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D Rambabu
Principal, Animal Husbandry Polytechnic, Vidyanagar, Karimnagar, Telangana, India

V Chinni Preetam
Dean of Student Affairs, PVNRTVU, Rajendranagar, Hyderabad, Telangana, India

M Venkateswarlu
Professor, Department of Animal Nutrition, CVSc, PVNRTVU, Hyderabad, Telangana, India

B Ashok Reddy
M.V.Sc., Scholar, Department of Poultry Science, CVSc, PVNRTVU, Hyderabad, Telangana, India

Corresponding Author
D Rambabu
Principal, Animal Husbandry Polytechnic, Vidyanagar, Karimnagar, Telangana, India

Effect of essential oils on performance, serum biochemical profile, livability and net profit of commercial layers

D Rambabu, V Chinni Preetam, M Venkateswarlu and B Ashok Reddy

Abstract
The purpose of this study was to see how supplementing commercial laying hens with microencapsulated essential oils affected their performance, haugh unit score, albumen index, yolk index, serum biochemical profile, livability, and net profit. A total of 240 commercial laying hens aged 22 weeks were randomly allocated to three treatments, each having 20 duplicates of four birds. Control diet (CD), CD + micro-encapsulated essential oil (MEEO-I: thymol, carvacrol, and menthol), and CD + micro-encapsulated essential oil (MEEO-II: cinnamaldehyde, eugenol, and piperine) were given to the birds, respectively. The percentage of hen day egg production, feed efficiency, Haugh unit score, and serum total cholesterol content all increased significantly ($P<0.05$) in layers birds fed MEEO-I and MEEO-II diets. However, yolk index, livability, and serum total protein content were not significantly different ($P>0.05$). During the experimental period, the addition of microencapsulated essential oils to feed impacted the net profit per dozen eggs, which was greatest in MEEO-I @ 100g/ton of feed (Rs.15.66) and followed by MEEO-II @ 100g/ton of feed (Rs.15.11) compared to the control (Rs.14.49) diet (22-37 wks). Finally, it can be concluded that supplementing the layer diet with microencapsulated essential oils improved the overall performance of commercial layers.

Keywords: essential oils, net profit, performance, commercial layers, livability, yolk index

Introduction
In India, the livestock industry is gaining traction, with poultry occupying a prominent role within it. The Indian poultry business is expanding at a rate of 8-10% each year. The Animal Husbandry industry contributes almost Rs. 11 lakh crores to the Indian economy each year, with the poultry sector contributing Rs. 1.2 lakh crore. In India, there are approximately 851.81 million chickens, including 534.74 million commercial birds and 317.07 million backyard chickens (DADF, 2019) [11]. PFAs (phytogenic feed additives) are first-line alternatives to AGPs owing to their comprehensive bioactivity, which includes anti-microbial, anti-oxidant, and anti-inflammatory effects (Miguel *et al.*, 2010). PFAs have a dual role in improving feed quality, animal health, and production performance in general (Uphadhaya and Kim, 2017) [24]. Plant extracts, essential oils (EOs), and individual (or) combined active EO components are included in the PFAs as effective replacements (Bozkurt *et al.*, 2014) [6]. Since ancient times, EO's have been widely employed in aromatherapy as taste and perfumes in cosmetics and foods, and more recently as medications, natural preservatives, and additives (Prakash *et al.*, 2012) [21]. The bioactivity of essential oils is determined by the complex combination of volatile molecules generated by aromatic and medicinal plants' secondary metabolism (Bakkali *et al.*, 2008 and Prakash *et al.*, 2012) [3, 21]. Incorporating the EOs into chicken feeds will increase avian health and production while also lowering blood cholesterol levels (Gerzilov *et al.*, 2015) [13]. Because essential oils are thermo sensitive, photosensitive, and highly reactive, their effects are limited by quick absorption and metabolization of these bioactive molecules. Microencapsulation is the process of creating a functional barrier between the core and the wall material in order to prevent chemical and physical interactions and preserve the biological, functional, and physicochemical features of the core material. As a result, a unique delivery system called microencapsulation is being developed to preserve the bioactivity of EOs from degradation during feed processing, oxidation during storage, and regulated release in the intestine. Techniques for microencapsulating essential oils include spray-drying and coacervation (Bakry *et al.*, 2015) [4]. As a result, the goal of this biological study was to see how microencapsulated essential oils (MEEO) affected White Leghorn layer performance, serum biochemical profile, net income, and livability.

