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Effects of inclusion of ground *prosopis juliflora* pod on fertility and hatchability of white leghorn hens

Abstract

A study was conducted to evaluate the effect of inclusion of ground Prosopis juliflora pod on fertility, hatchability and chick quality, of white leghorn layers in Haramaya University poultry farm. One hundred sixty eight white leghorn hens with similar initial body weight of 1077±6g and 27weeks of ages were randomly distributed to 12pens. The ingredient used for formulate layer ration were maize grain, noug seed cake, soybean meal, wheat short, ground P. juliflora pod, vitamin premix, lime stone and salt. The four treatment rations used in this study were 0% GPJP inclusion (T1) control group, 10% GPJP (T2), 20% GPJP (T3), and 30% GPJP (T4). Dry matter intake, fertility, hatchability and chick quality were measured during the experiment. The chemical analysis showed that ground P. juliflora pod contained 16.04% CP and 2461.6ME kcal/kg DM. Levels of GPJP did not negatively affected DMI, fertility, hatchability and chick quality. The result of the present study showed that GPJP can be used in formulation of layers ration up to 20%.

Keywords: chick quality, fertility, ground *prosopis juliflora* pod, white leghorn, ground *p. juliflora* pods, GPJP

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Introduction

Chickens are kept in many parts of the world irrespective of climate, traditions, life standard, and there is no religious taboo related to consumption of eggs and chicken meat like those for pig meat.[1] To the poor majority people of rural areas, chickens serve as an immediate source of meat and income when money is needed for urgent family requirement.[2] It renders a significant contribution to human livelihood and contributes significantly to food security,[3] particularly in providing animal protein to the people. Animal protein requirement in developing countries is becoming critical due to rapid population growth. In most developing countries, the daily animal protein consumption per capita is below that recommended by FAO.[4] Poultry production is the shortest means in filling the gap on animal protein deficiency as compared to other livestock species, because of the fact that it has short generation intervals, good environmental adaptation and requires small farming system. But, availability, quality and cost of feed ingredients are the major constraints to poultry production regardless of the system of production and geographical location.[5]

One other manifestation of the feed problem is the competition for feeds between human and poultry, such as for maize, sorghum, soybean, and groundnut.[6] Consequently, there is a worldwide interest in the search for new feed resource capable of substituting traditional crops and staple foods used as poultry feed.[7] It is in the light of this that ground *Prosopis juliflora* seed and pod was considered as a potential feedstuff for poultry in many countries. Therefore, the use of *P. juliflora* pods as feedstuff for animals must have two main purposes. These are use of ground pods in animal feed there by reducing the use of stable food grains for animal feed, and reducing the dissemination of the plant through reduction of seed transport by animals. Therefore, the current study answered the objectives of to evaluate the effect of different levels of ground *Prosopis juliflora* pod inclusion on fertility and hatchability of white leghorn layers ration.

Materials and methods

Study area

The experiment was conducted Haramaya University located at 42° 3'E longitudes, 9° 26'N latitude and at an altitude of 1980meter above sea level. The mean annual rainfall of the area is 780mm and the average minimum and maximum temperatures are 8 and 24°C, respectively.[8]

Experimental animal management

A total of one hundred sixty eight hens (1077±6g) and twenty four cocks (2300±3g) with similar body weight were randomly distributed in to four experimental rations for 90days of feed trial. Birds were offered twice a day at 8:00Am and 4:00Pm hours throughout the experimental period in *adlibitum* feeding system.

Data collection and measurements

A total of 20eggs per replication, were selected based on size used for fertility and hatchability analysis. Incubation was done using an electrically heated incubator at a temperature of 37.7°C and relative humidity of 85%. The incubated eggs were candled on the 7th day for determination of fertility, and on the 14th and 18thday of the incubation for identification of dead embryos. Average percentage fertility was determined according to the following formula.

$$\%\text{fertility} = \frac{\text{Total fertile eggs}}{\text{Total eggs set}} \times 100$$

$$\%\text{HFE} = \frac{\text{Number of chicks hatched}}{\text{Total fertile eggs}} \times 100$$

Statistical analysis

Analysis of variance (ANOVA) in (CRD) using SAS 9.1.3 version of statistical software package used to analyze the data,[9] LSD and logistic regression.

Results and discussion

Chemical composition of experimental feeds

The result of chemical composition of ground *Prosopis juliflora* pod (GPJP) in the current experiment disagree with the finding of Koech et al.[10] who reported 18.5, 88.4, 6.9 and 5.2 for CP, DM, CF and ash, respectively. But, the chemical composition of GPJP used in the current experiment was similar with the finding of Vimal et al.[11] who noted 16.5, 4.2, 16.8 and 5.4 for CP, EE, CF and ash, respectively. ME and CP content of the rations ranged 2798-2920kcal/kg DM and 16.5-18.1% CP, which are within the recommended ranges for layers.[12] The CP content increased and metabolizable energy contents decreased in the rations with increasing levels of GPJP, which is attributable to the small increment in the proportion of soybean meal and decrease in wheat bran and maize. This indicated that GPJP replace mainly these two ingredients.

