) activity were performed to evaluate the antioxidant activity of loin and rump meat. Statistical analysis was performed using SAS program version 9.4 (SAS Institute Inc., Cary, NC, USA) with Tukey's test at  $p < 0.05$ .

### Results

The proximate composition, collagen, and mineral contents of loin and rump meat in black goat were shown in Table 1. Loin and rump meat of black goat showed 75.00-75.49% moisture, 21.30-21.60% crude protein, 1.40-1.48% crude fat, and 1.25-1.41% ash with no significant differences. The collagen content of rump meat was higher than that of the loin meat ( $p < 0.05$ ). It may be due to the higher exercise status of rump muscle compared to that of loin muscle of black goat. In this study, the Fe content in rump meat (1.48 mg/100 g) was significantly ( $p < 0.05$ ) higher than that in loin meat (1.35 mg/100 g). The ideal Ca:P ratio, based on the recommended daily allowance of nutrients, is 1-2:1. In this study, the Ca:P ratios in both loin and rump meat satisfied the recommended level of 1-2:1. The K content of loin meat (325.22 mg/100 g) was higher than that of rump meat (281.40 mg/100 g,  $p < 0.05$ ).

The predominant fatty acids in black goat meat were palmitic acid, stearic acid, oleic acid, linoleic acid, and arachidonic acid (Table 2). Desirable fatty acids (DFAs) is sum up the content of stearic acid and all UFAs, and it is considered as another factor to evaluate the nutritional quality of fat for human having ability to reduce plasma cholesterol levels. Loin meat in black goat showed higher DFA than that of rump meat at 77.27 and 74.81%, respectively ( $p < 0.05$ ).

Bioactive compounds and antioxidant activities of loin and rump meat in black goat were shown in Table 3. In this study, the loin and rump meats contained L-carnitine at 1.25-1.37 mol/g wet tissue. Loin meat contained 187.87 mg/100 g of creatine, which was significantly higher the content of rump meat (178.26 mg/100 g). Also, carnosine and anserine contents of loin meat (62.25 and 81.93 mg/100 g, respectively) were higher than those of rump meat (49.54 and 66.32 mg/100 g, respectively,  $p < 0.05$ ). Loin and rump meat of black goat contained high anserine ratio compared to carnosine which was a similar pattern with meat from rabbits or red deer (Plowman & Close, 1988). In this study, the FRAP, ABTS and ORAC values of loin and rump meat were 15.92-15.92, 12.51-12.90, and 101.25-99.06 mol TE/g dry matter (DM), respectively. In our previous study, FRAP, ABTS, and ORAC values of boiled pork meat were 3.66-5.31 mol TE/g DM, 26.60-39.43 mol TE/g DM, and 143.74-198.35 mol TE/g DM, respectively (Gil et al., 2016).

### Conclusion

In this study, loin meat in black goat showed a higher composition of DFA, as well as higher contents of creatine, creatinine, carnosine and anserine, compared with those of rump meat. Rump meat of black goat had higher collagen and mineral contents, especially with respect to the Ca:P ratio, compared with those of loin meat. Loin and rump of black goat did not show any significant difference in reducing power activity. This was a novel study comparing the nutritional value and antioxidant activity between the loin and rump meat of black goat. Therefore, our results help to give scientific evidence for the bioactive properties of black goat meat as a nutritional food source.

### Reference

1. Gil J, Kim D, Yoon SK, Ham JS, Jang A. 2016. Anti-Oxidative and anti-inflammation activities of pork extracts. Korean J Food Sci An 36:275-282.
2. Plowman JE, Close EA. 1988. An evaluation of a method to differentiate the species of origin of meats on the basis of the contents of anserine, balenine and carnosine in skeletal muscle. J Sci Food Agric 4:69-78.

## Notes

Trait	Black goat meat cuts		SEM
	Loin	Rump	
<b>Bioactive compound</b>			
L-carnitine <sup>1)</sup>	1.37 <sup>a</sup>	1.25 <sup>a</sup>	0.041
Creatine <sup>2)</sup>	187.87 <sup>a</sup>	178.26 <sup>b</sup>	1.342
Creatinine	3.13 <sup>a</sup>	2.97 <sup>b</sup>	0.023
Carnosine	65.25 <sup>a</sup>	49.54 <sup>b</sup>	1.481
Anserine	81.93 <sup>a</sup>	66.32 <sup>b</sup>	1.825
Carnosine:Anserine	0.80 <sup>a</sup>	0.75 <sup>b</sup>	0.002
<b>Antioxidant activity <sup>3)</sup></b>			
FRAP	15.92	15.92	0.210
ABTS	12.51	12.90	0.216
ORAC	101.25	99.06	1.231

**Table 3. Bioactive properties of loin and rump meat of black goat.**

<sup>a-b</sup> Means within a row with different superscript differ significantly at  $p < 0.05$ .

