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Research Article

EFFECTS OF LINSEED (FLAXSEED) FEEDING TO RHODES ISLAND RED (RIR) LAYING HENS IN BACKYARD PRODUCTION SYSTEM ON BOTH PRODUCTION OF ENRICHED EGG AND PRODUCTION PERFORMANCE

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ABSTRACT

The present study was conducted under On-Farm Trial (OFT) to find out the effects of linseed feeding on the enrichment of polyunsaturated fatty acids and laying performance of laying birds in backyard poultry production. Twentyfive Rhodes Island Red (RIR) laying hens in each trial were fed linseed @10 % of the feed intake for 30 days. For the fatty acids estimation, the pooled egg samples were analyzed i.e. before supplementation of linseed and after 30 days of the supplementation of linseed. The more polyunsaturated fatty acids (PUFA) like linoleic acid deposited in eggs of hens fed linseed as compared to the egg of hens did not receive linseed supplemented feed. The mono unsaturated fatty acids (MUFA) like palmitoleic acids and oleic acid were decreased in eggs of hens fed linseed as compared to that of control group of hens. There was no difference in egg weight of before and after supplementation of linseed. Hens that consumed linseed supplemented feed showed significantly ($P<0.05$) increased egg production as compared to those hens didn't consume linseed supplemented feed. The fact of linseed supplementation in the hen diet is to improve the egg production performance and helps in increasing the level of polyunsaturated fatty acids and lowering the level of saturated and monounsaturated fatty acids.

Keywords: On Farm Trial, Flax seed, RIR, Polyunsaturated fatty acid, Egg production

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India's poultry sector is one of the fastest-growing segments among the agricultural as well as its allied sectors. As per estimates of 20th All India livestock census, the total poultry population in the country is 851.81 million during 2019. India is the third-largest egg producer in the world and produced 114.38 billion eggs during 2019-20 with 10.19% growth rate. Poultry contributes 15% of the total food energy and 5% of the feed intake protein. National Institute of Nutrition's recommendations (1990) for egg consumption is 180 eggs per capita per year, while in India the egg consumption is only 86 eggs per capita per year in 2019-20 (Annual Report 2020-21, DAHD).

The egg contains proteins and has been recognized as one of the highest quality proteins in digestibility as well as amino acid composition. The egg supplies an adequate amount of recommended daily allowance of essential fatty acids, several vitamins and minerals. Due to these advantages and as consumer are aware more about their health, so hen eggs is considered a functional food (Stadelman, 1999). Flaxseeds are rich source of PUFA (n-3 fatty acids and linolenic acid, etc.) and helps in development of functional food (Ahlawat *et al.*, 2019). It is well known and documented that n-3 PUFA has potential benefits for human health. That's why over the last few decades, many researchers have been trying to enrich the egg fatty acids content particularly n-3 PUFA by the inclusion of feed sources of these fatty acids into the hens' ration (Hargis and Van Elswyk, 1993). Bean and Leeson, 2003, found that there were no differences in egg production, egg weight, eggshell weight, eggshell thickness and albumen height when layers are fed 0 or 10% linseed. Whereas Beynen, 2004 observed an increase in egg production, hens were fed 5, 10 and 20% linseed. Keeping all the above facts in mind, the present On-Farm Trial (OFT) was carried out to find the effects of linseed feeding on the egg characteristics and performance of hens raised in backyard poultry production.

MATERIAL METHODS

The study was conducted under OFT in laying poultry flock at backyard poultry farmer's farm at three villages *viz*. Fatehgarh (30.5541ºN, 76.5715ºE), Abheypur (30.7891ºN, 76.6391ºE), and Tira (30.7752ºN, 76.7114ºE), of the district SAS Nagar (Mohali), Punjab. The farmers were rearing RIR breed of hens for egg purpose. The hens of above 60 weeks old age were reared at all these farms. A total 25 RIR hens were grouped for the study at each farm. The birds were housed in semi-intensive type of backyard poultry housing system and in this practice, the birds were mostly kept inside the housing enclosure and a few hours (3-4 hours) of a day birds were being allowed in open space for feeding on scavenging. The birds were offered self-made feed as per the formulated feed or also offered different grains which were waste for human consumption. Farmers prepared feed for hens as per the given feed formula and the chemical composition of feed was in Table 1 and 2.

Before implementation of the study, eggs were collected daily and data was recorded for 10 days

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continuously, and then followed the linseed feeding treatment to the hens for 30 days. Again the eggs were collected during linseed feeding practices and eggs collection was recorded daily basis for 30 days. Two eggs from each farm were collected for fatty acids analysis (before and after the treatment i.e. supplementation of linseed feed). The egg weight was also taken before and after the supplementation of linseed. The eggs collected from each farm and the pooled egg sample was analyzed for fat and fatty acids profile. The modified method of Analysis of the Association of Official Analytical Chemists (AOAC 925.32) was carried out for estimation of egg fat with ethyl ether (EE) process. Whereas the fatty acids were estimated in the egg using the gas chromatography (GC) method.

The data collected and analysis of comparative laying performance of hens before and after linseed supplementation were calculated. The data were analyzed under completely randomized (CRD) by employing one-way analysis of variance (Snedecor and Cocran, 1994). The P value less than 0.05 were considered significant.

