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Effect of supplementation of *Moringa oleifera* leaf meal (MOLM) on the performance of Vanaraja laying hens

B K SWAIN[1], P K NAIK[2], E B CHAKURKAR[3] and N P SINGH[4]

ICAR-Central Coastal Agricultural Research Institute, Old Goa, Goa 403 402 India

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ABSTRACT

An experiment was conducted to study the effect of dietary supplementation of *Moringa oleifera* leaf meal (MOLM) on the performance of Vanaraja laying hens. Five experimental diets were formulated by supplementing without (T_0), and with MOLM @ 0.5 kg ($T_{0.5}$), 1.0 kg ($T_{1.0}$), 1.5 kg ($T_{1.5}$) and 2.0 kg ($T_{2.0}$) per 100 kg basal diet. Sixty laying hens (22 weeks) were divided into 5groups (each group had 4 replicates with 3 laying hens per replicate) and were randomly fed the above 5 experimental diets. All the birds were reared on wire mesh floored cages during the experimental period of 8 weeks. The MOLM contained 27.27% CP, 3.76% EE, 18.53% CF, 11.50% TA and 0.37% AIA. There was improvement ($P<0.05$) in egg production and feed conversion ratio (FCR) in $T_{0.5}$ than T_0. The average egg weight in $T_{2.0}$ was lower compared to T_0 and $T_{0.5}$. The egg quality characteristics *viz.* albumen (%), yolk (%), shell (%), shape index and shell thickness (mm) were similar for all the treatments.The feed cost to produce dozen egg was highest for T_0 (₹27.98) and lowest for $T_{0.5}$ (₹22.33). It can be concluded that supplementation of *Moringa oleifera* leaf meal @ 0.50 kg/100kg diet in Vanaraja laying hens was beneficial in terms of improved egg production, better FCR and reduced cost of feed to produce dozen eggs.

Key words: Hen, Laying, Leaf, Meal, *Moringa oleifera*, Performance, Vanaraja

Poultry production plays a major role in bridging the protein gap in developing countries where average daily consumption is far below recommended standards (Onyimonyi *et al*. 2009). Productivity of poultry in tropics has been limited by scarcity and consequent high prices of the conventional protein sources which are limiting factors for poultry feed production (Atawodi *et al*. 2008). Hence, there is a need to search for alternate protein sources for use as feed supplement for sustainable poultry production. One possible source of cheap protein for poultry is the leaf meal of some tropical legume and plants (Iheukwumere *et al*. 2008).

The leaves and green fresh pods of *Moringa oleifera* are used as vegetables by humans and are rich in carotene and ascorbic acid with a good profile of amino acids (Makkar and Becker 1996). *Moringa oleifera* leaf meal (MOLM) can substitute protein source like sunflower seed meal partially (at 10% on protein basis) which suggest that the shrub have a potential for poultry feeding particularly for laying hens. This is exhibited through its protein content, relatively low fibre and high mineral contents (Kakengi *et al*. 2007). The essential nutrient contents of *Moringa* leaves/ twigs such as vitamin A & B, calcium, iron, copper, sulphur and protein and its ability to absorb and neutralize toxic elements in food could justify its significance in developing the plant as one of the major local feed stuffs (Lannaon 2007).The leaves of *Moringa* have components that make them suitable for replacement of soybean meal or fish meal in non-ruminant diets (Nuhu 2010). *Moringa* leaves are highly nutritious and contain significant quantities of vitamins (A, B and C), calcium, iron, phosphorus and protein (Murro *et al*. 2003). Furthermore, heavy metals such as mercury, arsenic and cadmium which are potentially toxic are absent from leaves of *Moringa oleifera*, thus making their incorporation in to poultry diets safe (Donkor *et al*. 2013). Dietary inclusion of 5 to 20% MOLM in broiler diets and 10% in layer diets have been found to improve bird performance in terms of growth rate and egg production including egg size (Cassius and Kenaleone 2014). Large amounts of *Moringa* forage can be obtained from easily established plots in the field without expensive inputs. *Moringa* is also a perennial plant that can be harvested several times in a year. Keeping in view the potential feed value of *Moring aoleifera* leaf meal (MOLM), an experiment was conducted to study the effect of dietary supplementation of MOLM on the performance of Vanaraja laying hens.

