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ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Effect of Dietary Dried Berberis Vulgaris Fruit and Enzyme on Some Blood Parameters of Laying Hens Fed Wheat-Soybean Based Diets

H. Kermanshahi[1] and A. Riasi[2]
[1]Department of Animal Science, College of Agriculture, Ferdowsi University of Mashhad, Mashhad, P. O. Box: 91775-1163, Iran
[2]Department of Animal Science, Birjand University, Birjand, Iran

Abstract: A study was conducted to evaluate dried berberry fruit (DBF) and enzyme on some blood parameters of laying hens. In a 5 * 2 completely randomized block design with factorial arrangement and 4 blocks as replicate, 5 levels of DBF (0.0, 0.5, 1.0, 1.5, and 2%) and 2 levels of NSP-degrading enzyme (0.0, and 0.05%) in wheat-soybean based diets were tested in 480, 100-week old laying hens for 4 weeks. Some blood parameters of laying hens including hematocrit value, triglyceride, total cholesterol, HDL and LDL-cholesterol were recorded at 104 weeks of age. DBF significantly ($P<0.05$) changed hematocrit value and HDL-cholesterol (with or without enzyme), and LDL-cholesterol (with enzyme). It was concluded that use of DBF as a phytochemical compound may improve some of the blood parameters and possibly egg components that are important for human health.

Key words: Berberry fruit, enzyme, HDL-cholesterol, laying hens

Introduction

Berberis vulgaris fruit has been used in the South Asian Traditional medicine as drug (Janbaz and Gilani, 2000). Parts of *Berbeis vulgaris* were also used as a traditional medicine for long in Iran (Fatahi *et al*., 2005). Berberis vulgaris fruit is safe for human consumption that is approved by FDA (Hallagan *et al*., 1995). Several properties such as antibacterial, antipyretic, antipruritic and antiarrhythmic activities for different parts of *Berberis vulgaris* have been reported (Aynehchi, 1986; Nafissi, 1990, Zargari, 1983). Due to increasing believe on traditional medicines worldwide, evidences suggesting medicinal plants are unlimited reservoirs of drugs. Berberine is a well known alkaloid from *Berberis vulgaris* that is shown to exhibit multiple pharmacological activities such as a potent vasodilatory and antiarrhythmic activity (Fatahi *et al*., 2005), anti-inflammatory and antinociceptive effects of isoquinoline alkaloids found in *Berberis vulgaris* (Kupeli *et al*., 2002), preventive and curative effects of Berberine on chemical-induced hepatotoxicity in rodents (Janbaz and Gilani, 2000), as a food additive to cure cholecytitis (Zargari, 1983; Ishwar *et al*., 2005), and antihistaminic and anticholinergic activities of crude extract of Berberry fruit (Shamsa *et al*., 1999). Recently Fatahi *et al*. (2005) shown that the aqueous extract of Berberry fruit has beneficial effects on both cardiovascular and neural system suggesting a potential use for treatment of hypertension, tachycardia and some neuronal disorders, such as epilepsy and convulsion. No study for the effect of *Berberis vulgaris* fruit and its effect on broiler chickens and/or laying hens is available. There are several studies on the effects of non-starch polysaccharide (NSP) degrading enzymes on laying hens and broilers indicating their positive effects on feed efficiency and performances particularly when the diets contained fats and saturated fatty acids (Bedford *et al*., 1991; Van der Klis *et al*., 1995; Bedford and Partridge, 2001). No study for the effect of *Berberis vulgaris* fruit with or without a NSP degrading enzyme in poultry is available. Therefore the purpose of this study was to evaluate the effect of *Berberis vulgaris* fruit with or without a dietary NSP degrading enzyme on some blood parameters of laying hens.

