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Investigations into the Addition of Herbal Methionine (Phytonin) As a Substitute of Synthetic Methionine in Poultry Feeds 1-Effect of Herbal Methionine (Phytonin) Supplementation on Performance and Egg Quality of Laying Hens

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Abstract: An experiment was conducted during the period from February to April, 2013 to determine, whether the eggs laying performance and egg quality characteristics could be affected by feeding HM (Phytonin) as a substitute of SM. A number of 48 sixty two weeks old Hy Line hybrid laying hens were kept on cage batteries in an open sided poultry house at the Animal Production Research Center (APRC). Hens were fed on a basal diet supplemented with 100:0, 50:50, 25:75 and 0:100% SM:HM for a period of 7 weeks. Egg production was recorded daily, while feed intake and egg quality parameters were monitored weekly. No significant difference was observed among the dietary treatments in terms of performance indices, egg production, feed intake, body weight changes and feed conversion ratio (kg feed per kg eggs). On the other hand egg quality in terms of egg weight, albumin weight and yolk weight were increased ($p \leq 0.05$) by the supplementation of HM.

Key words: Eggs laying performance, egg quality characteristics, methionine, poultry feed

INTRODUCTION

The necessity of adding methionine and other essential amino acids in broilers and layers feed was due to their deficiency in cereal grains like sorghum and cakes as ground nut cake, which represent the greatest inclusion rate in poultry diets in Sudan. Super concentrate is being included in poultry diets to balance their contents of essential amino acids methionine and lysine and other nutrients. Despite that supplementation of the crystalline or synthetic form of methionine was for a long time been recognized as one of the common practices in the formulation of poultry diets to furnish the methionine requirement for the rapid growth or high egg production a consequence of genetic potentiality improvement in the commercial poultry breeds. Binder (2003) and Aerni *et al*. (2005) confirmed the role of methionine in energy production, protein synthesis, increase of egg production with optimum egg size, overall growth performance, feed efficiency and livability in broilers and layers. Methionine is a potent donor of methyl groups, which contribute to the synthesis of many important substances including epinephrine, choline and creatinine (Bender, 1975). It is more economical to add methionine to poultry diets than more soybean meal or other natural protein source to meet the requirement (Halder and Roy, 2007). Many researches were run for the determination of methionine requirement for the different types of poultry. Harms *et al*. (1996) determined the methionine requirement of Hy-Line W36^{R} laying hens by replacing corn by soybean meal or supplementation of SM. They found the methionine required to produce a g of egg content at near maximum production was 5.56 and 5.58 mg and 259.4 and 244.3 mg per hen per day in experiment 1 and 2 respectively and suggested that the requirements would be higher at a higher level of production.

Recently poultry feed ingredients and feed additives such as synthetic methionine (SM) became more expensive. Consumers worldwide prefer eggs produced by birds fed on natural materials. The Indian company Natural Remedies consequently developed herbal methionine (HM) named (Phytonin), which is a mixture of components from plant origin that have the same activity of SM. Now HM is available in the Sudanese animal feed market with cheaper price compared to the SM.

Most researches on the addition of HM were concentrated on broilers. The only corresponding research reviewed is the one which is done by a Nigerian researchers; Francis *et al*. (2012), who studied a comparative efficacy of herbal and synthetic methane on layer hens performance. The HM used (Meth-o-Tas) was supplied by Intas Pharmaceutical Limited, India. They added HM and SM to a standard diet at 0.5 and 1.0 kg per ton. They demonstrated that, layers fed on diets supplemented with HM produced less ($p \leq 0.01$) eggs, had lower egg mass output ($p \leq 0.01$) and final body weight ($p \leq 0.05$) and poorer feed conversion efficiency ($p \leq 0.05$) than those layers fed on diets supplemented with SM. However, feed intake was not affected by the dietary methionine source. They also found that the exterior and interior egg quality characteristics such as

egg weight, shell thickness, albumen weight and albumen height decreased ($p \leq 0.05$) with dietary supplementation of HM. They concluded that HM (Meth-o-Tas) is not an effective substitute for SM for optimum performance of layers.