Fertility and hatchability of eggs

Fertility and hatchability of eggs is presented in Table 1. Numerically, the average percentage of fertility of eggs increased as inclusion of ground *P. juliflora* pod increases. In fact fertility has correlated with shell thickness of eggs but white leghorn chickens have laid good fertile eggs as compared to other breeds. Therefore, the fertility increment was happen due to genetic traits rather than nutrition. The total egg set base of hatchability percentage in the current study is lower, except T2, than that reported by Muma et al.[13] 82.1% and 96.1% in white leghorn hens. Shell quality is known to be one of the most important factors that influence hatching of embryo, and egg shell quality has significant impact on the reproductive fitness of the parent.[14–16]

Embryonic mortality

The average mortality of chicks recorded as early, mid and late were presented in Table 2. In the current experiment, hatching was delayed by three days than the expected time (21days) due to high environmental humidity during the experiment. Embryo mortality of chicks was not significant among treatments, except mid-embryo mortality. The 10% GPJP (T2) has significantly ($P<0.05$) lower mid-embryo mortality than the 20% GPJP. The values recorded in the current study are higher as compared to that reported by Solomon[17] (8.1%) for white leghorn layers at the same farm.

Chick quality

The mean values of chick quality parameters are presented in Table 3. The logistic regression result of chick quality measured in terms of visual scoring (qualified/not qualified) depending on four treatment groups provided Wald Chi Sq value of 3.02 with pr>Chi Sq value of 0.39. The inclusion of ground *P. juliflora* pods in white leghorn layer ration on chick weight was insignificant among treatments. But, mean day old chick length was significant ($P<0.05$) among treatments. Hens fed diet consisting 20% GPJP (T3) has lower day old chick length than those fed diet without GPJP (T1) and 10% GPJP (T2), which could be attributed to the small egg size of T3.[12,18] According to earlier studies, the length of chicks in all treatments falls within short category[18] <17.8, <17.8-18.2 and >18.2, short, medium and long, respectively).

Table 1 Effect of *Prosopis juliflora* pod inclusion on egg quality parameters

Chemical Composition of offered feed	Treatment			
	T1	T2	T3	T4
DM (%)	89.9	90.2	90.2	89.8
CP (% DM)	16.5	17.6	17.8	18.1
CF (% DM)	6.9	7.6	7.7	7.8
EE (% DM)	5.6	6.1	5.5	5.9
Ash (% DM)	8.9	10.3	10	9.8
Ca (% DM)	3.4	3.4	4.2	4.3
P (% DM)	0.4	0.3	0.5	0.6
ME (kcal/kg DM)	2919.8	2827.7	2798.4	2819.5

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Table 2 Effect of *Prosopis juliflora* pod inclusion on egg quality parameters

Chemical composition of offered feed	Treatment				SEM	SL
	T1	T2	T3	T4		
Total egg incubated	20	20	20	20	-	-
No. of fertile eggs	17.3	18	18.3	18.7	0.38	Ns
% fertility	86.1	90.1	91.7	93.3	1.89	Ns
No. of hatched eggs	12.3	15.7	11.7	13.7	0.85	Ns
Hatchability						
%HTESB	61.7	78.3	58.3	68.3	4.28	Ns
%HFEB	70.8	86.7	62.7	73.5	4.16	Ns
Embryonic Mortality(%)						
Early	5.8	1.9	5.4	5.4	0.5	Ns
Mid	11.6ab	3.9b	16.6a	10.6ab	2.15	*
Late	11.8	7.5	15.3	10.5	1.9	Ns

HTESB, hatchability of total egg set basis; HFEB, hatchability of fertile egg basis; Ns, non-significant at (P>0.05); *=significant at (P<0.05); GPJP, ground prosopisjuliflora pod; SEM, standard error of mean; SL, significant level.

Table 3 Quality of chicks hatched from eggs of white leghorn hens fed diets containing different proportion of Prosopisjuliflora pod

Chemical composition of offered feed	Treatment				SEM	SL
	T1	T2	T3	T4		
Chick length (cm)	15.5^{a}	15.5^{a}	14.5^{b}	15.3^{ab}	0.14	*
Chick wt (g)	34.1	33.7	34.1	35.7	0.39	Ns
Visual score	70	80.5	74.4	77.9	2.08	Ns

*=significant at (P<0.05); Ns, none significant; GPJP, ground prosopisjuliflora pod; SEM, standard error of mean; SL, significant level.

Summary

An experiment was conducted to evaluate the effect of inclusion of graded levels of ground *P. juliflora* pods (GPJP) on egg fertility and hatchability of white leghorn layers. Numerically, the average percentage of fertility of eggs increased as inclusion of ground *P. juliflora* pod increases. Embryo mortality of chicks was not significant among treatments, except mid-embryo mortality. The 10% GPJP (T2) has significantly (P<0.05) lower mid-embryo mortality than the 20% GPJP.

The inclusion of ground *P. juliflora* pods in white leghorn layer ration on chick weight was insignificant among treatments. But, mean day old chick length was significant (P<0.05) among treatments. Hens fed diet consisting 20% GPJP (T3) has lower day old chick length than those fed diet without GPJP (T1) and 10% GPJP (T2), which could be attributed to the small egg size of T3. Therefore, *Prosopis juliflora* pod could be used in poultry ration up to 10% is recommended.

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Conflict of interest

The author declares no conflict of interest.

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