# PERFORMANCE OF LAYERS FED WITH DIETARY HERBAL METHIONINE AND DL-METHIONINE SUPPLEMENTED DIETS

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## ABSTRACT

**The objective of the study was to determine the performance of layers fed with either DL-methionine (DL-M) or herbal methionine (HM) supplemented diets. A total of 100 individually caged pullets were randomly assigned using a completely randomized design to 5 dietary treatments, namely: diet without methionine supplement, diet supplemented with 100% DL-M, diet with 50% DL-M + 50% HM, diet with 100% HM on equivalent weight basis, and diet with 150% HM. Layers were given their respective diets for 16 wk. Each treatment was replicated 20 times with a caged pullet per replicate. No differences were observed in the final body weight and body weight gains among the treatments. Layers fed the 50% DL-M:50% HM diet had the greatest (*P*<0.05) ADFI. Hen-day egg production was not affected by the type and level of methionine supplementation; however, layers fed either the 100% DL-M, 50% DL-M:50% HM, or 100% HM diet had improved (*P*<0.05) feed conversion efficiency compared with those fed the diet with no supplemental methionine. Layers fed the diet with 100% DL-methionine had greater (P<0.05) egg weight than those fed the diet with no supplemental methionine and the diet with 100% HM. However, layers fed with herbal methionine had greater (*P*<0.05) intensity of yolk color. Layers fed the diet with 50% DL-M:50% HM had the**

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**highest IOFC. Under the conditions set in this study, herbal methionine has similar efficacy in terms of egg production and feed conversion efficiency compared with DL-methionine as a supplemental source of methionine in laying diets.**

Keywords: methionine, egg production, yolk color, layers

## INTRODUCTION

Methionine is the first limiting essential amino acid in poultry diets. Aside from being used as a building block of protein, it can also be transformed into cysteine, another amino acid required for protein synthesis (Mack and Li, 1997, as cited by Librero, 1998). One form of methionine supplement is DL-methionine with a guarantee of at least 99% purity (Potter *et al.*, 1984). DL-methionine is a product of a chemical reaction of acrolein and methyl mercaptan with the presence of a catalyst (Fong *et al.*, 1981). Another form of methionine supplement is herbal methionine, which is a mixture of several herbs and a cereal like *Androphagispaniculata, Zea mays, Ocimum sanctum and Asparagus racemosus*. Methionine is present in plants together with the enzymes required for its conversion into the active L-isomer form for its optimal utilization (Halder and Roy, 2007). It is in the form of dipeptide and oligopeptide which are readily digestible.

The use of herbal methionine in animal diets has been claimed to be more efficient than its synthetic counterpart, more stable and less affected by heat treatment, free from poisonous chemical intermediates and industrial toxins, non-corrosive and have no obnoxious chemical odour. It is also claimed to be more economical to use compared to its chemical analogues. However, there is limited work evaluating the efficacy of herbal methionine, particularly in layer diets. As an emerging source of methionine for use in the poultry diets, further studies must be undertaken to provide information on the use of herbal methionine in poultry feeding.

Therefore, this study aimed to evaluate the effects of herbal methionine supplementation compared with DL-methionine on laying performance, egg quality, and economics of table egg production in layers.

## MATERIALS AND METHODS

### Time and place of study

The study was conducted from April 23, 2012 to September 14, 2012 at the University Animal Farm, Animal and Dairy Sciences Cluster, University of the Philippines Los Baños, College, Laguna.