The objective of this study is to investigate into the effect HM (here Phytonin) on performance and egg quality of laying hens.

MATERIALS AND METHODS

A number of 48 Hy line hybrid laying birds, 63 weeks of age were randomly collected from a flock of 500 birds raised at APRC They were housed in a 2 tier battery cages allocated in an open sided house. Birds were divided into four groups randomly assigned to the experimental diets in a completely randomized design (CRD). Each group was subdivided into four replicates of three birds each (4x4x3). Birds were maintained on a conventional layer diet throughout the first 7 days as adaptation period. Then they were provided with the experimental diets.

Four experimental layer diets were formulated such that diet 1 contained 100% SM as the main source of methionine supplement while in diets 2 and 3 the SM was proportionally replaced by HM combined in the ratios 75:25 and 50:50%, respectively. In diet 4 the SM was totally replaced by HM 0:100%. Table 1 represents the composition of the experimental rations and the calculated nutrients content of these rations. The rations were formulated to be similar in their contents of the inclusion rates of the raw materials and their content of the chemical composition. The only difference between rations was the added source or combination of SM and HM. The rations were formulated to meet the nutrients requirement for laying hens as recommended by NRC (1994) and also the nutrient specification of Hy line hybrid was recognized.

Water and feed were offered *ad-libitum*. The duration of the experiment was 7 weeks (between 63 and 70 weeks of age) considering cage fatigue and age factor.

Eggs were collected daily and egg production for each replicate was recorded as Hen Day (HD%). The egg production data were pooled into 7 days period. Feed consumption was determined at the end of each week. Feed conversion ratio (FCR) was calculated by dividing Kilograms of feed consumed over Kg eggs produced by hen (kg feed/kg eggs). Body weights change of each group were obtained at the start and end of the experiment.

Egg quality examination was done by the end of every week period and was carried out at the Nutrition Laboratory at the Animal Production Research Center. A sample of one egg per replicate was randomly taken for the analyses. Egg weights were measured with a sensitive weighing balance. The width and height of whole egg were measured using a digital vernnier. After that eggs were carefully broken and the albumen and yolk weights were separately measured with a sensitive weighing balance. The albumin and yolk heights were measured by the vernier. Eggshells weigh was determine by the sensitive balance and shell thickness was measured by a micrometer screw gauge.

For the data analysis software system Statistica version 6 (StatSoft, 2001), was used. Data obtained were subjected to one way analysis of Variance (ANOVA) to identify significant treatment differences. The means were separated using Duncans New Multiple Range Test (DNMRT) (Duncan's, 1955).

RESULTS AND DISCUSSION

Effect of herbal methionine on the performance of laying hens: Table 2 shows the effect of methionine source and combinations on the feed intake in different weeks of the experimental period as wells as their effect on the whole period. It can be observed that the weekly or the whole period feed intake was not significantly different ($p \leq 0.05$) between the groups. Table 3 shows that weekly live body weight gains between birds fed on the different experimental diets were not significantly different. On the same line the FCR values of the studied groups were not significantly ($p \leq 0.05$) different (Table 4).

The effect of HM on the studied performance indices of laying hens for the whole experimental period has been summarized in Table 5. These results display no significant difference ($p \leq 0.05$) in the total means of feed intake, egg production as Hen day (HD%) and FCR between the different groups. From these results it can be stated that, the HM, Phytonin, can partially or completely replace SM without affecting the performance of laying hens. These findings disagree with Francis *et al.* (2012) who found significant decrease in egg production and poor feed efficiency, when HM (Meth-o-Tas) was added compared to SM in layers feed. Feed intake had been similarly not affected by the supplementation of Meth-o-Tas. The contradiction between the results of this study and Francis *et al.* (2012), may be due to that they used a different form of HM (Meth-o-Tas) rather than HM (Phytonin) in this study and also the methionine level of their rations might have had some effect.