Materials and Methods

480, 100-week old commercial Hy-line W-36 laying hens were fed wheat-soybean based diets and tested in a 5*2 completely randomized block design with a factorial arrangement (5 levels of dried *Berberis vulgaris* fruit, DBF, 0, 0.5, 1, 1.5, and 2%) and 2 levels of a NSP degrading enzyme , 0, 0.05%, Endofeed W from GNC Bioferm Inc., Canada, with 1200 U/g arabinoxylanase and 400 U/g beta-glucanase activity) with 4 blocks (replicates) for 4 weeks. A blend of animal fat along with the basal diets (Table 1) were used to meet the requirement of laying hens as recommended by Hy-line W36 manual. Some blood parameters including hematocrit value, triglyceride, total cholesterol, LDL-cholesterol and HDL-cholesterol measured at the end of experiment using appropriate laboratory kits (Friedewald *et al*., 1972; Gordon and Amer, 1977). Data were analyzed based on a general linear model procedure of SAS (SAS, 1997) and treatment means when significant, were compared using Duncan multiple range test.

Table 1: Composition of experimental diets

Ingredients	%	Calculated composition	
Wheat	61.75	ME (kcal/kg)	2700
Soybean meal	18.7	Crude protein (%)	15
Animal-vegetable fat blend	4.41	Ca (%)	4
Oyster shell	0.9	Avail. P (%)	0.3
Dicalcium phosphate	11.33	Na (%)	0.18
Vit . and Min. premix[1]	0.5	Linoleic acid (%)	1.1
Salt	0.31	Arginine (%)	0.84
DL-methionine	0.06	Lysine (%)	0.74
L-Lysine	0.04	Met + Cys (%)	0.54
Fine grit[2]	2	Tryptophan (%)	0.21
Total	100		

[1]Supplied per kilogram of diet: vitamin A, 10000 IU; vitamin D_3,9790 IU; vitamin E, 121 IU; B_{12}, 20 μg; riboflavin, 4.4 mg; calcium pantothenate, 40 mg; niacin, 22 mg; choline, 840 mg; biotin, 30 μg; thiamin, 4 mg; zinc sulfate, 60 mg; manganese oxide, 60 mg.
[2] 0.0, 0.50, 1.00, 1.50 and 2.00 % dried berberry fruit as treatment replaced with fine grit.

Results and Discussion

The effect of DBF on blood parameters (Table 2) such as hematocrit value, total cholesterol, HDL and LDL-cholesterol without enzyme was significantly different ($P<0.05$). The highest hematocrit value was seen in 1.5% DBF. Adding enzyme conversely reduced this index and the lowest hematocrit value was seen in 2% DBF. Enzyme itself had no effect on hematocrit value but the interaction between enzyme and treatment was significant ($P<0.05$). Enzyme alone and the interaction between enzyme and treatment for triglyceride was not significant. DBF with or without enzyme had no significant effect on triglyceride. However, the decreasing trend for triglyceride was seen. Adding 1% DBF into the diets without enzyme and 1.5% DBF with enzyme showed the lowest values for triglyceride (2519 and 2618 mg/dl, respectively). The effect of enzyme alone on total cholesterol was not significant but the interaction between enzyme and treatment was significant ($P<0.05$). The lowest serum cholesterol level in laying hens that is a valid reflection in egg, was seen in 1% DBF when no enzyme was added into the diets ($P<0.05$). Spite the effect of DBF with enzyme was not significant but the values obtained for cholesterol in the presence of enzyme was lower than those of DBF without enzyme. This result may reflect some of the unknown interaction effects between enzyme and treatment. As seen in table 2, the effect of DBF without enzyme in HDL-cholesterol was significantly increased ($P<0.05$). Along with the lowering effect of DBF on triglyceride and cholesterol and the increasing effect of DBF on HDL-cholesterol, these results may bring the idea that use of such a product like DBF may satisfy egg consumers when they fear from eating egg as they fear from heart diseases, like arthrosclerosis, coronary heart disease, etc. Many researchers in recent years were tried to lower the cholesterol of the egg but all just increased the profile of some fatty acids like omega-3 in the egg but they failed to decrease the cholesterol. The ability of DBF to increase HDL-cholesterol is a profound result we found in this study but still more research is needed to confirm this positive effect and the transfer ability of HDL-cholesterol into the egg. Adding enzyme into the diets containing DBF showed a negative and significant effect on HDL-cholesterol ($P<0.05$). This effect may also describe some of the unknown interaction effects between enzyme and treatment. HDL-cholesterol was not affected by DBF without but this effect with enzyme significantly decreased ($P<0.05$). The lowest LDL-cholesterol value was obtained when 1.5 % DBF was used with enzyme (224 mg/dl). Enzyme itself had no effect on LDL-cholesterol but the interaction effect between DBF and enzyme was significant.