### Experimental design

A total of 110 pullets (16 weeks old) were purchased from a reliable source and quarantined for 4 wk to observe any signs of abnormalities and diseases. Birds were then transferred to individual cages before the onset of egg production. Of the pullets housed, only 100 pullets were selected and randomly assigned to 5 treatments following a completely randomized design. Each treatment was replicated 20 times with 1 pullet per replicate. The treatments were as follows:

| Treatment | Description |
|---|---|
| 1 | Diet with no methionine supplementation |
| 2 | Diet supplemented with required level of DL-methionine (100% DL-M) |
| 3 | Diet supplemented with 50%DL-M + 50% herbal methionine (HM) on equivalent weight basis |
| 4 | Diet supplemented with HM as replacement of DL-methionine on equivalent weight basis (100% HM) |
| 5 | Diet supplemented with HM as replacement of DL-methionine on a 1.5 to 1 basis (150% HM) |

### Feeding and management

A basal layer diet supplemented with DL-methionine (Table 1) to meet the Met+Cys requirements of layers was formulated.

The birds were initially fed with 80 g/d of pre-lay mash during the 1$^{st}$ week of quarantine period with an additional 5 g/d of feed in every succeeding week. The layers were given their respective treatment diets for 16 wk. The layers' daily feed offered was increased by 5 g/d every succeeding wk until it reached 110 g/d for the rest of the experimental period. Feeds were given in the morning around 0700 h. Clean drinking water was made available at all times. Trough feeders were cleaned weekly after data gathering of weekly feed refusal. Linear waterers were cleaned daily every morning. Artificial lights were installed to provide continuous lighting exposure of the layers during off-light periods and night time.

Table 1. Ingredient and calculated nutrient composition (as fed basis) of the basal layer diet.

| Item | % |
|---|---|
| **Ingredient** | |
| Corn, yellow | 48.66 |
| Soybean meal, US | 26.83 |
| Rice bran D1 | 11.00 |
| Limestone, fine | 6.09 |
| Limestone, grits | 4.00 |
| Monocalcium phosphate | 1.77 |
| Salt | 0.30 |
| Coconut oil | 1.00 |
| Vitamin premix | 0.13 |
| Mineral premix | 0.10 |
| DL-methionine | 0.09 |
| Choline chloride, 50% | 0.05 |
| Total | 100.00 |
| **Calculated analyses, %** | |
| ME, kcal/kg | 2,752 |
| CP (N × 6.25) | 17.50 |
| Crude fat | 4.23 |
| Crude fiber | 2.93 |
| Ca | 3.90 |
| Available P | 0.50 |
| Lys, total | 0.99 |
| Met+Cys, total | 0.70 |
| Thr, total | 0.68 |
| Trp, total | 0.22 |
| Linoleic acid | 1.31 |

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### Data collection

Individual layers were weighed at the start and end of the 16-wk experiment to calculate for weight gains. Feed offered and refusals were measured to calculate for ADFI and feed conversion efficiency. Hen-day egg production and egg weight was measured bi-weekly and egg characteristics such as percent yolk, percent albumen, percent shell with membrane, and yolk color scores of eggs laid by the layers were determined. Economic analysis was performed to determine income over feed cost (IOFC) and cost to produce an egg for each treatment.

### Statistical analysis

Data were analyzed using ANOVA following for a completely randomized design. Pairwise comparisons of treatment means were performed using the Duncan's Multiple Range Test. Statistical significance was set at $P \leq 0.05$ for all statistical tests.

## RESULTS AND DISCUSSION

### Body weights and livability

There were no significant differences observed in the final body weight and body weight gain of layers fed with diets supplemented with different sources and inclusion of methionine (Table 2).

Table 2. Average initial body weight, final body weight, and gain in weight of layers fed with DL-methionine (DL-M) or herbal methionine (HM) supplemented diets.

| Item | Treatment | | | | | % CV |
|---|---|---|---|---|---|---|
| | No Met | 100% DL-M | 50% DL-M: 50% HM | 100% HM | 150% HM | |
| Initial weight, g[ns] | 1,370 | 1,372 | 1,390 | 1,372 | 1,350 | 5.9 |
| Final weight, g[ns] | 1,379 | 1,451 | 1,449 | 1,405 | 1,405 | 6.6 |
| Weight gain, g[ns] | 9 | 79 | 59 | 32 | 55 | 49.7 |

[ns]Not significant

These findings were in contrast with those of Itoe *et al.* (2010) and Igbasan *et al.* (2012) where chickens fed with HM-supplemented diet had inferior weight gain compared with those fed with DL-M supplemented diet. No mortality was recorded during the whole duration of the study.