The positive effect of HM Phytonin as a substitute of SM found in this study agrees with previous studies on broilers; Chattopadhyay *et al.* (2006), Halder and Roy (2007) and Kalbande *et al.* (2009) demonstrated that broiler chickens fed on diets supplemented with HM (Methiorep®) had similar performance in terms of body weight and weight gain and feed conversion efficiency as those birds fed on DL-methionine.

Effect of herbal methionine on egg quality: Table 6 shows the effect of HM or combinations of HM and SM

Table 1: Experimental diets composition (%)

Treatment	A	B	C	D
Raw material (SM:HM)	(100:0%)	(50:50%)	(25:75%)	(0:100%)
Sorghum	67	67	67	67
Groundnut cake	19	19	19	19
Wheat bran	0.5	0.5	0.5	0.5
Layer max care*	2.5	2.5	2.5	2.5
Lime stone	10	10	10	10
DCP	0.5	0.5	0.5	0.5
Salt	0.1	0.1	0.1	0.1
L-Lysine	0.1	0.1	0.1	0.1
Antimycotoxin	0.1	0.1	0.1	0.1
Dl methionine	0.2	0.1	0.05	0
Herbal methionine	0	0.1	0.15	0.2
Total	100	100	100	100
Calculated nutrient composition				
Crude protein (%)	18.14	18.14	18.14	18.14
ME (MJ/Kg)	11.36	11.36	11.36	11.36
Crude fat (%)	3.19	3.19	3.19	3.19
Crude fiber (%)	3.52	3.52	3.52	3.52
Calcium (%)	4.21	4.21	4.21	4.21
Phosphorus (total) (%)	0.52	0.52	0.52	0.52
Lysine (%)	0.79	0.79	0.79	0.79
Methionine (%)	0.60	0.60	0.60	0.60

Layer max care* contains, 6.5 MJ/kg, 16.8% protein, 0.62% crude fat, 17.4% Ca, 5.8% Ph, 10% Lysine and 7.4% methionine

Table 2: Effect of HM phytonin on egg production (HD%) Mean ± SD

Treatment/weeks	1	2	3	4	5	6	7
A (100%SM+0%HM)	69±11.3	69±14.8	77±7.1	68±12.5	64±14.8	71±10.3	71±8.7
B (50%SM+50%HM)	56±16.2	78±2.3	82±6.0	75±10.6	73±13.1	70±9.8	79±12.0
C (25%SM+75%HM)	67±11.7	70±21.4	75±9.0	70±4.6	74±8.2	70±9.0	71±10.3
D (0%SM+100%HM)	74±12.6	70±6.0	68±15.7	69±6.1	64±8.2	68±8.1	62±12.9
Significance level	NS	NS	NS	NS	NS	NS	NS

Table 3: Effect of HM phytonin on feed intake (g/bird/day), Mean ± SD

	1	2	3	4	5	6	7
A (100%SM+0%HM)	81±3.9	104±9.6	73±4.6	85±7.1	83±6.2	85±7.9	70±6.0
B (50%SM+50%HM)	83±9.0	110±3.9	74±8.3	95±6.7	89±4.6	88±5.3	65±3.1
C (25%SM+75%HM)	79±6.2	107±8.1	77±2.4	99±9.0	87±6.0	83±6.2	72±5.0
D (0%SM+100%HM)	87±4.6	99±2.4	93±8.3	113±15.3	89±4.6	86±5.5	77±4.5
Significance level	NS	NS	NS	NS	NS	NS	NS