Materials and Methods

The study was conducted in the Department of Poultry Science at the Hyderabad in College of Veterinary Science (India). A total of 240 commercial white leghorn layers (Bovans white) were divided into three equal groups, each with four birds, and were all 21 weeks old and of uniform body weight. From December 2020 to March 2021, the experiment was conducted in a well-ventilated platform 2 tier cage layer house. The birds were kept in a four-bird colony cage (18 x 17 x 15 inch). Water is provided via nipple drinkers on the tops of the cages, and each copy has a shared linear feeder. A week was given to the hens to acclimate to their new diet. LED bulbs are used to provide a 16-hour daily lighting period, which includes daylight. The birds were fed and hydrated as needed throughout the study (4 periods of each 28 days from 22 to 37 weeks). Both the temperature and relative humidity were within normal norms for birds. The control group followed a corn-soybean-based baseline diet without the addition. Ingredients and nutritional value of the baseline diet fed to commercial layers during 22 to 37 weeks (percent). The other two groups were fed the same basic diet plus 100 grams of MEEO-I and MEEO-II per ton of feed, respectively. As active components, Microencapsulated essential oil-I (MEEO-I) comprises thymol and carvacrol, while Microencapsulated essential oil-II (MEEO-II) contains cinnamaldehyde and eugenol. All of the studies employed isonitrogenous and isocaloric diets. Standard layer mash was fed to the birds at a rate of 110g per day. According to the breeder's guidelines (Bovans White Management Guide, Skylark Hatcheries Pvt. Ltd, Jind (Haryana), India), the trail meals were created to meet the nutrient needs for layer hens.

Eggs were collected twice a day. The total of the two collections, as well as the number of birds alive on each day, were recorded and summarized at the end of each period. The total number of eggs laid each day was divided by the number of hens that survived each day to get the hen day egg output in percent. The feed efficiency (FE) was estimated (feed intake in kg/dozen eggs produced) by weighing back the feed on the day of death in that particular treatment group in order to preserve precision in the data collection. At the end of each period (28 days), 2 eggs (40 eggs per treatment) were collected from each replicate at the 28th, 56th, 84th, and 112th days to evaluate egg quality indexes such as Haugh unit score, albumen index, yolk index. The following formula was used to calculate the Haugh unit: HU = (h – 1.7w 0.37 + 7.57) log (h – 1.7w 0.37 + 7.57) log (h – 1.7w 0.37 + 7.5 (Singh, R.A. 2006) [23]. The albumen index was determined using a spherometer and digital vernier callipers to measure the height and diameter of thick albumen, respectively. The yolk index was determined using a tripod micrometre (Mitutoyo, 0.01 mm, Japan) and vernier callipers to measure the height and diameter of the yolk, respectively. At the conclusion of the experiment (37th week), around 3 cc of blood was obtained from one representative chick from each replication to analyze the serum biochemical profile. During the trial period, the data on livability was estimated based on the mortalities that were reported as and when they happened. The cost economics of two varieties of MEEO at 100 grams per ton of feed and a control diet were assessed in terms of net returns over feed costs. The cost of feeding over four phases was added to the total period's economics (22-37 weeks). The feed cost per egg mass was calculated using the current egg sale price (Rs. 4.09 per egg). MEEO-I and MEEO-II were priced at Rs.900/kg and Rs.850/kg, respectively. The data were analyzed with the Statistical Package for Social Sciences (SPSS) 20th version's one-way ANOVA. Duncan's multiple range test (Duncan, 1955) [12] was used to assess the differences between the treatment means at $P<0.05$.

Results and Discussion

Hen day egg production

In this study, nutritional supplementation with microencapsulated essential oils had a significant influence ($P<0.05$) on percent hen day egg production in commercial layers. During periods P1 (22-25 wks), P2 (26-29 wks), P4 (34-37 wks), and the total experimental period, the MEEO-I supplemented group produced substantially more hen day eggs ($P<0.05$) than the control group (22-37 wks). In commercial layer chickens fed with essential oils, Omer *et al.* (2019) [19] and Abo-Ghanima *et al.* (2020) [1] found that percent hen day egg production was enhanced. The inclusion of active components (thymol, carvacrol, and menthol) in MEEO-I may have benefited the health and reproductive performance of birds, resulting in higher egg production (Akhtar *et al.*, 2003) [2]. In contrast to the findings of the current study, Wang *et al.* (2019) [25] and Marume *et al.*, (2020) observed no significant difference in percent hen day egg production in commercial layer hens with essential oil supplementation.