MATERIALS AND METHODS

Moringa oleifera leaf meal (MOLM) was prepared by drying (up to 10% DM) followed by grinding the fresh

Present address: [1,2]Principal Scientist (nbkswain@gmail.com, pknaikicar@gmail.com), ICAR-Central Avian Research Institute (CARI) Regional Centre (RC), Bhubaneswar. [3]Prinicipal Scientist (eknchakurkar@yahoo.com), [4]Director (narendrapraptaps@yahoo.co.in).

Table 1. Composition (%) of experimental diets

Ingredient	Experimental diet				
	T_0	$T_{0.5}$	$T_{1.0}$	$T_{1.5}$	$T_{2.0}$
Ground yellow maize	52.00	52.00	52.00	52.00	52.00
Soybean meal	22.00	22.00	22.00	22.00	22.00
Deoiled rice bran	14.50	14.50	14.50	14.50	14.50
DCP	1.83	1.83	1.83	1.83	1.83
Limestone powder	8.76	8.76	8.76	8.76	8.76
Common salt	0.50	0.50	0.50	0.50	0.50
Min. Mix	0.15	0.15	0.15	0.15	0.15
DL-Methionine	0.03	0.03	0.03	0.03	0.03
Vitamin premix	0.03	0.03	0.03	0.03	0.03
Moringa oleifera leaf meal (MOLM)	0.00	0.50	1.00	1.50	2.00

Moringa oleifera leaves. Five experimental diets were formulated by supplementing without (T_0), and with MOLM @ 0.5 kg ($T_{0.5}$), 1.0 kg ($T_{1.0}$), 1.5 kg ($T_{1.5}$) and 2.0 kg ($T_{2.0}$) per 100 kg basal diet (Table 1). Sixty laying hens (22 weeks) were divided into 5 groups; each group had 4 replicates with 3 laying hens per replicate. All the birds were reared on wire mesh floored cages and were fed the respective diets *ad lib.* during the experimental period of 8 weeks. Standard management practices were followed and clean drinking water was made available *ad lib.* throughout the experiment. The weekly feed intake, daily egg production and egg weight were recorded. The egg quality parameters *viz.* albumen (%), yolk (%), shell (%), shape index and shell thickness were recorded once in a week. The feed cost to produce dozen egg for all the treatment groups was calculated. The data pertaining to various parameters were analysed (Snedecor and Cochran 1989). The means were tested for significant differences by Duncan's Multiple Range Test (Duncan 1955).

RESULTS AND DISCUSSION

The MOLM contained 27.27% CP, 3.76% EE, 18.53% CF, 11.50% TA and 0.37% AIA. Similar CP content was reported by earlier researchers (Oduro *et al*. 2008). However, lower values of CP were reported by other workers (Makkar and Becker 1996 (25.1%), Gakuya *et al*. 2014 (23.33%) and Gupta *et al*. 1989 (26.4%)). Higher value for CP (29.55% and 27.9%) were reported by Nuhu (2010), Kakengi *et al*. (2007) and Sarwatt *et al*. (2004), respectively. Significant (P<0.05) improvement in egg production and FCR was observed in Vanaraja laying hens fed diet supplemented with 0.5% MOLM compared to T_0 (Table 2). However, the laying hens fed diet supplemented with 1.0 and 1.5% MOLM had similar egg production and FCR compared to $T_{0.5}$ group. However, Ebenebe *et al*. (2013) reported that birds fed diet supplemented with 2.5% MOLM had significantly better egg production and external egg quality characteristics compared to those fed 5 and 7.5% MOLM supplemented diet. In contrast, monthly laying

Table 2. Effect of *Moringa oleifera* leaf meal (MOLM) supplementation on performance of Vanaraja laying hens

Treatment	Egg production (dozen)	Feed intake (kg)	Feed conversion ratio	Egg weight (g)	Feed cost/dozen egg (₹)
T_0	5.06^{a}	7.46^{b}	1.484^{b}	49.99^{bc}	27.98^{b}
$T_{0.5}$	6.23^{b}	7.35^{ab}	1.182^{a}	50.13^{c}	22.33^{a}
$T_{1.0}$	5.66^{ab}	7.34^{ab}	1.308^{ab}	48.05^{ab}	24.77^{ab}
$T_{1.5}$	5.78^{ab}	7.43^{b}	1.289^{ab}	48.50^{abc}	24.43^{ab}
$T_{2.0}$	5.12^{a}	7.29^{a}	1.426^{b}	47.83^{a}	27.09^{b}
SEM	0.150	0.023	0.036	0.326	0.684