**Feed consumption**

Layers fed the 100% HM diet consumed less ($P$<0.05) feed compared with layers fed diets with 100% DL-M and 50% DL-M: 50% HM (Table 3). However, their feed intake was similar to the amount of feed consumed by layers fed with diets without supplemental methionine. Birds fed the 50% DL-M:50% HM diet consumed more ($P$<0.05) feed compared with layers fed the other diets except with those fed the 100% DL-M diet. Although layers fed with 50% DL-M:50% HM diets had the greatest feed intake, it is within the normal feed intake of layers during this period. The result of this study was in contrast with the experiment conducted by Igbasan *et al.* (2012), in which they observed that feed consumption was not affected by diets supplemented with different methionine sources.

Table 3. Overall average daily feed intake, bi-weekly hen-day egg production, and feed conversion efficiency of layers fed with DL-methionine (DL-M) or herbal methionine (HM) supplemented diets.

| Item | Treatment | | | | | % CV |
|---|---|---|---|---|---|---|
| | No Met | 100% DL-M | 50% DL-M: 50% HM | 100% HM | 150% HM | |
| ADFI, g | 102.85[bc] | 103.38[ab] | 104.94[a] | 101.13[c] | 103.20[bc] | 4.03 |
| Hen-day egg production, % | 87.75 | 88.19 | 90.10 | 89.22 | 87.94 | 11.40 |
| FCE | 2.20[a] | 1.94[b] | 1.91[b] | 1.94[b] | 2.02[ab] | 33.13 |

[a,b,c]Within a row, means without a common superscript differ ($P$<0.05).

**Hen-day egg production**

The source and level of methionine supplement in the layer diet did not affect hen-day egg production (Table 3). The lack of an effect from supplemental methionine on egg production was in contrast with Igbasan *et al.* (2012), where diets containing 16% CP supplemented with methionine significantly improved egg production of layers. The higher CP content (18.93%) of the basal diet in this study may have contributed to the difference in results. The basal diet may have contained the required concentration of sulfur-containing amino acids to support normal egg production of the layers as supported by De Roma (1998). However, previous studies indicate that dietary levels of sulfur-containing amino acids influences egg weight more than egg production. Moreover, there are other factors that affect egg production performance such as the types of management implemented to the layers.

**Feed conversion efficiency**

Layers fed diets with supplemental methionine regardless of the source had improved ($P<0.05$) FCE compared with those fed the diet with no supplemental methionine, with the layers fed the diet with 150% HM being intermediate (Table 3). This observation conformed with the results of previous studies (Bertram *et al.*, 1991; Chattopadhyay *et al.*, 2006; Igbasan *et al.*, 2012). According to Bunchasak (2009), methionine supplementation improves amino acid balance and promotes growth performance by enhancing feed conversion efficiency and improving protein synthesis.

**Egg quality**

Egg weight**.** Layers fed the diet with 100% DL- methionine had greater ($P<0.05$) egg weight than those fed the diet with no supplemental methionine and the diet with 100% HM (Table 4). However, they were similar to those fed the diets with 50% DL-M + 50% HM and 150% HM.

Percent yolk**.** There were no significant differences observed in the percent yolk among the dietary treatments (Table 4). The yolk contents of the eggs laid by birds in the different treatments were similar in size, which ranged from 24.0% to 24.6%. In a study conducted by Kaminska and Skraba (1991), it was found that yolk size increases proportionally with egg size, hence, yolk in smaller eggs was lesser compared to larger eggs. In addition, egg yolk percentage among the treatments increased as the layers get older (Figure 1).

