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İ Ç İ N D E K İ L E R / C O N T E N T S

Effects Of Sweet Apricot Kernel Meal On Performance And Intestinal Microbiota In Broiler Chickens

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This study was carried out to determine the effects of apricot kernel meal (AKM) on performance and intestinal microbiota in broiler chickens. One hundred twenty broiler chickens raised in contiguous wire cages were used. The duration of the experiment was 21 days. In the trial, four diets containing different levels of AKM (control, 5, 10, and 20%) were utilized as the treatments. Birds given the 20% AKM diets from 1 to 21 days had significantly better body weight gain than those given the 0 and 5% AKM diets. However, birds fed the 0, 5 and 10% AKM diets consumed significantly less feed intake than did those fed the 20% AKM diet. Also, ileum microbiota was significantly affected by dietary treatment. Respective counts of lactic acid bacteria in the ileal contents, for the 10% AKM fed groups were found significantly lower than those of the other groups. Although, yeast and coliform counts were determined the highest in the 10% AKM fed groups. This by-product might be an alternative protein source in poultry nutrition. Further works are required to test their suitability in poultry diets.

Key words: Apricot kernel meal, broiler, feed, ileum, lactic acid bacteria

Etlik Piliçlerde Kayısı Küspesinin Performansa ve Bağırsak Mikrobiyotasi Üzerine Etkileri

Yürütülen bu çalışma ile kayısı çekirdeği küspesinin (KÇK) etlik piliç performansı ve bağırsak mikrobiyotası üzerine etkilerinin ortaya konulması amaçlanmıştır. Denemede, tel kafeslerde yetiştirilen yüz yirmi adet etlik piliç kullanılmıştır. Deneme 21 gün sürmüştür. Çalışmada, farklı düzeylerde KÇK (kontrol, %5, %10 ve %20) içeren dört muamele bulunmaktadır. Kayısı çekirdeği küspesini %0 ve 5 tüketenlere göre, %20 tüketen gruplarda daha iyi canlı ağırlık artışı görülmüştür. Bununla birlikte, %0, 5 ve 10 KÇK içeren rasyonlarla beslenen hayvanlar, %20 KÇK tüketen gruplara göre daha az yem tüketmiştir. İleum mikrobiyotası da muamelelerden önemli derecede etkilenmiştir. %10 KÇK içeren rasyonu tüketen grupların ileal içerikteki laktik asit bakteri sayıları, diğer gruplara göre önemli derecede daha düşük bulunmuştur. Bununla birlikte, maya ve koliform sayıları %10 KÇK tüketen gruplarda en yüksek saptanmıştır.Söz konusu yan ürün kanatlı beslemede alternatif bir protein kaynağı olarak kullanılabilir. Bununla birlikte KÇK nın kanatlı rasyonlarında kullanılmasıyla ilgili daha fazla çalışmaya gereksinim vardır.

Anahtar sözcükler: Kayısı çekirdeği küspesi, etlik piliç, yem, ileum, laktik asit bakterileri

Introduction

Apricot (*Prunus armeniaca L.*) is a member of the *Rosaceae* family with other stone fruits (Ozcan et al., 2010). Turkey is the largest apricot producer in the world (Durmaz and Alpaslan, 2007). Total fresh and dried apricot production of Turkey was 716,000 metric tons/years in 2008 (TUIK, 2009). The apricot kernels are mainly used in production of cosmetics, medicines, scents, and also consumed as appetizers, and in addition pits are used as fuel (Alpaslan and Hayta, 2006; Durmaz and Alpaslan, 2007). The percentage of kernel is in the fresh apricot ca. 1.5%, and total oil content of kernels ranges from 40.23% to 53.19%, with the average value of 46.19%. The oil contains unsaturated fatty acids, approximately 91.5-91.8% (Turan et al., 2007; Azouz et al., 2009). The defatted apricot kernel meal (AKM) was contained 625.37mg/ 100g total phenolics. Whereas, 500 and 1000 ppm phenolic compounds of apricot meal as antioxidant was more effective for lowering the development of peroxide value for corn oil than using butylated hydroxyl toluene BHT. Therefore, usage of AKM in diets as natural antioxidant might be healthier as alteration of synthetic antioxidants (Azouz et al., 2009). Durmaz and Alpaslan (2007) indicated that heat treatment greatly improves the antiradical power of apricot kernels. Apricot kernel is an important dietary protein source as well as oil and fibre (Durmaz and Alpaslan, 2007). The apricot kernel cake contains of 41.5% crude protein (Azouz et al., 2009). Crude protein contents of sunflower, cottonseed and soybean meals are 34%, 41% and 48.5 (as fed), respectively. Most of the used oilseed meals have anti-nutritional factors such as fibre in sunflower meal, trypsin inhibitors and lectins in soybean meal, gossypol in cottonseed meal (Senkoylu and Dale, 1999). However, there is no such an experiment that exerts the anti-nutritional factors of apricot kernel meal.