Table 4: Effect of HM Phytonin on FCR (kg feed/kg eggs), Mean ± SD

Treat/weeks	1	2	3	4	5	6	7
A (0%SM+100%HM)	1.4±0.21	1.9±0.32	1.1±0.12	1.5±0.16	1.6±0.32	1.4±0.11	1.2±0.19
B (0%SM+100%HM)	1.9±0.49	2.9±2.44	1.1±0.07	1.5±0.15	1.5±0.28	1.5±0.26	1.0±0.13
C (0%SM+100%HM)	1.4±0.16	2.0±0.68	1.3±0.15	1.7±0.12	1.4±0.11	1.4±0.13	1.2±0.25
D (0%SM+100%HM)	1.5±0.27	1.7±0.17	1.7±0.34	2.0±0.39	1.7±0.32	1.5±0.16	1.6±0.4
Significance level	NS	NS	NS	NS	NS	NS	NS

compared to the SM on egg quality. It was stated that there was no significant difference among all groups regarding, egg width, albumin and yolk height as well as shell weight and thickness, however, egg weight, albumin weight and yolk weight were significantly increased ($p \leq 0.01$) by the addition of HM. These findings disagree with those of Francis *et al.* (2012), who indicated that, layers fed on diets supplemented with HM (Meth-o-Tas) produced less ($p \leq 0.01$) eggs, had lower egg mass output ($p \leq 0.01$). They found also that the egg quality characteristics; egg weight, shell thickness, albumen weight and albumen height decreased with dietary supplementation of HM (Meth-o-Tas).

These different results of Francis *et al.* (2012) could be attributed to the use of HM (Meth-o-Tas), which showed different effects compared to Phytonin used in this study and to the circumstances of the two researches.

It was observed that there are no significant differences between the group fed on 50 SM:50% HM compared to those fed 100% HM regarding all egg quality parameters except for yolk weight, so it may

Table 5: Overall effect of herbal methionine on performance of laying hens (total Means ± SD)

Treatment	A	B	C	D	LS
Initial body weight, g	1442±32	1425±50	1442±32	1450±43	NS
End body weight, g	1383±84	1450±64	1425±50	1492±83	NS
Egg production, HD%	70±9	71±11	71±9	68±4	NS
Feed intake, g/hen/day	83±5	86±6	86±8	68±4	NS
FCR, Kg feed/dozen egg	1.5±0.13	1.6±0.46	1.5±0.18	1.7±0.1	NS

NS: No significance difference

Table 6: Effect of HM Phytonin on egg quality

Treatment	A	B	C	D	
Egg measurements (HM:SM)	(0:100%)	(50:50%)	(75:25%)	(100:0%)	LS
Egg weight (g)	62±1.1^{c}	65±1.5^{ab}	63±2.4^{bc}	66±2.1^{a}	**
Egg width (mm)	6.0±0.01	6.2±0.35	5.90±0.07	6.06±0.15	NS
Egg height (mm)	4.3±0.07	4.4±0.02	4.4±0.05	4.4±0.05	NS
Albumin weight (g)	35±2.8^{b}	38±2.1^{ab}	38±2.0^{ab}	40±1.4^{a}	**
Albumin height (mm)	0.75±0.07	0.84±0.09	0.82±0.06	0.82±0.09	NS
Yolk weight (g)	15.3±0.8^{c}	16.0±0.5^{bc}	16.3±0.7^{ab}	17.0±0.1^{a}	**
Yolk height (mm)	1.78±0.11	1.82±0.11	1.73±0.09	1.73±0.10	NS
Yolk diameter (mm)	3.8±0.10^{a}	3.7±0.05^{ab}	3.4±0.10^{b}	3.7±0.11^{ab}	**
Eggshell weight (g)	7.6±0.44	7.8±0.34	7.4±0.57	7.9±0.65	NS
Eggshell thick. (mm)	0.42±0.04	0.42±0.02	0.43±0.01	0.43±0.03	NS

NS: No significance difference, **$p \leq 0.01$, LS: Significance level

be beneficial for some farmers to use 50:50% rather than 100% Phytonin considering cost factors and returns.

Conclusion: It can be concluded from the study that:

1: Herbal methionine, Phytonin can partially or completely replace SM in layers feed without affecting production performance and egg quality
2: It could be advisable for some farmers to supplement layer feed with HM Phytonin (50:50%)
3: Layer feed supplemented with 100% HM Phytonin gave similar production performance and egg quality characteristics as 100% SM irrespective of cost

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