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THE FATTENING and CARCASS CHARACTERISTICS of CORRIEDALE, TURKISH MERINO, LINCOLN LONGWOOL X TURKISH MERINO F_1 and B_1 CROSSBRED LAMBS*

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Corriedale, Türk Merinosu ve Lincoln Longwool X Türk Merinosu F_1 ve G_1 Melezi Kuzuların Besi ve Karkas Özellikleri

SUMMARY

This study was carried out to investigate the fattening and carcass characteristics of Corriedale (n=6), Turkish Merino (M) (n=10) purebreds and Lincoln Long wool (L) x M (F_1) (n=10), L x L x M (LB_1) (n=6) and M x L x M, (MB_1) (n=8) crossbred lambs. From the initial weight of 20 kg to the final weight of 45 kg, the lambs were fed alfalfa hay 100 g/head/day and concentrate that had 19.70% crude protein (CP) and 2853 kcal/kg metabolic energy (ME) at the early stage and 16.39% CP and 2968 kcal/kg ME at the late stage of experiment, *ad libitum*. Lambs were slaughtered at 45 kg of live weight to determine carcass traits.

Daily live weight gains were found as 261, 318, 333, 349 and 298 g ($p<0.05$) for Corriedale and Merino purebred and F_1, LB_1 and MB_1 crossbred lambs, respectively. The slaughter ages at 45 kg of live weight were 171, 135, 141, 141 and 159 days; feed efficiency were 5.3, 4.9, 4.7, 3.7 and 4.7 kg. Slaughter weights were 43.9, 44.2, 44.6, 44.4 and 43.7 kg; cold carcass weights were 21.5, 22.0, 21.0, 20.6 and 21.2 kg; dressing percentages were 48.9, 49.8, 47.6, 46.7 and 48.1%; kidney and pelvic fats were 0.40, 0.26, 0.32, 0.25 and 0.28 kg; the ratios of leg weight to cold carcass weight were 33.1, 34.0, 33.3, 31.9 and 33.9% ($p<0.05$); the ratios of shoulder weights were 17.8, 19.0, 19.9, 19.1 and 19.5% ($p<0.05$); the lean meat ratios of leg cuts were 62.5, 64.6, 60.8, 63.1 and 63.7%; the lean meat ratios of shoulder cuts were 59.1, 60.7, 57.0, 58.5 and 59.6% for genotypes in the same order above.

As a result, except fattening performance, there was no superiority of crossbreeds to Merino for many traits evaluated in this experiment, and also Merino had higher levels in many carcass traits, but Corriedale, generally, showed the lowest performances in the traits examined.

KEY WORDS: Lambs, crosses, fattening, carcass characteristics, meat sensorial traits

ÖZET

Bu çalışma, saf Corriedale (n=6) ve Türk Merinosu (M) (n=10) ile Lincoln (L) x M (F_1) (n=10), L x L x M (LG_1) (n=6) ve M x L x M, (MG_1) (n=8) melezi kuzuların besi ve karkas özelliklerini araştırmak amacıyla yapılmıştır. 20 kg'lık besi başı ağırlığından 45 kg'lık besi sonu ağırlığına kadar kuzulara, hayvan başına günlük 100 g kuru yonca ve *ad libitum* konsantre yem verilmiştir. Beside, 20-35 kg canlı ağırlık arasında %19.7 ham protein (HP) ve 2853 kcal/kg metabolik enerji (ME), 35-45 kg canlı ağırlık arasında %16.4 HP ve 2968 kcal/kg ME içeren yem kullanılmıştır. Karkas özelliklerini incelemek üzere, gruplardan 45 kg ağırlığında 6'şar kuzu kesilmiştir.