Table 4. Average bi-weekly egg weight, percent yolk, percent albumen, percent shell with membrane, and yolk color scores of eggs laid by layers fed with DL-methionine (DL-M) or herbal methionine (HM) supplemented diets

| Item | Treatment | | | | | % CV |
|---|---|---|---|---|---|---|
| | No Met | 100% DL-M | 50% DL-M: 50% HM | 100% HM | 150% HM | |
| Egg weight, g | $55.74^{bc}$ | $8.56^{a}$ | $57.38^{ab}$ | $54.80^{c}$ | $56.38^{abc}$ | 16.67 |
| Yolk, % | 24.02 | 24.28 | 24.28 | 24.61 | 24.07 | 9.95 |
| Albumen, % | 63.61 | 63.40 | 63.68 | 62.83 | 63.42 | 4.06 |
| Shell + membrane, % | 12.37 | 12.32 | 12.04 | 12.55 | 12.52 | 8.91 |
| Yolk color score | $6.14^{c}$ | $6.66^{b}$ | $6.41^{bc}$ | $6.77^{b}$ | $7.26^{a}$ | 12.81 |

$^{a-c}$Within a row, means without a common superscript differ ($P$<0.05).

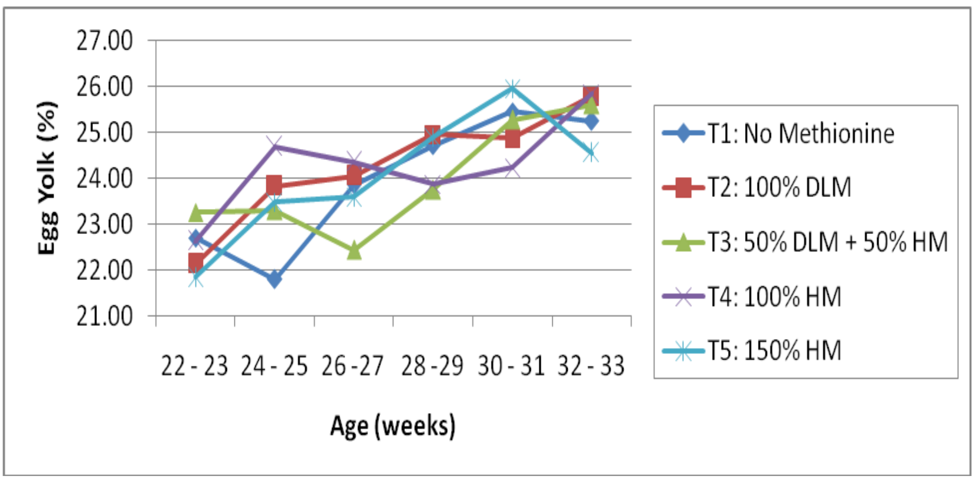


Figure 1. Average percent yolk (egg weight basis) of eggs laid by layers fed with DL-methionine (DL-M) or herbal methionine (HM) supplemented diets.

<u>Percent albumen</u>. The average percent albumen (in egg weight basis) of layers fed with herbal and DL-methionine supplemented diets showed no significant differences (Table 4).There was a decreasing trend in albumen percentage as the layers mature (Figure 2).This is attributed to the increasing

percentage of the yolk as the layers aged. The observation was similar to the result of the study by Rossi and Pompei (1995). As the hen ages, there is a decrease in albumen percentage in the edible part of egg due to increase in the proportion of yolk. Similarly, Ahn *et al.* (1997) reported a low yolk:white ratio in the eggs laid by 28 -week-old hens.