Apricot kernel meal (AKM) is processing by-product of kernel oil production. To utilize the process by-products and wastes are getting great importance in the developing world. Apricot kernel meal, a new by-product of the Turkish apricot kernel oil and soap industry, is a possible optional feed ingredient for broiler chickens. No research work has yet been conducted on the effect of apricot kernel meal in broiler diets. Also, we have not encountered any report describing the amount of apricot kernel meal production.

The objective in this study was to examine the effects of apricot kernel meal on performance and intestinal microbiota in broiler chickens.

Materıals And Methods

Animals and housing

Male Ross 308 broilers (1 d old; n=120) were obtained from a local parent stock supplier and randomly transferred to compact-type three-tier cages 5 chicks per cage. Battery cages (100 x 60 cm) were equipped with wire mesh, nipple drinkers and trough feeders. The experiment consisted of four dietary treatments and was set up in a completely randomized design in which 30 chicks were randomly assigned to each of the four treatments, six replicates each. The experiment lasted for 21 days and the chicks were fed the experimental diets throughout the experimental period. Feed and water provided ad libitum. The lighting regime was 23 h/d. The birds were weighed individually 1, 7, 14 and 21 days of age.

Diets

Dietary treatments were: (i) control diet, (ii) 5% apricot kernel meal, (iii) 10% apricot kernel meal, and (iv) 20% apricot kernel meal.

Experimental diets were formulated using ration-formulation software (UFFDA, University of Georgia, 1992, Athens, GA) to be isocaloric and isonitrogenous following National Research Council recommendations (NRC, 1994). Experimental diets were formulated to contain 22% crude protein and 3050 kcal//kg, and other essential nutrients (Table 1). In the experiment only methionine and lysine levels were calculated in high doses.

Birds were fed the experimental diets *ad libitum* in mash form. Feed intake was recorded weekly. The feed conversion ratio (FCR) was calculated as grams of feed consumed per chick divided by grams of weight gain per chick.

Processing technique of apricot kernel meal

The apricot kernel meal (AKM) was produced in an apricot kernel oil extraction plant in Malatya city (Dogaci Sabun Imalat Sanayi Ticaret ve Pazarlama, Malatya/Turkey) using mechanical screw press extraction technique.

The nutrient composition of the apricot kernel meal was determined using the standard Weende analysis methodology (AOAC, 1990). A typical analysis of the product indicates the following proximate composition: crude protein, 43.4%; ether extract, 16.9%; crude fiber, 10.0%. Using these values, a metabolizable energy value of 3520 kcal/kg was calculated from equation (Carpenter and Clegg, 1956). Amino acid composition, as percent of sample, was as follows: Methionine, 1.1%; Lysine, 3.0%; Arginine, 4.3%; Threonine, 2.2%.