Araştırmada, sırasıyla, Corriedale, Merinos, L x M (F_1), L x L x M (LG_1) ve M x L x M (MG_1) genotiplerinde ortalama günlük canlı ağırlık artışı 261, 318, 333, 349 ve 298 g ($p<0.05$); 45 kg ağırlıkta kesim yaşı 171, 135, 141, 141 ve 159 gün yemden yararlanma 5.3, 4.9, 4.7, 3.7 ve 4.7 kg; kesim ağırlığı 43.9, 44.2, 44.6, 44.4 ve 43.7 kg; soğuk karkas ağırlığı 21.5, 22.0, 21.0, 20.6 ve 21.2 kg; randıman %48.9, 49.8, 47.6, 46.7 ve 48.1; böbrek-pelvik yağı 0.40, 0.26, 0.32, 0.25 ve 0.28 kg; karkasta but oranı %33.1, 34.0, 33.3, 31.9 ve 33.9 ($p<0.05$); kol oranı %17.8, 19.0, 19.9, 19.1 ve 19.5 ($p<0.05$); et oranı, butta %62.5, 64.6, 60.8, 63.1 ve63.7; kolda %59.1, 60.7, 57.0, 58.5 ve 59.6 bulunmuştur.

Sonuç olarak, besi performansı hariç, incelenen bir çok özellik bakımından melezlerin Merinosa bir üstünlüğü tepit edilmemiştir. Merinos çoğu karkas özelliğinde yüksek değerler göstermiştir. Corriedale, genel olarak, incelenen bütün özelliklerde düşük değerler göstermiştir.

ANAHTAR KELİMELER: Kuzu, melezleme, besi ve karkas özellikleri, et duyusal özellikleri

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INTRODUCTION

In Turkey, because meat yield from sheep is a main concern in recent years, the developmental studies in sheep breeding has been intensified on forming some mutton sheep via crossbreeding. Some studies have been performed to develop composite populations of sheep to be used as a terminal sire line in commercial crossbreeding since 1989 in Animal Research Institute in Konya. So far, the Turkish sheep breeds (Merino, Akkaraman and Awassi) were crossed with mutton sheep breeds of Lincoln, Hampshire Down and German Blackheaded Mutton.

In the current study, the F1 (Lincoln 50% + Merino 50%), LB1 (Lincoln 75% + Merino 25%) and MB1 (Lincoln 25% + Merino 75%) crossbred were produced. In the previous study, fattening performance and carcass characteristics of F1 crossbred have been compared with Turkish Merino purebred (Tekin and Akçapınar 1992, 1993). It was reported that F1 crossbred was superior to Merino in fattening performance whereas the Merino purebred had better carcass traits. In another Institute (Bandırma, Turkey), Akgündüz *et al.* (1993), have studied the fattening performance and carcass characteristics of Kıvırcık (purebred), Hampshire Down x Kıvırcık (F1) and German Blackheaded Mutton sheep x Kıvırcık (F1) crossbred lambs. They reported that the daily gain and feed efficiency ratios were 226 g and 4.9 kg, respectively, for purebred, and 300 g and 4.2 kg for crossbreed, respectively, with the statistically significant differences of $p<0.01$ between the two groups. Jensen (1994), has reported daily gains from 390 to 510 g for 7 various mutton breeds in a performance test-study. The lambs from Western or ¼ Finn ewes have been fed on a high-concentrate diet and had daily weight gains as 351 and 381 g respectively (Notter *et al.* 1991). In the same study, overall feed efficiency as 4.29 kg feed / kg gain, slaughter weight as 51.8 and 51.8 kg at 163 and 153 days old, dressing as 49.5 and 49.5%, Longissimus dorsi (LD) muscle area as 14.4 and 14.2 cm^2, back-fat thickness as 4.8 and 5.0 mm, have been reported, respectively. It was concluded that lambs from Western and ¼ Finn ewes were similar in growth and carcass traits. Spiker *et al.* (1988) reported the dressing percentage of Corriedale and Romney Marsh x Corriedale as 47%, at 6 months old. Snowder *et al.* (1994), reported the dressing as 50.1 and 49.3%, kidney and pelvic fat as 4.0 and 3.1%, back fat depth as 7.7 and 6.3 mm, LD muscle area as 11.1 and 11.5 cm^2 for Targhee and Columbia slaughtered at 52.3 and 53.9 kg, respectively. Leymaster and Jenkins (1993), have found the LD muscle area as 13.8 and 13.3 cm^2 , kidney and pelvic fat weight as 0.60 and 0.56 kg for Texel- and Suffolk- sired lambs at 147 days old and 20.7 and 22.0 kg carcass weight, respectively.

