SUPPLEMENTATION OF KELP (*Laminaria japonica*) POWDER FOR BLACK GOAT AND THE PHYSICOCHEMICAL MEAT QUALITY

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I. INTRODUCTION

Black goat meat has relatively lower fat and cholesterol, and high protein, calcium, iron, and tocopherol content compared with other meat sources. In certain Asian countries, black goat meat is mainly consumed in the form of extraction with meat and bone together as health food for pregnant women and elderly people [1, 2]. Despite the health effect of black goat meat, the perception of it as a meat product is not generalized as it has characteristic off-flavor. A kelp, *Laminaria japonica*, contains more than 30% of dietary fiber such as laminarin, fucoidan, alginic acid [3] with many polyphenols [4], which has antiviral, antimutagenic, anti-blood coagulation, and immunity enhancing activities [5, 6]. Thus, the supplementation of the kelp can be anticipated to improve meat quality as well as black goat health. There has been little information on livestock products for utilizing the physiological activity of kelp. Therefore, this study was conducted to investigate the effects of kelp powder feeding on the meat quality of black goats.

II. MATERIALS AND METHODS

Total ninety black goats (3 months old) were placed to one of the following three treatments: control (fed by only basal diet), KLOW (fed by kelp powder with basal diet at 0.9 g / head every 3 days), and KHIGH (fed by kelp powder with basal diet at 0.9 g / head everyday). When reaching 12 months of old (about 60 kg in live weight), 10 black goats from each treatment were randomly selected and slaughtered to obtain the loin samples and the physicochemical qualities were analyzed. The results were statistically analyzed by Student-Newman-Keul multiple test using SAS 9.1.

III. RESULTS AND DISCUSSION

Table 1 shows an effect of Kelp (*Laminaria japonica*) supplementation on physicochemical traits of black goat loin meat. Although the proximate compositions of the goat black loins were not significantly different among treatment, the loin meats supplemented by kelp showed relatively lower fat content compared with the control. There was no significant difference in moisture and fat content when kelp was added to duck feeding [7]. However, shear force was significantly lower in the KLOW and KHIGH than in the control ($p < 0.05$), showing that kelp diet softened the meat of black goat.

In lipid oxidation, treatments with kelp feeding were significantly lower TBARS values than control ($p<0.05$). This was in agreement with the study that duck feeding was effective in inhibiting lipid oxidation when added with 0.1% kelp [7]. The results can be attributed to the antioxidant ability of kelp polyphenols. The contents of linoleic acid (C18:2) and arachidonic acid (C20:4) were higher in KHIGH, and the content of oleic acid (C18:1) closely related to flavor was higher in treatments fed kelp powder than that in control ($p < 0.05$). The polyunsaturated fatty acid contents were in the order of KHIGH > KLOW > control.

Table 2 shows an effect of kelp powder supplementation on the free amino acids contents of black goat meats. Among the analyzed free amino acids, aspartic acid and glutamic acid (which are responsible for the umami taste of meat), and alanine, glycine, and serine (sweet taste) were mainly higher in KHIG treatment ($p<0.05$). This is thought to be due to the high amino acid content of kelp, which may have affected the black goat muscle.

Table 1. The physicochemical traits of black goat meat supplemented by of Kelp (*Laminaria japonica*)

	Treatment[1)]			
	Control	KLOW	KHIGH	SEM[2)]
pH	5.87	5.96	5.93	0.02
Moisture (%)	72.78	74.04	73.37	0.24
Fat (%)	3.99	3.22	3.48	0.21
Shear force (kg/cm^2)	4.34^a	3.42^b	3.42^b	0.14
TBARS (mg MDA/kg)	0.24 ^{a}	0.15^b	0.15^b	0.01
Oleic acid (%)	44.83^b	46.3^a	47.00^a	1.01
Linoleic acid (%)	4.15 ^{b}	4.60^b	5.32^a	0.57
Arachidonic acid (%)	2.21^b	2.50^b	2.96^a	0.37
PUFA[3)]	6.45^c	7.17^b	8.38^a	0.42

[1)] Control: basal diet, KLOW: kelp feeding (0.9 g / head) with basal diet every 3 days, KHIGH: kelp feeding (0.9 g / head) everyday
[2)] Standard error of the means (n = 10)
[3)] Polyunsaturated fatty acids
[a-c]Figures with different letters within the same row differ significantly ($p<0.05$)

Table 2. The free amino acid composition (%) of black goat meat supplemented by of Kelp (*Laminaria japonica*)

	Treatment[1)]			
	Control	KLOW	KHIGH	SEM[2)]
Alanine	34.04^b	38.13^a	38.80^a	2.26
Aspartic acid	1.82 ^{b}	1.57 ^{b}	2.82 ^{a}	0.39
Glutamic acid	16.52^b	16.72^b	20.75^a	3.1
Glycine	17.12^b	18.31^b	20.84^a	1.78
Serine	11.85^b	11.35^b	15.01^a	1.86

[1)] Control: basal diet, KLOW: kelp feeding (0.9 g / head) with basal diet every 3 days, KHIGH: kelp feeding (0.9 g / head) everyday
[2)] Standard error of the means (n = 10)
[a, b]Figures with different letters within the same row differ significantly ($p<0.05$)

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