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Effect of Apple Cider Vinegar on Fattening Performance and Carcass Characteristics in Lambs

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Özet

Bu çalışma, besiye alınan kuzuların içme suyuna elma sirkesi ilavesinin besi performansı ve karkas özellikleri üzerine etkisini araştırmak amacıyla yapılmıştır. Denemede, hayvan materyali olarak ortalama canlı ağırlığı 23-25 kg arasında değişen, 2,5-3 aylık 40 adet Kıvırcık erkek kuzu kullanılmıştır. Kuzular, deneme planına uygun olarak 4 farklı gruba (kontrol (0), 5, 10 ve 15 ml/L sirke) ayrılmış ve her grupta 10 hayvan bulunması sağlanmıştır. Besi süresi sonunda, her gruptan 6'şar hayvan kesilerek karkas özelliklerinin ölçümleri yapılmıştır. Deneme süresi sonunda grupların final ağırlıkları arasındaki farklılıkların önemli olmadığı, elde edilen değerlerin ise 35.17 ile 36.00 kg arasında değiştiği saptanmıştır. Farklı gruplara ait kuzuların soğuk karkas ağırlıkları 15.75 ile 16.30 kg arasında değişim göstermiş olup, elde edilen ortalamalar arasındaki farklılıklar önemli bulunmamıştır. Sonuç olarak, besiye alınan kuzularının içme suyuna 15 ml/L'ye kadar elma sirkesi ilavesinin karkas özellikleri üzerine olumsuz bir etkisinin olmadığı söylenilebilir.

Anahtar kelimeler: Kuzu, elma sirkesi, besi performansı, karkas verimi, karkas özellikleri.

Abstract

This study was carried out to investigate the effects of adding vinegar to the drinking water of fattening lambs on their fattening performance and carcass characteristics. In the experiment, 40 Kıvırcık male lambs aged 2.5-3 months and with an average live weight between 23 and 25 kg were used as the animal material. Lambs were divided into 4 different groups (control (0), 5, 10, and 15 ml/L vinegar) in accordance with the experimental design, and it was planned to have 10 animals in each group. At the end of the treatment period, it was determined that the differences between the final weights of the groups were not significant and the obtained values varied between 35.17 and 36.00 kg. Cold carcass weights of lambs belonging to different groups varied between 15.75 and 16.30 kg, and the differences between the averages were not significant. As a result, it can be said that adding up to 15 ml/L of apple cider vinegar to the drinking water of fattening lambs does not have a negative effect on carcass characteristics.

Key words: Lamb, apple cider vinegar, fattening performance, carcass yield, carcass characteristics.

Introduction

In recent years, studies have been carried out on the possibilities of using vinegar as a natural additive in animal nutrition. The most prevalently studied vinegar is apple cider vinegar. However, studies on the use of vinegar in lamb fattening are very limited. Most producers are of the opinion that the use of vinegar in animals is quite beneficial. For this reason, they recommend different doses of vinegar for different animal species. Nonetheless, there is a need for scientific conclusions and findings on whether these doses are beneficial. Apple cider vinegar is given to sheep by adding it to drinking water or feed and silage. Supplementing apple cider vinegar by 10 ml/L in the drinking water of lambs was reported to be appropriate

in terms of dosage [1]. Studies on apple cider vinegar are mostly carried out on poultry, and studies on small ruminants are highly limited.

It was found that apple cider vinegar is an organic supplement with many beneficial effects on the health of sheep and lambs [2]. One of the benefits of vinegar is its effect on maintaining the pH balance, which is vital for the body. The blood of sheep and lambs is slightly alkaline, with an average pH of 7.40. Although apple cider vinegar is acidic, it has an alkalizing effect on muscle tissue. Vinegar is rapidly assimilated in the body and is especially effective in the early stages of digestion. Vinegar, which is a rich source of potassium, is recommended for sheep and lambs, especially for supplementation in feeds that are low in potassium [2]. Some benefits of apple cider vinegar for small ruminants can be counted as regulating pH, helping the absorption of nutrients, preventing the formation of urinary tract stones, removing toxins from the body, strengthening the immune system, and showing natural antibiotic and antiseptic effects against diseases and parasites. Apple cider vinegar can be used therapeutically against endoparasites in sheep [3]. In this study, it was aimed to determine the effects of adding apple cider vinegar at different ratios to the drinking water of fattening lambs on their carcass characteristics.