Coronary heart disease is number 1 disease having the highest risk in modern populations (Sim *et al*., 1999) and such an effect from berberris fruit might be a good news for the scientist trying to decrease this risk. High levels of DBF decreased LDL-cholesterol and this result might be interesting for scientist. There is a close relationship between some of the compounds in the diet and egg composition (Cherian *et al*., 1999; Horrocks and Yeo, 1999; Sim, 1999; Van Elswyk *et al*., 1999;). As previously stated, Berberine is a well known alkaloid from *Berberis vulgaris* that is shown to exhibit multiple pharmacological activities such as a potent vasodilatory activity (Fatahi *et al*., 2005), and it is possible that the vasodilatory effect of DBF changed the profile of some lipids in blood. Recently it is postulated that administration of *Berberis vulgaris* extract in a dose dependent manner, significantly reduces the mean arterial blood pressure and heart rate of rats in both normotensive and hypertensive rats (Fatahi *et al*., 2005). They suggested that the aqueous extract of berberry has beneficial effects on both cardiovascular and neural system and a potential use of treatment of hypertension, tachycardia and some neuronal disorders, such as epilepsy and convulsion. Some of the www sites also indicated that berberry fruit improves the immune

Table 2: Effect of dried berberry fruit on blood parameters of laying hens

Treatments		Blood parameters (104 weeks)				
Enzyme level (%)	Berberry level (%)	Hematocrit value	Triglyceride (mg/dl)	Total cholesterol (mg/dl)	HDL-cholesterol (mg/dl)	LDL-cholesterol (mg/dl)
0	0	28.5^{b}	3170	323.5^{a}	23.2^{c}	252
0	0.5	29.0^{b}	2818	256.0^{ab}	28.5^{abc}	280
0	1	28.8^{b}	2519	212.0^{b}	26.2^{bc}	289
0	1.5	30.6^{a}	2604	256.5^{ab}	33.1^{a}	332
0	2	28.8^{b}	2670	305.5^{a}	31.0^{ab}	207
P value		0.053	0.199	0.010	0.014	0.175

Means in each column with different superscripts are significantly different (P<0.05)

Enzyme level (%)	Berberry level (%)	Hematocrit Value	Triglyceride (mg/dl)	Total cholesterol (mg/dl)	HDL-cholesterol (mg/dl)	LDL-cholesterol (mg/dl)
0.05	0	30.5^{a}	3148	243.6	34.2^{a}	339^{a}
0.05	0.5	29.5^{a}	2693	287.5	27.4^{b}	249^{bc}
0.05	1	31.5^{a}	3076	268.4	27.5^{b}	321^{ab}
0.05	1.5	30.6^{a}	2618	216.5	25.4^{b}	224^{c}
0.05	2	26.8^{b}	2843	248.0	28.6^{b}	291^{abc}
P value		0.003	0.256	0.349	0.023	0.038

Means in each column with different superscripts are significantly different (P<0.05)

system (www.pdrhealth.com). So it is worthy to do more research on broilers and layers to produce products fortified with some of the phytochemical compounds present in *Berberis vulgaris*.

Under the conditions of this study, it was concluded that use of dried berberry fruit as a herbal drug may improve some of the components of the blood and possibly egg and this may lead us to produce a fortified eggs that are healthier for human nutrition.

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