The meat sensorial traits from Tsigai, Merino, and improved Valacian lambs at 35 kg of slaughter weights revealed high scores of tenderness and juiciness. The Tsigai lambs had higher score than Merino in this respect. There were no significant differences between groups in color and water, protein and ash content (Sanudo *et al.* 1992). In Aragone, Lacaune and German Mutton Merino lambs at light or medium slaughter weights, the dressing percentages have been found to be 47.5% with the highest tenderness score found in light Arogone lambs ($p<0.01$) and there were no statistically significant differences between either genotypes above or light or medium slaughter weight groups with regard to other meat sensorial traits (Sanudo *et al.* 1993). Notter *et al.* (1991), have assigned the scores as 1-8 and found the tenderness score as 5.33 and juiciness as 4.05 in ram lambs from Western and ¼ Finn ewes.

The purpose of this study was to determine the fattening and carcass characteristics of Lincoln x Turkish Merino F1, LB1 and MB1 crossbreed lambs.

Table 1. The Rations Used in Fattening *.

Foods	Mixture-I (%)	Mixture-II (%)	Alfalfa hay (%)
Barley	25.5	28.5	
Wheat	20.0	20.0	
Corn	23.0	33.0	
Soybean meal	15.0	12.0	
Sunflower seed meal	10.0		
Molasses	2.0	2.0	
Limestone	3.0	2.5	
DCP	-	0.5	
Salt	1.0	1.0	
Vit.-Min. Premix	0.5	0.5	
Dry Matter	90.21	90.60	93.28
Crude Protein	19.70	16.39	13.12
Crude Fat	2.31	2.55	1.12
Crude Fiber	5.94	4.62	36.13
Crude Ash	6.53	4.20	5.20
ME (kcal/kg)**	2853.00	2968.00	-
Ca**	1.25	1.19	-
P**	0.37	0.42	-

*: The analyses of rations were made in the laboratory of Department of Animal Nutrition and Nutrition Diseases.
**: Theoretically estimated.

MATERIALS and METHODS

This work was carried out at the Animal Research Institute in Konya and the animals used in the study were obtained from the same institute. There were 6 Corriedale male lambs, and 10 Turkish Merino purebreds, 10 Lincoln (L) x Turkish Merino (M) (F_1), 6 L x (L x M) (LB_1) and 8 M x (L x M) (MB_1) crossbreeds to evaluate the fattening performance. The components of the rations used were given in Table 1.

The lambs were fattened as a group feeding from the initial weight of approx. 20 kg to the final weight of 45 kg. The animals were penned by breed. The lambs were fed as 100 g/day/head alfalfa hay and freely accessible concentrate that had 19.70% crude protein (CP) and 2853 kcal/kg metabolic energy (ME) at the early stage (weight of 20 to 35 kg) of the experiment and 16.39% CP and 2968 kcal/kg ME at the late stage (weight of 35 to 45 kg). The lambs were weighed every fortnights to obtain daily live weight gains. In order to determine the consumption of feed, the meals given to lambs and the left over feeds were weighed daily just prior to a new feeding.

In each groups, 6 lambs which was each individual approx. 45 kg of live weight (on a full stomach) were slaughtered to evaluate the carcass characteristics. In the slaughter procedure, the lambs were fasted for 16 h prior to slaughtering but had continued access to water. The slaughtering was accomplished by commercial procedures valid in Turkey at a private abattoir named Konet. The hot carcasses were weighed soon after the slaughtering and after a 24 h chill and then separated into 5 retail cuts by the procedure reported by Akçapınar (1981). The retail cuts were named as: 1, Leg (including the 6^{th} lumbal vertebrae, coxae, sacrum, femur, tibia-fibula and tarsal joint bones and the muscles and fats related to those bones); 2, Shoulder (including scapula with its cartilage, humerus, radius-ulna and carpal joint bones and the muscles and fats related to those bones); 3, Back (including 8 thoracal vertebrae with their rib continuations approx. 12 cm aside from midline); 4, Loin (including 5 lumbal vertebrae and the muscles and fats approx. 10 cm aside from midline); and 5, Remainders (including the remaining of the carcass).