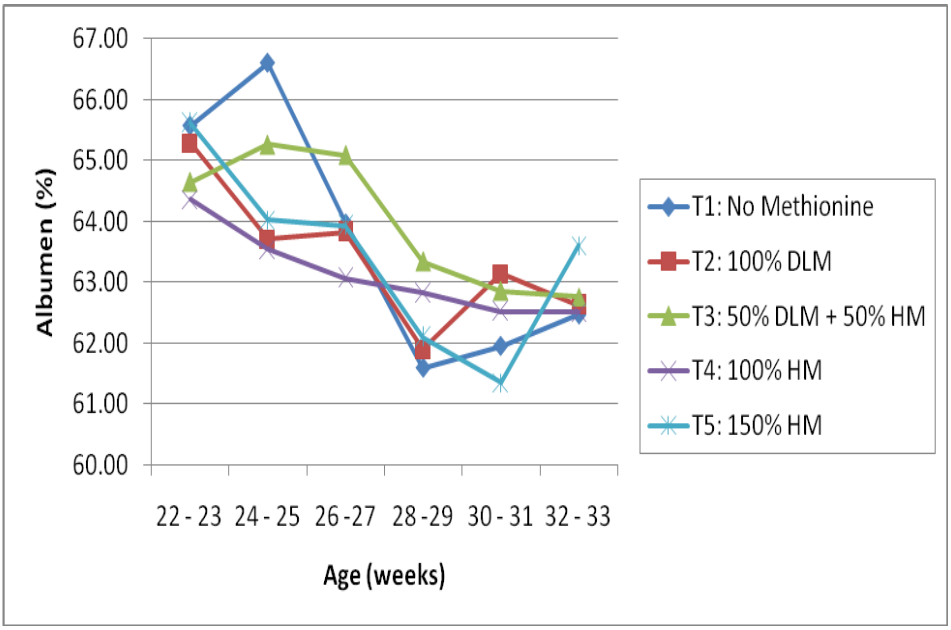


Figure 2. Average percent albumen (egg weight basis) of the eggs laid by layers fed with DL-methionine (DL-M) or herbal methionine (HM) supplemented diets.

Percent shell with membrane**.** The overall percent egg shell with membrane did not significantly differ among the dietary treatments (Table 4).

Yolk color score**.** Layers fed the diet with 100% DL-M or HM had greater (*P*<0.05) yolk color score (intense yellow color) compared with those fed no supplemental methionine (Table 4). The highest yolk color score was observed in eggs laid by layers fed the diet with 150% HM. was significantly higher (*P*<0.05) than the rest of the treatments.

**Economic analysis**

Price of eggs was based on the selling price of the Animal and Dairy Sciences Cluster Meat Store as of September, 2012. Layers fed the 50% DL-M:50% HM diet had the highest IOFC due to numerically greater egg production and heavier eggs (Table 5). The sales of the eggs were also greatest for layers fed the 50% DL-M:50% HM diet. Diet with 100% HM had the lowest cost to produce an egg due to reduced feed consumption of the layers.

Table 5. Economic analysis of layers fed with herbal methionine (HM) and DL-methionine (DL-M) supplemented diets (per bird).

| Item | Treatment | | | | |
|---|---|---|---|---|---|
| | No Met | 100% DL-M | 50% DL-M: 50% HM | 100% HM | 150% HM |
| ADFI, g | 102.85 | 103.38 | 104.94 | 101.13 | 103.20 |
| Feed cost/kg, PhP | 7.76 | 17.96 | 17.95 | 17.94 | 18.02 |
| Ave feed cost/d, PhP | 1.83 | 1.86 | 1.88 | 1.81 | 1.86 |
| Ave egg produced/d, pcs | 0.85 | 0.86 | 0.88 | 0.87 | 0.86 |
| Ave egg price, PhP | 3.90 | 4.07 | 4.03 | 3.91 | 3.97 |
| Ave sales/d, PhP | 3.33 | 3.49 | 3.55 | 3.40 | 3.40 |
| Income over feed cost, PhP | 1.50 | 1.64 | 1.67 | 1.59 | 1.54 |
| Cost to produce an egg (based on feed cost) | 2.14 | 2.16 | 2.14 | 2.08 | 2.17 |

## CONCLUSIONS

Under the conditions set in this study, herbal methionine has similar efficacy in terms of egg production and feed conversion efficiency compared with DL-methionine as a supplemental source of methionine in laying diets. However, the lack of an effect of herbal methionine on egg weight when it replaced DL-methionine on an equivalent basis in the layer diet needs further investigation.

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