EFFECTS OF FATTENING PERIOD ON NUTRITIONAL COMPOSITION AND PHYSICO-CHEMICAL QUALITY PROPERTIES OF JEJUSAN-HORSE MEAT

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Abstract –The aim of this study was to evaluate the chemical compositions and physico- chemical properties of Jejusan-horse meat (JHM) at different fattening periods (4, 8, and 13.5 months). The fat content and moisture of JHM after 4-months feeding were decreased significantly up to 13.5 month. However, the protein content was significantly increased during the fattening period. Meat color, cooking loss, and shear force value were not affected by fattening period. However, fattening horse for 8 and 13.5 month significantly increased water holding capacity compare to control ($p<0.05$). The contents of Fe, Na, Zn were significantly higher in meat from 4-month group than 8- and 13.5-month group. Cystein, methionine, threonine, serine, glutamic acid, alanine, valine, lysine, histidine, arginine contents were significantly increased during the fattening period ($p<0.05$). The oleic acid (C18:ln9) contents were the highest in the 8-month group and the lowest in the 13.5-month group. The linoleic acid (C18:2n6) contents were the lowest in the 4-month group and increased as the fattening period increased. These results indicated that longer fattening period could be more effective to enhance horse meat quality.

Key Words – Horse, Fattening Period, Nutritional composition, Meat quality.

I. INTRODUCTION

As national income increase, it tends to increase consumers' preferences about high-protein, low-calorie and healthier foods like horse meat. In Korea, horses are mainly used for race horses recently but in the past, horses were used for the purpose of agriculture, riding and meat. In particular, horse meat consumption increases especially in restaurants in Jeju. As a result, the number of slaughtered horses rose sharply from 359 horses in 2004 to 781 horses in 2010. However most horse meats which are distributed in the market are produced from horses grown for the purpose of riding. So, horse meats are provided by fattened retired horses or unsuitable horses for meat which are bred for the purpose of riding. Recently horse meats have implemented carcass grade system in accordance with marbling score like beef on a trial basis. According to this background, this study was conducted to investigate meat properties after feeding concentrations to 24 months old male horses for 4, 8, and 13.5 months.

II. MATERIALS AND METHODS

For this study 15 fattening male horses (Thoroughbred × Korean native breed) were selected and separated into 3 groups of 5. The age of fattening horses was 24 months old and they were fed concentrated diet of 1.6% of their body weights and hay *ad libitum*. Treatment was separated into feeding concentrated diet for 4 months (28 months old), 8 months (32 months old) and, 13.5 months (37.5 months old) respectively. Nutrient contents of concentrated feed for fattening horses serve 17.12% crude protein, 5.02% crude fat, 6.30% crude fiber and 3,59 cal/g. We measured the chemical composition, meat color, physical characteristics, mineral contents on the horse meat after feeding concentrated feed during fattening period.

III. RESULTS

The moisture contents were decreased as the fattening periods increased. The fat contents were 3.78% at 4-months and decreased at 13.5-months whereas the protein contents increased as the fattening period increased. There were no

significant differences in L*, a* and b* values between the 3 fattening groups ($p>0.05$). The cooking loss (%) was highest (33.41%) at 4-months group and decreased during fattening period, however, there was no significant difference among 3 fattening groups ($p>0.05$). The Warner-Bratzler shear force (WBS) values were the lowest at 4-months group and tended to increase with the fattening period ($p>0.05$). The water holding capacity (WHC) of the meat in 8 and 13.5 month fattening period was significantly higher than 4-month fattening group (53.99%). For mineral contents, there were no significant differences in the contents of Ca, Cu, K among the 3 fattening groups ($p>0.05$). The contents of Fe, Na, Zn were significantly higher for the 4-month group than for the 8- and 13.5- month groups whereas the contents of Mg were significantly lower for the 4-month group than for the 8- and 13.5-month groups ($p<0.05$). The results of the amino acid composition analysis showed that cystein, methionine, threonine, serine, glutamic acid, alanine, valine, lysine, histidine, arginine contents were significantly increased and tyrosine contents were significantly decreased during the fattening period ($p<0.05$). No significant difference was found in palmitoleic acid (C16:1n7) composition during fattening period. Linoleic and linolenic acid of horse meat were significantly increased after 8 and 13.5 months fattening period.

Table 1. Chemical compositions of horse meat by period of feeding concentrates (unit:%)

Fattening period	Moisture	Crude fat	Crude protein	Crude ash
4 months	73.92 ±0.93[a]	3.78 ±0.78[a]	19.65 ±0.50[b]	0.91 ±0.07[b]
8 months	71.91 ±0.53[b]	2.14 ±0.33[b]	22.76 ±1.07[a]	1.01 ±0.02[a]
13.5 months	71.54 ±0.62[b]	2.22 ±0.45[b]	23.03 ±0.19[a]	0.93 ±0.02[b]

[a-b] Mean±SD with different superscript in the same column differ significantly at $p<0.05$.