After separating, every cuts were weighed with a scale having 10 g of sensitivity. In the mean time, the measures of eye muscle area and subcutaneus fatness as a fat depth over the LD muscle have been obtained between last thoracal and first lumbal vertebrae from the left part of the carcass. Following, each of the LD muscle located in Loin parts were removed with back-fat and loaded in a deep freeze to determine the sensory evaluation of the groups. To obtain the information about carcass composition, the Leg and Shoulder cuts were used as a sample and physically dissected into separable muscle, fat and bone, of which each was weighed separately to determine the relative proportions. The reason that the leg and shoulder cuts were taken as a sample to predict the carcass composition was because in the previous studies (Malik 1972, Boccard *et al.* 1976, Simm *et al.* 1990) the leg and shoulder cuts were regarded as a good sample for estimating the whole carcass composition and also this method was easy to perform and save time and money. To test the sensorial traits of the groups, 6 LD muscle parts were mixed and formed as one sample in each groups, and then the meats were cut as a grill type and located in oven trays. Following this, each samples were equally salted and cooked for 20 minutes in the oven. After the meats taken out from the oven, the tests were performed by the panelists who are not specialists on the matter by procedure reported by Stone and Sidel (1985). The previously prepared form were given to every member of the jury (n=10) for evaluating the traits on the view and color, the ability of being chewed, juiciness, tenderness and flavor of the meats. In grading, the numbers 10 and 9 were evaluated as excellent, 8 and 7 as good, 6 and 5 as average, 4 and 3 as poor and 2 and 1 as very poor.

In statistical analyses, data for the fattening and carcass characteristics were analyzed by one way ANOVA or ANCOVA procedures, for pair-wise multiple comparison, Tukey's HSD test was used. The initial weight of the animals was used as a covariate for analyzing final weight, daily gains and fattening duration. The age and weight of the lambs at slaughter were used as a covariate for analyzing all the carcass traits. The sensorial traits were analyzed by Kruskal-Wallis test. All the statistical tests were conducted by Minitab software, r:11.12.

RESULTS and DISCUSSION

Fattening Traits: The results of the fattening traits of the lambs were presented in Table 2. The fattening period to gain approx. 25 kg live weight were as 88, 76, 72, 70 and 79 days for Corriedale, Merino, F_1, LB_1 and MB_1 lambs, respectively. While the Corriedale lambs were approx. 5.5 months old at the slaughter, the other lambs were generally 4.5-5 months old. The highest daily gain was found in LB_1 groups and the lowest in Corriedale groups and the differences between Corriedale and F_1 and LB_1 were significant ($p<0.05$) whereas there were no differences between Merino and its crosses. The feed efficiency values were found as 3.73-5.29 kg feed/kg-gain for all groups.

The results indicated that the fattening period, slaughter age, daily gains and feed efficiency of the groups were at acceptable levels except in Corriedale group. Lower values obtained for Corriedale, which imported from New Zelland, may have been caused by their not being adapted to the new environment yet. Although there were no differences between Merino and its crosses, the LB1 and F1 group indicated higher values than Corriedale. This study slightly indicates that the values have increased as the Lincoln genotype increases in crossbreeding. The figures obtained in this study were higher than those of the previous study on the same material (Tekin and Akçapinar 1992). This is may be due either to the better quality of rations used in this study or to the conditions more excellent than before. However, there was an agreement with the previous study that the crossbred had more fattening performance than purebred. The results were also higher than those reported by Akgündüz *et al.* (1993), but lower than those reported by Jensen (1994) and Notter *et al.* (1991).

Carcass Traits: The results of some of the slaughter and carcass traits of groups were presented in Table 3. The lambs that are approx. 5 months old and 44 kg of live weight, had 21-22 kg of carcass weight. The differences between the groups were not significant. Merino presented the highest ($p<0.05$) LD muscle area. Back-fat thickness were found between 5.8-8.0 mm for all groups and the differences between the groups were not significant. The cold carcass yields (dressing percentages) were found as 46.7-49.8% and the differences between the groups were not significant. The percentage of the Leg in the carcass of Merino and MB_1 were higher than those of LB_1 and similar to those of the values of Corriedale and F_1. The percentage of the Shoulder averaged the lowest level for Corriedale, which was statistically different from F_1. The higher value for kidney and pelvic fat was found in Corriedale and the lowest in LB1.

Table 2. The Means (and SEM) of Fattening Traits.

