

# EFFECT OF SEAWEED BY-PRODUCTS ON CARCASS COMPOSITION AND MEAT QUALITY OF HANWOO BEEF

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**Abstract** – The study was designed to evaluate the seaweed by-product (SBP) supplementation on carcass characteristics, fatty acid profile, and cholesterol content of Hanwoo beef. A total of 16 Hanwoo steers were assigned in to two dietary treatment groups in a completely randomized design: Control and SBP 2.0% (basal + SBP 2.0% DM basis). At the end of trial, steers were slaughtered and carcasses were evaluated by trained carcass evaluator. It revealed that, dietary SBP supplementation had no significant effect on meat proximate components, meat quality & carcass yield grade ( $P>0.05$ ) in two dietary groups. However, SBP reduced cholesterol significantly ( $P<0.05$ ) compared to control group. Among individual fatty acid concentration, the palmitoleic acid concentration reduced while the stearic acid concentration increased significantly ( $P<0.05$ ) in SBP treated group. No significant variation observed in saturated and unsaturated fatty acid concentration as well as mono and poly unsaturated fatty acid concentration ( $P>0.05$ ). A reduced ratio of n6/n3 was found in SBP supplemented group which is not statistically significant ( $P>0.05$ ). So, SBP markedly reduced the cholesterol content of Hanwoo beef which would be beneficial for the production of functional meat for health concerned people.

**Key words** - Functional meat, Marine by-product, Public health issue

## I. INTRODUCTION

Meat and meat products play a vital role as a means of healthy diet comprising important sources of nutrients whereas a negative image often attaches to them as a source of fat, saturated fatty acids and cholesterol content in inappropriate amounts are associated with heart disease, cancer and obesity. Increased consumer demand for healthier meat and meat products, with reduced fat levels, cholesterol, sodium chloride, nitrite, enhanced fatty acid profile and containing health promoting ingredients has led to the development of functional meat and meat products by Toldrá & Reig [1]. Although the

chemical composition of edible seaweeds varies among species, habitats, maturity and environmental conditions, they generally contain useful amounts of various bioactive compounds by Bocanegra *et al.* [2]. Edible seaweeds contain acceptable amounts of protein, and their amino acid composition is of nutritional interest Fleurence [3] and Kolb *et al.* [4]. Scientific studies on the potential for incorporating health promoting bioactive compounds derived from seaweed into muscle foods, *via* supplementation of animal diets, are limited and need to investigation. In addition to deposition of bioactive compounds in muscle tissues of meat producing animals, dietary bioactive compounds also demonstrate potential to improve animal health and welfare. Thus, the objective of this study was to assess the effect of dietary supplementation of seaweed by-product (SBP) on carcass characteristics and meat quality of Hanwoo (Korean native cattle) steers.

## II. MATERIALS AND METHODS

A total of 16 Hanwoo steers (22 months old;  $630 \pm 10$  kg BW) were randomly assigned in to two dietary treatment groups in a completely randomized design: Control (basal diet) and seaweed 2.0% (basal diet + Seaweed 2.0% DM basis). Total mixed ration (TMR) was supplied to the animals within an automated animal shed. Feed and water supplied *ad libitum* maintaining the optimum room temperature. The animals were slaughtered at the end of the trial and carcasses were evaluated by the trained carcass evaluator. Moisture, crude protein, crude fat, and ash percentage of meat samples were analyzed according to Official methods for analysis of AOAC International (17th Ed.). Meat fatty acid composition was determined by the methyl ester extraction methods according to Yang *et al.* [5]. Fatty acids were identified by matching their retention times with those of their relative standards (PUFA-2, Animal Source, SUPELCO, Bellefonte, PA, USA).

The cholesterol content of meat was determined by gas chromatography (DS 6200, Donam, South Korea), according to the method described by Brunnekreeft *et al.* [6] and Yang *et al.* [5]. Data were analysed using SAS (Version 9.1 Ed.), SAS Institute, Cary, NC, USA. The effect of each formulation was tested by ANOVA one-way and the level of significance was set at  $p < 0.05$ .

### III. RESULTS AND DISCUSSION

Criteria used to establish carcass yield grades differ among countries, but carcass fatness is a key factor and is usually described by a measurement of subcutaneous fat by Dubeski *et al.* [7]. Different carcass characteristics of Hanwoo steers fed on SBP are shown in Table 1.

Table 1 Carcass characteristics of Hanwoo beef

Treatment	Control	Seaweed
Carcass weight (kg)	435.50±14.13	438.75±15.20
Yield index	60.55±1.23	60.49±2.26
Meat quality grade <sup>1)</sup>	3.75±0.25	3.86±0.34
Carcass yield grade <sup>2)</sup>	1.25±0.16	1.57±0.30

<sup>1)</sup> Meat quality grade: 1+=5, 1+=4, 1=3, 2=2, 3=1

<sup>2)</sup> Carcass yield grade: A=3, B=2, C=1

Although differences in meat quality grade were not detected ( $P > 0.05$ ), SBP group carcass showed better quality grade compared to control group. In addition, SBP supplemented carcasses possesses high yield grade than control group ( $P > 0.05$ ) without any significant variation in carcass weight.