Material and Method

The treatment was carried out in a semi-open barn in a sheep farm belonging to the Agricultural Application and Research Center of Bursa Uludağ University. In the experiment, 40 Kıvırcık male lambs aged 2.5-3 months were used as the animal material. The live weights of the lambs varied between 23 and 25 kg. The lambs were divided into 4 different groups (control (0), 5, 10, and 15 ml/L vinegar) in accordance with the experimental design, with 10 animals in each group. The study was carried out in the period of April-June 2022 and for 42 days. Vinegar was not given to the control group, while the drinking water of the experimental groups was supplemented with vinegar at the ratios of 5, 10, and 15 ml/L. The vinegar that was added to the drinking water of the lambs was renewed every other day. The drinking water of the animals was individually provided in separate plastic buckets and offered ad libitum. The lambs were fed with concentrated feed *ad libitum* and 200 g of alfalfa hay per day during the fattening period. The nutrient composition of the concentrated feed and alfalfa is given in Table 1, and the content of the concentrated feed is given in Table 2.

Table 1. Nutrient composition of concentrated feed and alfalfa used in the experiment.

Nutritional content (% DM)	Concentrated feed	Alfalfa
Dry matter	86.42	90.75
Organic matter	91.45	90.23
Crude ash	8.56	9.77
Crude fat	0.87	3.23
Crude cellulose	10.91	21.78
Nitrogen free extracts	57.27	45.67
Hemicellulose	11.52	11.51
Cellulose	9.70	21.82
NDF	26.83	37.27
ADF	15.31	25.76
ADL	5.61	5.91
Crude protein	22.40	19.55
ME kcal/kg DM	2310	2055

NDF: Neutral Detergent Fiber. ADF: Acid Detergent Fiber. ADL: Acid Detergent Lignin. ME: Metabolic Energy. DM: Dry Matter.

Table 2. Composition of the concentrated feed

Raw materials	**%**
Barley	73.0
Sunflower seed meal	25.0
Marble powder ($CaCO_3$)	1.4
Salt	0.5
Mineral-vitamin mixture*	0.1

*Per kg, Vit. A: 300,000 IU. Vit. D_3: 50,000 IU. Vit. E: 1250 mg. manganese (oxide) 3000 mg. iron (sulphate) 3000 mg. zinc (oxide) 4500 mg. copper (sulphate) 1000 mg. cobalt (mono carbonate) 30 mg. iodine (calcium iodate) 45 mg. selenium (sodium) selenite) 12 mg. filler (fine bran or $CaCO_3$) 969.066 mg.

Twenty-four of the lambs used in the experiment were slaughtered on the same day in a slaughterhouse at the end of the fattening period. The animals were starved for 12 hours before slaughtering and were slaughtered after weighing in the slaughterhouse. A scale with a precision of 100 g was used to measure the slaughter weight of the lambs. Immediately after slaughter, the animals were skinned, and their internal organs were removed. After the hot carcass weights were taken, the carcasses were rested in cold storage at +4°C for 24 hours. The carcass processing method described by [4] was used to break up the carcasses and determine carcass characteristics. One-way analysis of variance (ANOVA) was used in the statistical analyses of the data obtained in the study, and for this purpose, the SPSS 21.0 package program was used. Duncan's Multiple Comparisons test was used to determine the significance level of the differences between the mean values.

Results

The initial weight, final weight, average daily weight gain, and feed efficiency values of the lambs in the four groups are given in Table 3. Initial weights varied between 24.30 and 24.66 kg, and the differences among the mean values of the groups were found to be not significant.

Adding different levels of vinegar to the drinking water of the lambs for 42 days did not significantly affect their final weights, daily weight gains, or feed conversion ratios. The differences among the groups in terms of daily average concentrated feed consumption were found to be not significant. Vinegar given at different levels did not affect the average daily feed consumption of the lambs.

Table 3. Mean values and standard errors of some performance characteristics of lambs.

Traits	**Vinegar ratios (ml/L)**				
	Control	5	10	15	**P**
Initial weight, kg	24.30±0.81	24.42±0.89	24.66±1.08	24.64±0.84	NS
Final weight, kg	35.17±0.58	35.75±0.79	35.31±1.20	36.00±0.52	NS
Average daily feed intake, kg	1.10±0.05	1.13±0.04	1.15±0.04	1.13±0.03	NS
Daily weight gain, kg	0.267±0.014	0.266±0.005	0.268±0.012	0.271±0.013	NS
Feed conversion ratio, kg:kg	4.87±0.19	4.92±0.21	4.96±0.19	4.90±0.23	NS

Differences between means in the same row are not significant. NS: Non-significant.

