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Effects of Fermented Sour Cherry (*Prunus cerasus*) Kernel with *Aspergillus niger* under Solid State Fermentation on Performance, Digestibility and Cecal Microflora in Broiler Chicks*

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Abstract

The effects of unfermented (UCK) and fermented (FCK) sour cherry kernel (0,1,2,4%) with *Aspergillus niger* (ATCC 200345) under solid state fermentation on performance, digestibility and cecal microflora in broiler chicks were investigated in this study. UCK did not affect (P>0.05) growth performance and digestibility at 1% but decreased (P<0.05) at 2 and 4%. Cecal microflora was not affected (P>0.05) by UCK inclusion. FCK improved (P<0.05) growth performance and cecal microflora at 1%, did not change (P>0.05) at 2% and decreased (P<0.001) performance at 4%. Digestibility was not affected (P>0.05) by FCK addition. In conclusion, using of FCK in poultry diets at 1% is recommended.

***Key words**: Aspergillus Niger, Broiler, Prunus Cerasus, Sour Cherry Kernel*

Introduction

World meat demand is supposed to be increased by 60-70% in 2050 (FAO, 2011). Poultry meat is crucial to fulfilling meat demand in Turkey. It is only possible to fulfill meat demand by increasing production. The world population is expected to rise to more than 9 billion by 2050 (Cohen, 2003). Increased production and growing population will make a pressure on cereal, grains etc. that are consumed by both human beings and animals. Therefore, feedstuffs that are not using in human nutrition should be used much more in poultry nutrition.

Feed costs that constitute 70-80% of total costs affect the profitability of poultry production considerably. Feed cost can be reduced by using agricultural residues in poultry diets. Therefore, agricultural residues should be made available for poultry nutrition.

Kernels are a by-product that separated from sour cherry by seed separating machines in factories (Korlesky et al., 2016). It contains 25-37% crude protein (CP), 18-42% ether extract (EE), 6-31% crude fiber (CF) and 2-5% ash (Lazos, 1991, Yilmaz, 2013, Eryilmaz, 2016, Güngör et al., 2017). Sour cherry kernel can be used in broiler diets but it remains at limited level due to being weak in methionine and threonine (Yilmaz, 2013), having some antinutritional components such as amygdalin, tannin, phytic acid and hydrocyanic acid (El-Adawy et al., 1994, Bolarinwa et al., 2014).

Solid state fermentation can be used to improve nutritional composition, reduce CP content and eliminate antinutritional components of agricultural residues (Zhang et al., 2006). *Aspergillus niger* is preferred in solid state fermentation because of suitable for growing in the low-water environment (Raimbault, 1998). The effects of unfermented and fermented sour cherry kernel with *A. niger* under solid state fermentation on performance, digestibility and cecal microflora in broiler chicks were investigated in this study.

Materials and Methods

Two different trials were conducted in the study. In trial I, unfermented sour cherry kernel (UCK) was given at increasing levels (0, 1, 2, and 4%) to broiler chicks, while in trial II, fermented sour cherry kernel (FCK) was given. In trial I, 196 one-day-old Ross-308 male broiler chicks were divided into 4 groups with 7 replicates consisting of 7 animals each. Chicks were fed with diets containing 0, 1, 2, and 4% UCK for 42 days. In trial II, 196 one-day-old Ross-308 male broiler chicks were divided into 4 groups each consisting of 7 animals and fed with feed containing 0, 1, 2, and 4% FCK until 42 days of age. Birds and feed were weighed weekly on a pen basis and live weight gain (LWG), feed intake (FI) and feed conversion ratio (FCR) were calculated. Cecal *Lactobacillus acidophilus*, *Enterococcus faecalis* and *Escherichia coli* count determined as described by Arda (1985). Digestibility trial is operated with acid insoluble ash method as described by Emami et al. (2012).