Traits	Corriedale (n=6)	Merino (n=10)	F1 (n=10)	LB1 (n=6)	MB1 (n=8)	P
Initial wt, kg	21.3±1.96	22.3±1.19	21.4±1.45	21.0±2.78	21.0±2.44	0.58
Daily gains, g	261±20^{b}	318±16^{ab}	333±16^{a}	349±20^{a}	298±17^{ab}	0.03
Final wt, kg	43.7±0.62	45.2±0.49	45.0±0.48	44.4±0.62	44.0±0.54	0.24
Fattening duration, day	88±4.5	76±3.6	72±3.5	70±4.5	79±3.9	0.07
Feed efficiency, kg	5.29	4.91	4.68	3.73	4.69	

$^{a, b}$: Means without a common superscript within each variable differ (p<0.05).

Table 3. The Means (and SEM) of Slaughter and Carcass Traits of Groups (n=6, wt = weight).

Traits	Corriedale	Merino	F1	LB1	MB1	P
Slaughter age, day	171±9.3	135±9.2	141±9.4	141±9.2	159±9.4	0.08
Slaughter wt	43.9±0.53	44.2±0.50	44.6±0.49	44.4±0.48	43.7±0.49	0.72
Hot carcass wt	22.0±0.46	22.2±0.42	21.4±0.41	20.8±0.41	21.4±0.41	0.17
Skin wt	6.1±0.31^{ab}	5.7±0.29^{ab}	6.3±0.29^{a}	6.6±0.28^{a}	5.2±0.29^{b}	0.02
Lungs + liver + heart wt	2.0±0.10	2.1±0.10	2.0±0.10	2.0±0.09	2.1±0.09	0.96
Mesenteric fat wt	0.51±0.041^{a}	0.41±0.038^{ab}	0.35±0.038^{b}	0.27±0.037^{b}	0.40±0.038^{ab}	0.01
Cold carcass wt	21.5±0.41	22.0±0.38	21.0±0.38	20.6±0.37	21.2±0.38	0.13
Carcass yield (%)	48.9±0.91	49.8±0.85	47.6±0.84	46.7±0.82	48.1±0.85	0.12
LD muscle area, cm^2	12.9±0.67^{b}	15.5±0.63^{a}	13.1±0.62^{ab}	12.6±0.61^{b}	13.7±0.62^{ab}	0.02
Back fat thickness, mm	7.5±0.85	7.9±0.79	5.8±0.79	7.1±0.77	8.0±0.79	0.29
Leg wt	7.1±0.17^{ab}	7.5±0.16^{a}	7.0±0.16^{ab}	6.6±0.15^{b}	7.2 ±0.16^{a}	0.01
Shoulder wt	3.8±0.14	4.2±0.13	4.2±0.13	3.9±0.12	4.1±0.13	0.20
Back wt	2.14±0.114	1.91±0.107	1.87±0.106	1.80±0.104	2.14±0.106	0.20
Loin wt	1.93±0.071	1.80±0.066	1.72±0.066	1.71±0.064	1.75±0.066	0.21
Remainder wt	5.8±0.14	5.9±0.13	5.6±0.13	5.9±0.13	5.4±0.13	0.06
Kidney-pelvic fat wt	0.40±0.041	0.26±0.038	0.32±0.038	0.25±0.037	0.28±0.038	0.11
The leg ratio (%)	33.1±0.51^{ab}	34.0±0.47^{a}	33.3±0.47^{ab}	31.9±0.46^{b}	33.9±0.47^{a}	0.02
The shoulder ratio (%)	17.8±0.47^{b}	19.0±0.44^{ab}	19.9±0.44^{a}	19.1±0.43^{ab}	19.5±0.44^{ab}	0.04

$^{a, b}$: Means without a common superscript within each variable differ (p<0.05).

Merino presented the highest (p<0.05) LD muscle area. In respect of back-fat thickness, the differences between the groups were not significant. But the back-fat thickness values of Merino and F_1 were higher than those obtained from the same genotype at the same slaughter weight in the previous study (Tekin and Akçapinar 1993). This might be resulted from the rations used which had more energy per kg. The cold carcass yields differences between the groups were not significant. This result is in agreement with those of other researchers (Spiker *et al*. 1988, Tekin and Akçapinar 1993, Akgündüz *et al.* 1993), but the carcass yield of Corridale was higher than reported by Rodriguez and Castells (1991) who found this traits as 44.8%. However, the values of all genotypes were lower than those of reported by Mendez *et al.* (1994) who referred this trait for Merino ewes as 51.4%. The percentage of the Leg, which is an excellent cuts, in the carcass was highest in Merino followed by MB1 groups. This shows the importance of the

Table 4. The Means (and SEM) of Meat, Fat and Bone Composition in the Sample Cuts of Groups (n=6).