RESULTS AND DISCUSSION

The data pertaining to the laying performance of RIR hens in terms of egg production and egg weight were depicted in Table 3. The effect of linseed feeding to the laying hens resulted in egg production were significantly increased ($P < 0.05$) when compared to the before (Pre) and after (Post) linseed supplemented hens. The percent of egg production was found 39.46 and 48.84 in before and after linseed-fed laying hens, respectively. The linseed feeding to the laying hens did not show any adverse effect on the egg weight and it was similar to the non-supplemented hens. The data regarding the fat in egg yolk and fatty acids (i.e. SFA, MUFA and PUFA) were presented in Table 4. PUFA i.e. linoleic percent of the egg was increased but on contrary, the linolenic percent of the egg was decreased in linseed-fed hens. There was decrease in oleic acid and palmitoleic acid percent of MUFA when linseed-fed to the laying hens. The reduction in stearic acid percent was found in the eggs of linseed-fed laying hens which is a good indicator for the healthy feed intake of the human population.

In our result, the egg production of linseed fed feed intake to the laying hens was increased which was the similar finding of Scheideler and Froning (1996) and Scheideler *et al.* (1998) who found that feeding of ground linseed to laying hens enhanced the egg production. This result also agreed with the increased egg production of hens when supplemented with feed containing 4.32% flaxseed (Basmacýoglu *et al.*, 2003). Al-Nasser *et al.* (2011) did not find any adverse effect on egg production if adding flaxseed in the feed intake of laying hens. Najib and

Table 1. Feed Composition for laying hens

S.No.	Feed Ingredients	Quantity (kg)
1	Maize	34
2	Bajra	20
3	Deoiled rice bran	13
4	Rice Polish	3
5	Groundnut cake	8
6	Soyabean meal	10
7	Mustard cake	5
8	Calcite/LSP	5
9	DCP	1.6
10	Salt	0.40
	Total	100.00
11	Sodium bicorbonate	25 g
12	D-Methionine	100 g
13	L-Lysine	100 g
14	Trace Mineral	100 g
15	Vitamin premix	25 g
16	Toxin Binder	100 g
17	Liver Tonic	50 g

Al-Yousef (2010) found that the addition of 10% full-fat flaxseed in the feed intake of laying hens improved egg production. They did not find any changes in the egg weight with the feeding of different levels of full-fat flaxseed to the hens. In agreement with our findings, Beynen (2004) found an increase in egg production in hens fed linseed when compared to the control diet. While Celebi and Utlu (2006) also reported higher egg production with the addition of 4% linseed in the diet of hens. Aziza *et al.* (2013) found in their result when lohmaan brown hens were fed linseed meal, there was an improvement of egg production performance and our result was on the same trend. But they could not find any adverse effects on the egg weight when hens were fed linseed meal.

The fat content of yolk was relatively increased in our study as compared with the control one which is similar to the result found by Najib and Al-Yousef (2010) which might be due to an increase in the percentage of cholesterol in yolk fat with increasing levels of flax (Najib and Al-Yousef, 2010). While Beynen (2004) could not find any reduction changes in egg cholesterol in hens fed linseed in the diets. On the other hand, Caston and Leeson (1990) reported that dietary flaxseed did not affect the amount of cholesterol in an egg. In the present trial, linoleic acid (omega-6 fatty acid) content of PUFA was increased by 34.13 percent over that of the control group and this was similar to the result found by Najib and Al-Yousef (2010) who found there was a decrease in linoleic acid in egg yolk. They also reported that the MUFA level lowered when the hen fed different levels of full-fat flaxseed. Oleic acid and palmitoleic acid (MUFA) was decreased in this study when hens were fed 10% of linseed of the diet as compared to that of the MUFA of the control

Table 2. Calculated chemical composition of feed (Layer feed formulated by 'Least Cost Feed Formulation Software' developed by Dr. D. Chandrasekaran)

S.No.	Calculated Chemical Composition	Values
1	ME (Kcal)	2606
2	CP (%)	16.75
3	Energy : Protein ratio (C:P)	155.60
4	Crude fibre (%)	6.00
5	Crude oil (%)	2.52
6	Lysine (%)	0.79
7	Methionine (%)	0.38
8	Methionine + Cysytine (%)	0.69
9	Available P (%)	0.39
10	Calcium (%)	2.30

Table 3. Effect of linseed feeding on egg production/day and egg weight performance

Treatments	Mean Egg Production	Mean Egg Weight (gm)
Pre	9.866^{a} ±0.446	52.61^{a} ±0.380
Post	12.211^{b}±0.257	52.55^{a} ±0.495

The mean values in same column with different superscripts differ significantly (P< 0.05)

Table 4. The Fatty Acids (FA) profile of eggs of laying hens: fatty acid profile on 100% fat basis. (as per pooled egg sample analyzed)

Parameters		Pre treatment	Post treatment
Fat (%)		10.50	11.51
Saturated Fatty Acids (SFA)	Palmitic acid (%)	30.56	32.03
	Stearic acid (%)	07.26	06.40
Mono Unsaturated Fatty	Oleic acid (%)	45.39	41.37
Acids (MUFA)	Palmitoleic acid (%)	02.26	01.73
Poly Unsaturated Fatty	Linoleic acid (%)	11.25	15.09
Acids (PUFA)	Linolenic acid (%)	00.48	00.08

Pre, before supplementation; post, after supplementation

group which indicates better for human consumption and health. Most of the researchers found the positive effects of flaxseed or linseed on the linolenic acids, while in this study result showed a lower value than that of the control group. It may be due to higher fiber content in the hen diet which was reared in the semi-intensive condition of the backyard poultry farming system where the birds picked a lot of feed and forage from the natural vegetations.

It concluded that the linseed supplementation in the hen diet improves the egg production performance. It helps in increasing the level of polyunsaturated fatty acids, and lowering the level of saturated and monounsaturated fatty acids. Such eggs having a higher level of PUFA and lower level of SFA as well as MUFA is beneficial for human health point of view.

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