The values of the carcass characteristics of the groups are given in Table 4. In terms of hot carcass weights, the mean values of the groups were similar and varied between 16.13 and 16.70 kg. No significant differences were observed between the control and treatment groups. The use of vinegar had no significant effect on hot carcass weights. Furthermore, the hot carcass percentage values were close among the groups and were not significantly affected by the vinegar doses. The hot carcass percentages of the vinegar groups were found to be between 42.60 and 44.80%. The supplementation of apple cider vinegar at different doses did not significantly affect the cold carcass weights of the lambs, and the weights obtained at the end of 42 days of fattening were between 15.75 and 16.30 kg.

The cold carcass weight values of the control group were numerically lower than those of the treatment groups. On the other hand, the differences among the groups were statistically insignificant. The addition of vinegar at different ratios to the drinking water of the lambs did not affect their cold carcass percentages in this study. In this study, the differences among the mean values obtained in terms of carcass losses were not found to be statistically significant. Carcass loss values varied between 0.87-1.08 kg. It was observed that different vinegar doses did not affect carcass losses significantly.

Table 4. Mean values and standard errors of some carcass characteristics of lambs.

Characteristics	**Vinegar ratios (ml/L)**				
	Control	5	10	15	**P**
Hot carcass weight, kg	16.13±0.40	16.70±0.53	16.43±0.38	16.57±0.43	NS
Hot carcass percentage, %	43.60±1.69	44.80±0.74	42.60±1.44	44.37±1.32	NS
Cold carcass weight, kg	15.75±0.40	16.30±0.54	16.10±0.38	16.17±0.40	NS
Cold carcass percentage, %	42.57±1.69	43.75±0.79	41.72±1.40	43.33±1.33	NS
Carcass losses, %	1.05±0.04	1.08±0.07	0.87±0.06	1.07±0.11	NS
Neck weight, kg	1.03±0.92	0.94±0.22	1.13±0.13	0.96±0.07	NS
Arm weight, kg	3.08±0.11	3.33±0.13	3.18±0.90	3.17±0.07	NS
Loin weight, kg	2.73±0.16	2.71±0.23	2.88±0.19	2.98±0.24	NS
Rib weight, kg	1.24±0.05	1.26±0.14	1.34±0.01	1.38±0.09	NS
Thigh weight, kg	5.37±0.06	5.83±0.23	5.54±0.06	5.48±0.10	NS
Tail fat weight, kg	0.17±0.02	0.17±0.04	0.17±0.01	0.22±0.04	NS
Breast weight, kg	1.88±0.04	1.91±0.08	1.82±0.06	1.99±0.07	NS
MLD area (cm^2)	15.72±0.89	15.93±0.41	14.88±0.78	13.37±0.66	NS
Back fat thickness (mm)	3.28±0.17	3.06±0.12	3.27±0.23	3.17±0.24	NS

Differences between means in the same row are not significant. NS: Non-significant.

No significant differences were observed among the groups in terms of neck weight or neck percentages. The neck weights of the lambs in all groups varied between 0.04 and 1.13 kg. It can be stated that supplementing vinegar in the drinking water of lambs at different ratios was not significantly effective on neck weight.

The differences between the control and treatment groups in terms of arm weight were not significant. While the arm weights of the groups varied between 3.08 and 3.33 kg. It was determined that the addition of vinegar to drinking water at different doses was not effective on the arm weight of the lambs.

The loin weights of the groups were similar and the differences among them were not significant. It can be stated that the addition of vinegar to the drinking water of the lambs at different ratios was not effective on their loin weights. The mean loin weights of the groups were 2.71-2.98 kg. It is seen that these values we are numerically higher in the group in which vinegar was used at the ratio of 15 ml/L.

In terms of the mean rib weight of the lambs, it was seen that there was no significant difference among the groups. The addition of vinegar at different doses did not have a significant effect on rib weight. The rib weights of the groups was in the range of 1.24-1.38 kg.

The mean thigh weight of the groups varied between 5.37 and 5.83 kg. In this study, although the treatment groups showed numerically higher thigh weight in general, the differences were not statistically significant. It can be stated that the use of vinegar in drinking water was not significantly effective on thigh weight.

The tail fat weight of the groups also did not show statistically significant differences. The group in which 15 ml/L vinegar was added to the drinking water had a numerically higher mean value. While the values of tail weight varied between 0.17 and 0.22 kg. It was observed that the addition of vinegar to drinking water at different doses was not effective on the tail fat weight of the lambs.

The breast weights of lambs in this study did not show significant differences among the groups. It was determined that the effect of the treatments was not significant. The breast weight values of the groups varied between 1.82 and 1.99 kg.