Microbiology of ileum

Samples of the ileal contents were immediately collected. The entire ileal contents were transferred under aseptic conditions into sterile glass tubes in which they kept on ice until subsequent inoculation into agar. Accordingly, as the incubation medium; MRS agar (MERCK, Darmstadt, Germany, 1.10660) was used for lactic acid bacteria (LAB) and malt extract agar (MERCK, Darmstadt, Germany, 1.05398) was used for yeast. LAB and yeast counts of the ileum contents were obtained at 30°C following a 3-day incubation period. Coliform bacteria were grown aerobically on VRB agar (MERCK, Darmstadt, Germany, 1.01406) at 37°C for 24 - 48 hours. The LAB, yeast and coliform bacteria counts, and the average number of live bacteria were determined per gram of original ileal contents. LAB, yeast and coliform bacteria counts of the samples were converted in to logarithmic colony forming units (cfu/g).

Table 1. Chemical composition of the basal diet (as fed)

Ingredients (g/kg of diet)	I	II	III	IV
Maize	537.1	547.0	557.0	575.7
Full fat soybean	235.6	179	160.1	10
Soybean meal	167.1	163.6	122.4	153.4
Apricot kernel meal	-	50.0	100.0	200.0
Dicalcium phosphate	20.5	20.9	21.3	22.1
Limestone	11.7	11.5	11.2	10.8
DL-Methionine	9.5	9.5	9.5	9.5
L-Lysine HCl	9.5	9.5	9.5	9.5
Salt	4.0	4.0	4.0	4.0
Premix a	5.0	5.0	5.0	5.0
Calculated nutrients (g/kg) b				
ME, kcal/kg	3050	3050	3050	3050
Crude protein	220.0	220.0	220.0	220.0
Crude fiber	39.8	42.1	44.4	49.0
Ether extract	75.3	71.9	68.5	61.9
Linoleic acid	32.1	28.2	24.2	16.5
Calcium	10.0	10.0	10.0	10.0
Available phosphorus	5.0	5.0	5.0	5.0
Arginine	13.7	14.3	14.9	16.1
Lysine	21.5	21.5	21.4	21.4
Methionine	13.0	12.8	13.0	13.5
Met + Cys	16.0	16.1	16.2	16.5
Threonine	8.6	8.7	8.8	9.0

[a] Provided the following per kg of diet: vitamin A (retinyl acetate), 14,000 IU; vitamin D_3, 5,000 IU; vitamin E, 50 mg; vitamin K_3, 4 mg; vitamin B_1, 3 mg; vitamin B_2, 8 mg; vitamin B_6, 4 mg; vitamin B_{12}, 16 μg; niacin, 20 mg; iron, 80 mg; folic acid, 2 mg; pantothenic acid, 20 mg; biotin, 150 μg; choline, 1800 mg; copper, 5 mg; manganese, 100 mg; zinc, 80 mg; selenium, 150 µg.

[b] Based on National Research Council (NRC) (1994) values for feed ingredients.

Statistical analyses

Data were recorded on a weekly basis and subjected to ANOVA using a statistical package program (Statistica for the Windows Operating System, 1999). The differences between group means were examined using Duncan's multiple range tests.

Results And Discussion

Performance parameters and organ weights

Weight gain, food intake and FCR were monitored weekly throughout the experiment (Table 2).

At 21 days of age, the inclusion of apricot kernel meal did significantly influence body weight gain, feed intake and FCR (P < 0.05). Similar results were reported by Jadhav et al. (2011) in lambs. Jadhav et al. (2011) reported that feeding of apricot cake in complete feed of lambs had no adverse effect on performance and blood biochemical profile of lambs. The effects of the dietary treatments on relative organ weights are presented in Table 3.

The results at the end of experiment revealed no significant differences among dietary treatments in digestive organ weights except pancreas. The relative weights of pancreas were reduced by the 10 and 20% AKM treatment (P < 0.001). Duodenum, jejunum, ileum and cecum weights and lengths were affected by 20% AKM supplementation (Table 4).

