Melatonin Supplementation Can Ameliorate the Detrimental Effects of Heat Stress on Performance and Carcass Traits of Japanese Quail

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ABSTRACT

Melatonin, the major pineal hormone, modulates growth in poultry by influencing hormones involved in growth. We investigated the effects of dietary melatonin supplementation on performance, carcass characteristics, and excretion of nitrogen and some minerals in broiler Japanese quails (Coturnix coturnix japonica) exposed to high-ambient-temperature stress (34°C). One hundred twenty Japanese quails (10 d old) were randomly assigned to 4 treatment groups, 3 replicates of 10 birds each. The birds were kept in either an environment-controlled room at a constant 22°C or were kept at 22°C for 16 h/d and at 34°C for 8 h/d (9:00 AM to 5:00 PM). At both temperatures birds were fed either a basal diet or the basal diet supplemented with 40 mg of melatonin per kilogram of diet. The experiment lasted for 32 d. Melatonin improved feed efficiency in both temperatures groups compared with their corresponding controls. Although feed intake was similar in all groups, the improvement in feed efficiency was more noticeable in melatonin-fed quails kept at high temperature (p < 0.01). Supplemental melatonin significantly increased live weight gain and carcass characteristics under stress conditions (p < 0.01) but did not show the same effect at thermoneutral conditions (p > 0.05). Heat exposure increased excretion of N, Ca, P, Zn, Fe, and Cr and decreased retention rates for them. Dietary melatonin supplementation returned these values to normal (p < 0.01). No interactions between melatonin and temperature were found.

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in the parameters measured. The results of the study show that melatonin supplementation attenuated the retardation in performance as well as the excretion of minerals caused by heat stress in broiler quails. Our data suggest that melatonin might offer protection against heat-stress-related depression in the performance of broiler quails.

Index Entries: Heat stress; quails; melatonin; performance; mineral.

INTRODUCTION

Melatonin is mainly produced by the pineal gland at night or the dark phase of the light : dark cycle (1). Melatonin is suggested to modulate growth in poultry by influencing hormones involved in growth (2). Bermudez et al. (3) reported that melatonin depresses feed intake and improves feed efficiency. John et al. (4) reported that melatonin administration stimulated growth hormone (GH) secretion in pigeons. Similarly, GH release decreased in pinealectomized pigeons (5). It has been speculated that melatonin modulates growth in chickens; however, the mechanisms of action are not well defined (6). Chuang et al. (7) hypothesized that melatonin could interact with transcriptional factors. Melatonin could interact with GH production (8) and affect energy metabolism (9). Stress factors such as high ambient temperature might negatively influence the performance of poultry (10). The retardation in growth is probably the result of reduced feed intake and decline in feed efficiency and nutrient digestibility. Stress also induces several hormonal responses related to the utilization of nutrients (10,11). In general, absorption of nutrients are negatively influenced and their excretion is increased under stress conditions (10,12,13). Because of the high cost and impracticality of cooling animal buildings, there is increased interest in dietary manipulations. Recently, many studies have shown that antioxidant nutrient supplementation, especially vitamin C, vitamin E, vitamin A, zinc, and chromium, could be used to attenuate the detrimental effects of environmental stress on performance (13–15). The objective of this experiment was to evaluate the ability of supplemental melatonin to alleviate the detrimental effects of heat stress on the performance of broiler quails. The effects of melatonin on live weight gain, feed intake, feed efficiency, carcass traits, and mineral retention–excretion in broiler Japanese quails reared under heat stress (34°C) were investigated.

MATERIALS AND METHODS

Animals, Diet, Experimental Design, and Data Collection

One hundred twenty, 10-d-old Japanese quails (Coturnix coturnix japonica) provided by Uluova Company (Elazig, Turkey) were used in the study. The birds were randomly assigned, according to a 2 × 2 factorial