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Effects of High-Oleic Peanut Inclusion on Production and Egg Quality in Laying Hens.

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In this study we aimed to identify the optimal inclusion levels of unblanched high-oleic peanuts (HO-PN) in the diets to enhance layer performance and to nutritionally enrich the eggs. Two hundred Hy-Line Brown hens (40 weeks of age) were fed 5 different inclusion levels of HO-PN in the diet to determine the effect on layer performance, egg quality, and egg fatty acid profile over a period of eight weeks. One ton of #1 unblanched whole aflatoxin-free non-roasted high-oleic Runner peanuts were donated by Premium Peanut (Douglas, GA) and were processed into peanut granules using a Roller Mill. Peanut granules were incorporated into five different experimental diets, at varying inclusion levels (0%, 5%, 10%, 15%, 20%) in a complete layer ration formulated with defatted solvent extracted soybean meal and yellow corn. Layer diets were formulated using Concept 4 software to meet and/or exceed the nutrient requirements for laying hens. The experimental diets were designed to be isonitrogenous, containing 18% crude protein, and isocaloric, with 3080 kcal/kg metabolizable energy. Hens were provided feed and water freely for 8-weeks. Each treatment group consisted of 40 hens, divided into 5 replicates with 8 hens per replicate. Layer body weights were collected at wk0 and termination & and feed weights were collected weekly. Eggs were collected daily, weighed, and enumerated weekly. Bi-weekly eggs were analyzed for quality parameters, grading, and lipid analysis. All data was analyzed using analysis of variance, with t-test mean comparisons at $P < 0.05$.

There were no significant differences in body weights between the treatment groups over the 8-week feeding trial. Additionally, there were no significant differences in hen day egg production (HDEP) between the treatment groups at week 2, 4, 6 and 8 ($P > 0.05$). Hens fed the 15% and 20% HO-PN experimental diets had significantly reduced feed intake over the 8-week feeding trial as compared to hens fed the conventional control diet (0%) at 4, 6 and 8 weeks ($P < 0.01$). Egg mass (EM) was not significantly different between the dietary treatments at week 4, 6 or 8, while at week 2 EM from the 5% and 10% HO-PN treatment groups were significantly less than EM of the 15% HO-PN experimental treatment group ($P < 0.05$) only. Feed conversion ratio (kg feed/dozen) was significantly improved in hens fed the 15% HO-PN treatment group at week 2, and at week 8 the FCR/dozen was improved in hens fed the 15% and 20% HO-PN treatment as compared to the conventional controls ($P \leq 0.01$). Similarly, feed conversion ratio calculated as g feed/g egg was significantly improved at week 6 in hens fed the 20% HO-PN diet and at week 8 in hens fed the 15% and 20% HO-PN diets as compared to the conventional controls ($P < 0.05$). There were no significant differences between egg quality parameters (egg weights, Haugh Unit, shell strength, vitelline membrane strength) measured between the treatment groups at any of the time points (week 2, 4, 6, 8) measured over the course of this feeding trial ($P > 0.05$). Eggs produced from hens fed the 10%, 15% and 20% HO-PN experimental diets had significantly reduced levels of total saturated fatty acids, palmitic acid (16:0), and myristic acid (14:0) at weeks 6 and 8 as compared to eggs produced from hens fed the conventional diet ($P < 0.0001$). Stearic acid (18:0) levels were significantly lower in eggs produced from hens fed the 20% HO-PN diet as compared to control eggs at 6 and 8 weeks ($P < 0.0001$). Monounsaturated oleic acid and omega 9 fatty acid content was significantly enhanced in eggs produced from hens fed the 10%, 15% and 20% HO-PN diets at week 6 and 8 ($P < 0.0001$). Eggs produced from hens fed the 10%, 15% and 20% HO-PN diets had significantly lower levels of linoleic acid (18:2) at 6 and 8 weeks as compared to the controls. While total omega 3, α-linolenic (18:3) and ɣ-linolenic (18:3) acid levels found in all eggs irrespective of treatment were very low (α-linolenic values < 1.5% of crude fat content, ɣ-linolenic acid values < 0.5% of total crude fat content), these values were significantly lower in eggs produced from hens fed the 10%, 15% and 20% HO-PN diets as compared to control eggs at week 8 ($P < 0.0001$). There were no significant treatment differences in serum estrogen and progesterone levels at week 8 of the feeding trial ($P > 0.05$). However, there was a positive linear correlation ($R^2 = 0.7813$) between the inclusion of HO-PN in the diets and serum estrogen levels, suggesting a positive correlation between increased dietary fat intake and elevated serum estrogen levels. Hens fed the 10% HO-PN diet produced more total number of eggs and total dozen eggs as compared to the controls and other treatment groups. Expectantly, the experimental feed cost per ton for the HO-PN containing diets were more costly as compared to the conventional layer diet (0%). However, hens fed the 5%, 10%, 15% and 20% HO-PN diets consumed less feed over the 8-week feeding trial as compared to the conventional controls, resulting in reduced experimental feed cost for the 15% and 20% HO-PN treatment groups. Egg income was the highest in the 5% and 10% HO-PN treatment groups. Nonetheless, the calculated return over feed (egg income-experimental feed cost) was the best in the 10% HO-PN treatment group as compared to the controls and other treatment groups. The inclusion of high-oleic peanuts in the diets of layers at 10%, 15% and 20% inclusion enriched the eggs with oleic acid and omega 9 fatty acids, while reducing the levels of saturated fatty acids as compared to conventional eggs. However, omega 6 and omega 3 levels were slightly reduced in eggs produced from hens within these feeding treatments. Moreover, layer performance was optimized in the 15% and 20% HO-PN treatment groups, with hens from these two treatments consuming less total feed with similar hen day egg production as compared to the controls.