Table 2. Effects of experimental diets on broiler performance

Treatments	Body Weight, g	Feed Intake, g	FCR
AKM % 0	577.8 b	673.2 b	1.165 b
AKM % 5	611.2 b	699.1 b	1.144 b
AKM % 10	631.0 ab	715.6 b	1.134 b
AKM % 20	660.1 a	813.0 a	1.232 a
Pooled SEM	9.054	16.559	0.014
P-level	0.006	0.007	0.043

a-b: Means in the same row with different letters differ significantly by main effects

Table 3. Effects of experimental diets on organ weights (g/body weight)

Treatments	Proventriculus	Gizzard	Abdominal fat	Heart	Liver	Pancreas
AKM % 0	0.64	2.78	0.80	0.63	2.78	0.51 a
AKM % 5	0.59	2.63	0.71	0.60	2.61	0.42 b
AKM % 10	0.61	2.90	0.65	0.61	2.70	0.29 c
AKM % 20	0.59	2.54	0.83	0.69	3.01	0.32 c
Pooled SEM	0.016	0.066	0.035	0.012	0.086	0.019
P-level	0.618	0.623	0.362	0.064	0.529	<0.001

a-c: Means in the same row with different letters differ significantly by main effects

Table 4. Effects of experimental diets on small intestine weight (g/body weight) and length (cm/body weight)

Treatments	Duodenum weight	Duodenum length	Jejunum weight	Jejunum length	Ileum weight	Ileum length	Cecum weight	Cecum length
AKM % 0	1.40	4.21 a	2.18	10.85 a	2.22	7.82 a	0.75 ab	2.70
AKM % 5	1.31	3.48 b	2.21	9.80 b	2.20	7.13 a	0.90 a	2.61
AKM % 10	1.30	3.99 a	2.01	10.47 ab	1.84	7.61 a	0.64 b	2.39
AKM % 20	1.18	3.49 b	1.87	8.42 c	1.82	6.19 b	0.60 b	2.37
Pooled SEM	0.036	0.095	0.059	0.245	0.063	0.192	0.040	0.078
P-level	0.298	0.004	0.068	<0.001	0.332	0.005	0.003	0.364

a-c: Means in the same row with different letters differ significantly by main effects.

Table 5. Effects of experimental diets on ileum microbiota (log cfu/g ileal content)

Treatments	Lactic acid bacteria	Yeast	Coliform bacteria
AKM % 0	4.701 a	4.771 b	4.410 b
AKM % 5	4.277 c	4.889 b	4.472 b
AKM % 10	3.754 d	5.768 a	5.300 a
AKM % 20	4.557 b	4.115 c	4.439 b
Pooled SEM	0.079	0.131	0.091
P-level	<0.001	<0.001	<0.001

a-d: Means in the same column with different letters differ significantly.

Intestinal microbiota

The composition of ileal microbiota of chicks at the end the experiment is shown in Table 5.

Ileum microbiota were significant (P <0.001) by dietary treatment (Table 5) affected. Such counts (cfu/g) of lactic acid bacteria (LAB) in ileum content for the 10% AKM fed groups were significantly lower than that of other groups.

Birds given the 20% AKM diets from 1 to 21 days had significantly better body weight gain than those given the 0 and 5% AKM diets. However, birds fed the 0, 5 and 10% AKM diets consumed significantly less feed intake than did those fed the 20% AKM diet. Jejunum and ileum length were affected by the 20% AKM treatment, presenting a smaller small intestine (Table 4). Possibly, supplementation of 20% AKM to the diet improved the feed passage rate of the chickens. The results might be related to the increase in crude fiber levels and decrease in ether extract levels of diets. Ileum microbiota were significantly (P < 0.001) affected by dietary treatment (Table 5). Respective counts (cfu/g) of lactic acid bacteria in the ileal contents, for the 10% AKM fed groups were significantly lower than those of the other groups.

20% of AKM, particularly when used in this study were found to be the highest level of body weight. This is because the feed consumption is to increase the use of the AKM. Body weight did not change except for the pancreas. The usage of 10% and 20% ratio of AKM had shortened the length of the small intestine. This might be because of the higher levels of crude fiber in these diets.

Conclusions

In conclusion, this study demonstrates that AKM can be used as a valuable protein source in broiler diet. The by-product utilized by the apricot oil industry might be an alternative protein source in poultry nutrition. The addition of AKM in chicken diets caused a positive effect on performance, and intestinal microbiota. Especially, the usage of 10% AKM in broiler diets might be suggested than other treatment groups. However, further works are required to test their suitability in poultry diets.

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