Trait	Corriedale	Merino	F1	LB1	MB1	P
Leg muscle, %	62.5±4.05	64.6±1.20	60.8±1.79	63.1±2.05	63.7±1.77	0.10
Leg fat, %	20.7±3.14	17.3±1.24	19.2±3.04	18.2±1.19	17.6±2.01	0.11
Leg bone, %	16.8±1.93^{b}	18.1±0.69^{ab}	20.0±1.29^{a}	18.8±1.27^{ab}	18.7±1.15^{ab}	0.01
Shoulder muscle, %	59.1±2.56	60.7±0.88	57.0±1.95	58.5±1.74	59.6±2.82	0.06
Shoulder fat, %	21.8±1.64	20.8±2.78	22.8±2.40	21.4±2.16	21.2±3.07	0.69
Shoulder bone, %	19.1±1.35	18.4±2.34	20.2±1.81	20.1±1.70	19.2±1.46	0.42

$^{a, b}$: Means without a common superscript within each variable differ (p<0.05).

Table 5. The Medians of Sensorial Traits of Groups (n=10).

Trait	Corriedale	Merino	F1	LB1	MB1	P
Color score	7.0	9.0	8.5	7.5	7.0	0.14
Chewed ability score	8.0	9.0	8.0	8.0	8.0	0.54
Tenderness score	8.0	8.0	8.0	8.0	8.0	0.81
Juiciness score	7.0	7.0	7.5	7.0	7.0	0.82
Flavor score	8.0	8.5	8.0	7.5	8.0	0.34
View of meats score	7.0b	9.0^{a}	8.0^{ab}	9.0^{a}	8.0^{ab}	0.04

$^{a, b}$: Means without a common superscript within each variable differ (p<0.05).

Merino in meat yields. There were a significant differences between the groups on kidney and pelvic fat. Although there were no significant differences between the groups in terms of cold carcass yields, Merino had the highest and LB_1 groups had the lowest levels. This may be due to the Merino's finer and shorter wool and therefore lighter skin weight and LB_1's longer and more greasy wool and therefore more heavy skin weight.

The carcass composition results were presented in Table 4. At 44 kg of slaughter weight, the carcasses studied from all the groups had average of 60.8-64.6% muscle, 17.3-20.7% fat and 16.8-20.0% bone tissues in the Leg; There were no significant differences between the groups except for the percentage of bone in the Leg from F_1 that was higher than that of Corriedale. In respect of compositional traits, there were no significant differences between the groups. However, the values of Merino was slightly higher than those of others. The muscle and fat percentage of the Leg and Shoulder of F1 were similar to those of F_1 in the previous study (Tekin and Akçapinar 1992), but the values of Merino were higher than before.

The results of organoleptic traits of the lambs were given in Table 5. From these traits point of view, Merino had generally the highest values. The differences between the groups were significant only in meat view. From sensorial traits point of view, Merino had generally the highest values. The differences between the groups were significant only in meat view. Although the differences between the groups were not significant in other traits, the values of Merino were the highest and Merino can be more acceptable than other groups. The crossbreed lambs were similar to each other.

As a result, from either fattening or carcass traits point of view, there were no superiority of F_1 and B_1 crossbred over the Merino. While the fattening traits of LB_1 were slightly higher than others and not statistically significant, many carcass traits of Merino had statistically higher levels than those of the crossbreeds. Although there was no superiority of crossbreeds over Merino, the crossbreed lambs had generally higher performance at examined traits than the native breeds of Turkey. Therefore, it would be advisable to use this crossbreeds. Corriedale, which were imported from New Zelland, had the lowest performance at either fattening or carcass traits. This may be due to the adaptation problems, and therefore, a further study comparing the crossbreeds with Corriedale should be performed.

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