<sup>1)</sup> L-carnitine content is expressed by  $\mu\text{mol/g}$  wet tissue.

<sup>2)</sup> Creatine, creatinine, carnosine, and anserine contents are expressed by  $\text{mg}/100 \text{ g}$  wet tissue.

<sup>3)</sup> Antioxidant activities were expressed as  $\mu\text{mol TE/g}$  dry matter.

## Notes

Traits	Black goat meat cuts		SEM
	Loin	Rump	
<b>Proximate composition (%)</b>			
Moisture	75.00	75.49	0.281
Crude protein	21.60	21.30	0.743
Crude fat	1.48	1.40	0.071
Crude ash	1.41	1.25	0.076
<b>Collagen (g/100 g)</b>	0.59 <sup>b</sup>	1.12 <sup>a</sup>	0.010
<b>Minerals (mg/100 g)</b>			
Fe	1.35 <sup>b</sup>	1.48 <sup>a</sup>	0.003
Ca	5.22 <sup>b</sup>	6.09 <sup>a</sup>	0.029
P	3.39 <sup>a</sup>	3.34 <sup>a</sup>	0.015
K	325.22 <sup>a</sup>	281.40 <sup>b</sup>	0.700
Na	76.03 <sup>b</sup>	94.97 <sup>a</sup>	0.215
Ca:P	1.54 <sup>b</sup>	1.82 <sup>a</sup>	0.008

**Table 1. Proximate composition, collagen, and mineral contents of loin and rump meat of black goat.**

<sup>a-b</sup> Means within a row with different superscript differ significantly at  $p < 0.05$ .

## Notes

Fatty acid (%)	Black goat meat cuts		SEM
	Loin	Rump	
C14:0 (myristic acid)	1.37 <sup>b</sup>	2.14 <sup>a</sup>	0.079
C16:0 (palmitic acid)	21.36 <sup>b</sup>	23.05 <sup>a</sup>	0.302
C16:1n7 (palmitoleic acid)	0.88 <sup>b</sup>	1.22 <sup>a</sup>	0.031
C18:0 (stearic acid)	16.35 <sup>a</sup>	14.94 <sup>b</sup>	0.222
C18:1n9 (oleic acid)	30.00 <sup>a</sup>	28.76 <sup>a</sup>	0.328
C18:1n7 (vaccenic acid)	5.84 <sup>a</sup>	5.18 <sup>a</sup>	0.312
C18:2n6 (linoleic acid)	10.48 <sup>a</sup>	11.64 <sup>a</sup>	0.359
C18:3n6 ( $\gamma$ -linolenic acid)	0.07 <sup>b</sup>	0.08 <sup>a</sup>	0.003
C18:3n3 ( $\alpha$ -linolenic acid)	0.15 <sup>a</sup>	0.18 <sup>a</sup>	0.008
C20:1n9 (eicosenoic acid)	1.84 <sup>a</sup>	1.83 <sup>a</sup>	0.206
C20:4n6 (arachidonic acid)	9.88 <sup>a</sup>	9.04 <sup>a</sup>	0.431
C20:5n3 (eicosapentaenoic acid)	0.35 <sup>a</sup>	0.30 <sup>a</sup>	0.019
C22:4n6 (adrenic acid)	1.43 <sup>a</sup>	1.59 <sup>a</sup>	0.055
C22:6n3 (docosahexaenoic acid)	0.00 <sup>b</sup>	0.05 <sup>a</sup>	0.000
SFA	39.07 <sup>a</sup>	40.13 <sup>a</sup>	0.350
UFA	60.93 <sup>a</sup>	59.87 <sup>a</sup>	0.350
MUFA	38.56 <sup>a</sup>	36.99 <sup>a</sup>	0.541
PUFA	22.37 <sup>a</sup>	22.89 <sup>a</sup>	0.860
MUFA/SFA	0.99 <sup>a</sup>	0.92 <sup>b</sup>	0.008
PUFA/SFA	0.57 <sup>a</sup>	0.57 <sup>a</sup>	0.026
DFA	77.27 <sup>a</sup>	74.81 <sup>b</sup>	0.358

**Table 2. Fatty acid composition of loin and rump meat of black goat.**

SFA, saturated fatty acids; UFA, unsaturated fatty acids; MUFA, mono-unsaturated fatty acids; PUFA, polyunsaturated fatty acids; DFA, desirable fatty acid (stearic acid + unsaturated fatty acids)

<sup>a-b</sup> Means within a row with different superscript differ significantly at  $p < 0.05$ .

## Notes