Sour cherry kernel fermented with *A. niger* (ATCC 200345) at 10^5 spores/kg kernel. Fermentation was conducted according to Güngör et al. (2017). Differences between treatments were tested with using ANOVA and Duncan's multiple range test (SPSS 21.0 Statistics). The level of statistical significance was declared at $P \leq 0.05$.

Results and Discussion

In trial I, UCK did not affect ($P>0.05$) LW, LWG, and FI at 1% but decreased ($P<0.001$) at 2% and 4% compared to control group. Similar findings have been obtained from the studies on apricot kernel (Arbouche et al., 2012), palm kernel (Ezieshi and Olomu, 2008, Abdollahi et al., 2016), mango kernel (Diarra and Usman, 2008) and date kernel (Masoudi et al., 2011). UCK addition decreased ($P<0.05$) FCR at 1% but not changed at 2% and 4%. This result showed that UCK represented positive effect on FCR at 1% even though it did not improve other performance parameters.

Dry matter (DM), organic matter (OM) and CP digestibility were affected negatively by UCK addition. DM, OM, and CP digestibility were not changed (P>0.05) by 1% UCK addition while decreased (P<0.05) at 2% and 4%. Nevertheless, EE digestibility was not affected by UCK inclusion. Negative effects on nutrient digestibilities may be due to high CF content and antinutritional factors of UCK (Cowieson et al., 2006).

Cecal *L. acidophilus*, *E. faecalis* and *E. coli* counts were not changed (P>0.05) by UCK addition. Kołodziejczyk et al. (2013) reported that sour cherry kernel has antimicrobial effect. Nevertheless, UCK did not affect bacterial counts that are investigated. It is assumed that inclusion quantity of UCK not enough to change cecal microflora.

Crude protein, crude fat and ash content increased (P<0.001) CF, neutral detergent fiber, acid detergent fiber, nitrogen-free extract decreased (P<0.01) in UCK by *A. niger* solid state fermentation. Similar findings were obtained from the study on palm kernel (Iluyemi et al., 2006).

In trial II, LW and LWG (P<0.001) were increased by 1% FCK inclusion but remained the same (P>0.05) with control at 2% and decreased (P<0.001) at 4%. FI was not affected (P>0.05) by any FCK dosage. FCR decreased (P<0.001) by 1% FCK inclusion but not changed (P>0.05) at 2% and increased (P<0.001) at 4% compared to control. Similar results have been reported at the studies in which LW increased by fermented feedstuff compared to control group on shea nut (Dei et al., 2008) and palm kernel (Lawal et al., 2010). *A. niger* is used in poultry diets as a probiotic that has positive effects on growth performance (Mountzouris et al., 2007). Improvement in LW and FCR by 1% FCK inclusion may be due to probiotic effect of *A. niger*.

DM, OM, CP and EE digestibility were not changed (P>0.05) by FCK addition. Antinutritional factors can be eliminated by solid state fermentation (Chang and Zhang, 2012). This result indicates that negative effect of UCK inclusion on nutrient digestibility is resolved by fermentation because of eliminating antinutritional factors or decreasing CF content of UCK possibly.

Cecal *L. acidophilus* increased (P<0.05) by 1% FCK addition. However, cecal *E. faecalis* and *E. coli* counts were not changed (P>0.05) by FCK inclusion. Similarly, it has been reported that *A. niger* can improve cecal microflora by its probiotic effect (Mountzouris et al., 2007).

Conclusion

Unfermented sour cherry kernel can be used up to 1% in broiler diets without negative effect on performance and also has positive effect on feed conversion ratio at 1%. *Aspergillus niger* solid state fermentation improved nutritional composition of sour cherry kernel. Fermented sour cherry kernel increased live weight, live weight gain, improved feed conversion ratio and increase cecal *Lactobacillus acidophilus* count without affecting feed intake and dry matter, organic matter, crude protein and ether extract digestibility at 1%. Using of fermented sour cherry kernel at 1% in broiler diets is recommended.

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