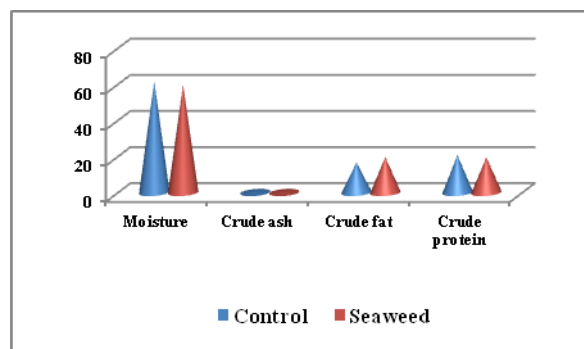


Figure 1. Meat Proximate composition (%) ( $P > 0.05$ )

Laborde *et al.* [8] reported that fatty acid composition influences the flavor of meat according to the percentage of monounsaturated fatty acids. The fatty acid compositions of present study are shown in Table 2. No significant

variation observed in case of individual fatty acid concentration except palmitoleic acid which reduced ( $P < 0.05$ ) while the stearic acid concentration increased significantly ( $P < 0.05$ ) in SBP supplemented group compared to control group.

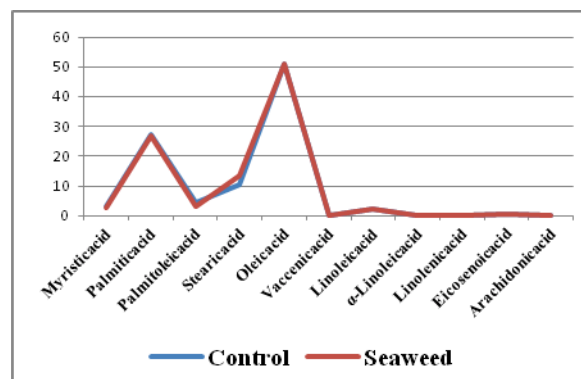


Figure 2. Individual meat fatty acid (%) ( $P > 0.05$ )

Similarly, concentration of saturated fatty acid (SFA) and unsaturated fatty acid (USFA) did not show any significant variation between treatment groups ( $P > 0.05$ ). According to Cho *et al.* [9] Hanwoo beef contained greater *n-6* PUFA in three different muscles, which can be attributed to different feeding conditions. To some extent, a reduced ratio of *n6/n3* was found in the SBP supplemented group which was not statistically significant ( $P > 0.05$ ), however no significant variation observed in *n-3* and *n-6* fatty acids concentration ( $P > 0.05$ ).

Table 2 Fatty acid composition in Hanwoo beef (%)

Treatment	Control	Seaweed
SFA	40.91±0.48	42.90±2.23
USFA	59.10±0.48	57.10±2.23
(MUFA+PUFA)/SFA	1.44±0.03	1.33±0.13
mono	56.43±0.56	54.63±2.24
poly	2.66±0.10	2.48±0.16
n3	0.10±0.01	0.10±0.01
n6	2.56±0.09	2.37±0.15
n6/n3	25.60±1.51	23.70±1.27
MUFA/SFA	1.38±0.03	1.27±0.13
PUFA/SFA	0.07±0.00	0.06±0.00

SFA = saturated fatty acid, USFA = unsaturated fatty acid, MUSFA = monounsaturated fatty acid, PUFA= polyunsaturated fatty acid

The fatty acids in Hanwoo beef found less linolenic acid and greater ratio of *n-6/n-3* unsaturated fatty acids compared to the Australian

Angus beef by Cho *et al.* [9]. Cho *et al.* [10] also reported that the fatty acid compositions of beef had a significant relationship with the palatability of Korean consumers, and specific types of fatty acids discriminated the palatability based on beef origin.

Cholesterol concentration reduced significantly by the addition of SBP ( $P<0.05$ ) which support the findings of Fukumoto *et al.* [11], reported that the intramuscular cholesterol content of Hanwoo cattle may be lower than that of European breeds.

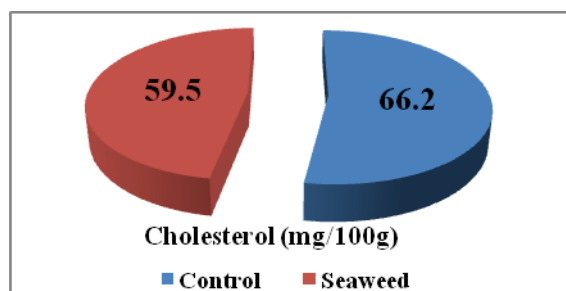


Figure 3. Cholesterol content of meat ( $P<0.05$ )

#### IV. CONCLUSION

Sea weed by-product can be supplemented to ruminant diets particularly to reduce the cholesterol concentration of meat noticeably considering public health concern to reduce the cardiovascular disease susceptibility. In addition, it would be more beneficial by reducing the feed cost utilizing marine by products without any conflict between human & animal feed.

#### ACKNOWLEDGEMENTS

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