Table2. Change in meat color values for horse meat by period of feeding concentrates

Fattening period	Lightness(L*)	Redness(a*)	Yellowness(b*)
4 months	36.31 ±1.68	20.47 ±1.04	7.48 ±0.94
8 months	36.48 ±0.53	18.02 ±2.79	7.44 ±0.85
13.5 months	36.96 ±2.10	18.70 ±0.31	6.73 ±0.28

Table 3. Change in physical character on meat of horses by period of feeding concentrated feed

Fattening period	Cooking loss(%)	Shear value (㎏/0.5inch^2)	Water holding capacity(%)
4 months	33.41±2.27	3.77±0.61	53.99±0.91[b]
8months	30.43±3.25	4.35±0.58	55.68±0.81[a]
13.5 months	31.10±1.01	4.62±1.18	55.43±0.74[a]

[a-b] Mean±SD with different superscript in the same column differ significantly at $p<0.05$.

Table 4. Mineral contents on meat of horses by period of feeding concentrated feed (unit: mg /kg)

Fattening period	Ca	Cu	Fe	K	Mg	Na	P	Zn
4 months	46.58	1.31	39.18	3,421	196[c]	545[a]	1,990	59.99
8months	46.88	1.21	24.97	3,394	246[a]	432[b]	2,699	20.52
13.5months	49.54	-	26.09	3,203	216[b]	433[b]	1,944	26.27

Table 5. Amino acid compositions of horse meat with different fattening period (unit: %)

Fattening period	4 months	8 months	13.5 months
Cystein	0.221±0.008[1)t]	0.250±0.010[a]	0.246±0.007[a]
Methionine	0.391±0.037[b]	0.587±0.025[a]	0.578±0.014[a]
Aspartic acid	1.798±0.071[a]	2.134±0.075[a]	1.947±0.050[a]
Threonine	0.926±0.035[b]	1.058±0.038[a]	0.960±0.024[b]
Serine	0.799±0.032[b]	0.924±0.033[a]	0.840±0.020[b]
Glutamic acid	2.851±0.104[c]	3.360±0.115[a]	3.086±0.081[b]
Glycine	0.842±0.028[b]	0.950±0.037[a]	0.864±0.022[b]
Alanine	1.095±0.038[b]	1.306±0.051[a]	1.237±0.053[a]
Valine	0.825±0.024[b]	1.005±0.025[a]	1.070±0.118[a]
Isoleucine	0.863±0.029[b]	0.952±0.027[a]	0.861±0.025[b]

Leucine	1.847±0.067[a]	1.933±0.073[a]	1.909±0.060[a]
Tyrosine	0.827±0.051[a]	0.822±0.032[a]	0.745±0.023[b]
Phenylalaine	0.899±0.091[ab]	0.914±0.036[a]	0.825±0.022[b]
Lysine	1.842±0.055[b]	2.032±0.081[a]	1.889±0.079[b]
Histidine	0.876±0.034[c]	1.114±0.031[a]	0.998±0.023[b]
Arginine	1.202±0.055[c]	1.424±0.056[a]	1.317±0.036[b]
Proline	0.839±0.028[a]	0.836±0.046[a]	0.790±0.019[a]

[a-c] Mean±SD with different superscript in the same row differ significantly at $p<0.05$.

IV. CONCLUSION

Fattening period significantly affected the horse meat quality likely increase of protein contents, water holding capacity, unsaturated fatty acid composition. Therefore, longer fattening period could be more efficient to produce enhanced meat quality rather than shorter fattening period.

Table 6.Fatty acid compositions on meat of horses by period of feeding concentrated feed (unit: %)

Fattening period	4 months	8 months	13.5 months
Myristicacid(C14:0)	3.35±0.35[a]	3.85±0.33[b]	3.72±0.32[ab]
Palmiticacid(C16:0)	29.19±1.48[a]	27.33±1.03[b]	27.30±1.04[b]
Palmitoleicacid(C16:ln7)	7.81±2.59[a]	6.10±0.50[a]	7.31±1.36[a]
Stearicacid(C18:0)	4.95±1.35[a]	3.95±0.38[a]	4.32±0.45[a]
Oleicacid(C18:ln9)	38.22±0.97[a]	38.37±1.24[a]	36.42±0.09[b]
Vaccenicacid(C18:ln7)	0.10±0.03[b]	0.29±0.03[a]	0.00±0.00[c]
Linoleicacid(C18:2n6)	11.83±3.02[b]	15.44±1.62[a]	16.03±1.52[a]
γ-Linoleicacid(C18:3n6)	0.04±0.02[b]	0.06±0.00[a]	0.04±0.01[b]
Linolenicacid(C18:3n3)	2.78±0.60[b]	3.90±0.53[a]	3.97±0.30[a]
Eicosenoicacid(C20:ln9)	0.65±0.13[a]	0.48±0.05[b]	0.46±0.06[b]
Arachidonicacid(C20:4n6)	1.08±0.51[a]	0.23±0.06[b]	0.42±0.08[b]
Saturated fatty acid	37.49±0.82[a]	35.13±1.33[b]	35.35±0.98[b]
Unsaturated fatty acid	62.51±0.82[b]	64.87±1.33[a]	64.65±0.98[a]

[a-b] Mean±SD with different superscript in the same row differ significantly at $p<0.05$.

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