Means possessing different superscripts in a column differ significantly (P<0.05)

percentage (24–40 wks) in Lehmann layers were not significantly (P>0.05) affected by the treated diets (0.2–0.8% MOLM) (Paguia *et al*. 2014). In another study, no significant (P<0.05) improvement in laying percentage was observed due to supplementation of 10% MOLM (Olugbemi *et al*. 2010). Feed intake was significantly (P<0.05) decreased in laying hens fed diet supplemented with 2% MOLM compared to T_0 and $T_{1.0}$. Gakuya *et al*. (2014) reported that laying hens fed higher levels of MOLM (5–10%) had slightly lower feed intake which was not significantly different from other groups. In contrast to present findings, Olugbemi *et al*. (2010) observed that MOLM added up to 10% to cassava chips based diets in laying hens had no effect on feed intake. The marked increase of MOLM dietary bulkiness treatment could be the reason behind the reduction in feed intake in the present study. In addition, the hen's digestive system is simple and has a limited capacity to digest high fibrous ingredients efficiently, as well as chickens lack the enzyme necessary for utilizing high fibrous ingredients (Son *et al*. 2002, Esonu *et al*. 2006 and Ige *et al*. 2006). The average egg weight recorded on all treatment groups remained similar except on $T_{2.0}$, which was significantly (P<0.05) lower compared to those recorded on T_0 and $T_{0.5}$. In contrast, Gakuya *et al*. (2014) reported that the average egg weight did not differ for various treatments (1.25 to 10% MOLM supplemented diets). Similar to these findings, Paguia *et al*. (2012) also found that there was no big difference in egg weights from layers fed on *Moringa oleifera* leaf and twig meal at different levels (0.2–0.8%).

The egg quality characteristics *viz.* albumen (%), yolk (%), shell (%), shape index and shell thickness were similar in all the groups (Table 3). In agreement with these findings, Ebenebe *et al*. (2013) found that egg shape index and shell thickness did not show any significant difference (P>0.05) due to supplementation of MOLM (2.5 to 7.5%). Similarly, no adverse effect was found on the egg quality traits due to MOLM supplementation according to results of earlier study (Abou-Elezz *et al*. 2011). The feed cost to produce dozen eggs was highest (₹27.98) for T_0 followed by $T_{2.0}$ (₹27.09), $T_{1.0}$ (₹24.77), $T_{1.5}$ (₹24.43) and lowest (₹22.33) for $T_{0.5}$. The feed cost to produce dozen egg was

Table 3. Effect of *Moringa oleifera* leaf meal (MOLM) supplementation on egg quality characteristics of Vanaraja laying hens

Treatment	Albumen (%)	Yolk (%)	Shell (%)	Shape index	Shell thickness (mm)
T_0	59.90	28.50	10.87	75.03	0.339
$T_{0.5}$	59.43	31.57	12.50	75.73	0.324
$T_{1.0}$	59.23	29.90	11.80	74.33	0.328
$T_{1.5}$	59.53	30.10	10.20	75.60	0.318
$T_{2.0}$	60.13	29.07	11.77	75.60	0.318
SEM	0.339	0.584	0.378	0.327	0.004

significantly ($P<0.05$) lower in $T_{0.5}$ compared to T_0 and $T_{2.0}$. In contrast, significant ($P>0.01$) increase in feed cost/kg of egg produced was reported by addition of *Moringa* leaf powder in layer ration (Paguia *et al*. 2014). The reduced cost of dozen egg produced on $T_{0.5}$ might be due to better utilization of nutrients and improved FCR.

It can be concluded that supplementation of *Moringa oleifera* leaf meal (MOLM) @ 0.50 kg/100kg diet in Vanaraja laying hens is beneficial in terms of improved egg production, better FCR and reduced cost of feed to produce dozen eggs.

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