The MLD areas of the control and treatment groups ranged from 13.37 to 15.93 cm^2. The differences among the mean values of the groups were not significant. It was observed that the treatments had no significant effect on MLD area. The differences among the back fat thicknesses of the groups in this study were not significant. These values varied between 3.06 and 3.28 mm, and it was determined that the treatments were not significantly effective on back fat thickness.

Discussion and Conclusion

In this study, it was aimed to determine the possible effects of apple cider vinegar, which has been given to animals by different methods in different studies (with drinking water, feed, and silage) due to its beneficial effects in terms of health, on the carcass characteristics and some body parts of fattening lambs. In the experiment, 3 different doses (5, 10, and 15 ml/L) of vinegar recommended for lambs were added to the drinking water, and the animals were given this water to drink every other day. At the end of the 42-day fattening period, a total of 24 animals, 6 from each group, were slaughtered, and some parameters for the carcass and some body parts were analyzed. The results of providing apple cider vinegar to lambs at different ratios were analyzed.

The initial weights of the lambs in this study showed no statistically significant difference among the groups. Different researchers have reported different initial weights. [5] and [6] reported the initial live weights of Kıvırcık lambs as 20.58 kg and 23.14 kg, respectively. The live weights of the lambs at the end of the trial period in this study varied between 35.17 and 36.00 kg. It was observed that the addition of vinegar to the drinking water of the animals in this study at different ratios did not have a significant effect on their live weights throughout the fattening period. The results regarding the final fattening weights of the lambs were similar to those reported by [7]. On the other hand, these values were found to be different from those reported by [5] (28.07 kg). [6], [8], and [9] determined the live weights of lambs at the end of fattening as 39.00, 31.15, and 28.98 kg, respectively. The reason why the final fattening live weights obtained in other studies were different may be the differences among initial weights before fattening and differences in the

fattening periods. The differences among the daily live weight gain values we obtained in different groups were insignificant. The values we found were similar to those reported by [9] and higher than those found by [5], [6], and [8]. The feed conversion ratios of the lambs that were included in our study were between 4.87 and 4.96, which were lower than those reported by [5], [6], and [9]. It can be stated that the differences were due to the different live weights and fattening ages of the animals used in the experiments. In this study, the cold carcass weights and percentages of the groups were not significantly different from each other. [5] and [9] reported lower cold carcass weights than our results and higher cold carcass percentages. The difference in the values found was attributed to the fact that the animals were slaughtered at different live weights and were less fatty. Regarding carcass losses, [6] and [8] observed values of 3.1% and 2.95%, respectively. These reported values were higher than those we obtained.

The mean loin weights of the groups in our study were 2.71-2.98 kg. Considering these values, the supplementation of vinegar in this study at different ratios had no significant effect on the loin weight of the lambs. In a study conducted by [5], the loin weight of Kıvırcık lambs were reported to be 1.20 kg in a 42-day fattening period. Similarly, this difference is thought to be caused by differences in slaughter weight and lubrication. It was observed that the treatment in our study did not have a significant effect on tail fat weight. While the values in this study regarding tail fat weight varied between 0.17 and 0.22 kg. [6] reported the tail fat weight value of Kıvırcık lambs fattened for 60 days as 0.385 kg. This difference was due to the longer fattening period in the study in question.

In this study, the MLD areas of the groups varied between 13.37 and 15.93. Accordingly, there was no significant difference between these values. In studies conducted with Kıvırcık sheep, while some researchers reported similar MLD area values to ours, some reported different findings. These values were reported as 11.77, 11.07, 14.60, 10.60 and 15.26 cm^2 by [5], [6], [7], and [8], [9] respectively. The different results obtained by different researchers in similar breeds were attributed to differences in fattening times, slaughter weight, and fattening age. Consequently, studies on the use of vinegar in animals have mostly focused on poultry. In a study where apple cider vinegar was used as an alternative to antibiotics in broilers, it was reported that carcass yield and carcass parts were positively affected [10]. Studies on ruminants are highly limited.

According to the findings of our study, vinegar added to the drinking water of the lambs at different ratios did not have significant effects on carcass characteristics or some body parts of the lambs. There was no statistically significant difference among the obtained values in terms of the measured parameters. Although the treatment groups showed numerically higher values in terms of arm, loin, rib, thigh, and breast weights compared to the control group, the differences were not statistically significant. In terms of some properties (such as loin and rib parameters), some improvements were seen depending on an increase in vinegar doses.

This study showed that there was no negative effect of giving vinegar to lambs with drinking water. No undesirable effects were observed in the animals at the highest dose (15 ml/L) used. The results demonstrated that adding apple cider vinegar to the drinking water of lambs does not have any harmful effects and can be tested without any problems.

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