Feed efficiency

In commercial layers between 22 and 37 weeks of age, a significant reduction ($P<0.05$) in feed efficiency /dozen eggs was seen in the MEEO-I supplemented group compared to the control and MEEO-II groups. The addition of essential oils to the meal increased feed efficiency in this study. The findings are consistent with those of Abo-Ghanima *et al.* (2020) [1] and Marume *et al.* (2020), who found a significant ($P<0.05$) increase in feed efficiency in commercial layer birds given essential oils. In contrast to the findings of this study, Olgun *et al.* (2016) [18] and Wang *et al.* (2019) [25] reported that no significant variation in feed efficiency was detected in layer birds treated with essential oils. The increase in feed efficiency per dozen eggs with the addition of EOs may be related to enhance nutrient digestion and absorption owing to enzymatic stimulation, and they may have a favorable influence on feed efficiency (FE) when added to layer diets.

Egg quality parameters

Haugh unit score

Supplementation of MEEO-I throughout period-P2 (26-29 weeks) and the total experimental duration impacted Haugh unit score significantly ($P<0.05$) in the current investigation (22-37 wks). The findings are consistent with those of Abo-Ghanima *et al.* (2020) [1] and Marume *et al* (2020). Li *et al.* (2016) [16] and Wang *et al.* (2019) [25] found no significant variation in Haugh unit score between the therapy groups, contrary to the findings of others.

Albumen index

The impact of food supplementation with microencapsulated essential oil on albumen index in commercial layers throughout P1 (22-25 wks), P2 (26-29 wks), P3 (30-33 wks), and the entire experimental period (22-37 wks) was shown to be significant ($P<0.05$) in this study. Yesilbag *et al.* (2013) [27] found similar results when they supplied rosemary oil to pharaoh quails aged 6 to 15 weeks. Despite these findings, Marume *et al.* (2020) found no significant differences in albumen index across the experimental groups.

Yolk index

During P1 (22-25 wks), P3 (30-33 wks), period-P4 (34-37 wks), and the whole experimental period (22-37 wks), no significant difference (*P*>0.05) in the yolk index values was found with supplementation of MEEO-I (or) MEEO-II in commercial layers. Abo-Ghanima *et al.* (2020) [1] and Marume *et al.* (2020) both support the current findings (2020). In contrast to the findings of Boka *et al.* (2013) [5], Yesilbag *et al.* (2013) [27], Cabuk *et al.* (2014) [9], and Omer *et al.* (2019) [19], treatment groups supplemented with essential oils in layer meals showed considerable improvement in yolk index values.

Serum biochemical profile

At 37 weeks of age, MEEO-I and MEEO-II supplementation had no effect on the serum total protein content of commercial layers. These findings are consistent with those of Yalcin *et al.* (2006) [26], Cetingul *et al.* (2007) [10], and Abo-Ghanima *et al.* (2020) [1], who found no significant differences in serum total protein concentrations between the dietary regimens. In layer meals supplemented with essential oils and 1% garlic powder, studies by Migliorini *et al.* (2019) [16] and Omer *et al.* (2019) [19] found a substantial change in serum total protein content.

At 37 weeks of age, commercial layers supplemented with MEEO-I and MEEO-II showed a significant (*P*<0.05) decrease in blood cholesterol levels. The findings of Akhtar *et al.* (2003) [2], Li *et al.* (2016) [16], Omer *et al.* (2019) [19], and Abo-Ghanima *et al.* (2020) [1] who observed a considerable reduction in blood cholesterol concentration in laying hens are in line with these findings. Cetingul *et al.* (2007) [10], Ozek *et al.* (2011) [20], and Migliorini *et al.* (2019) [16] found no significant differences in blood cholesterol levels across dietary groups.

Livability

Except for period-2, there was no mortality in layer birds for the whole trial period in treatments (MEEO-I and MEEO-II) (26-29 wks). Bozkurt *et al.* (2008), Ozek *et al.* (2011) [20], Bozkurt *et al.* (2012) [8], and Olgun *et al.* (2016) [18] found that supplementing essential oils in layer diets had no effect on livability (percent) across the treatment groups. However, Akhtar *et al.* (2003) [2] found that the Nigella Sativa seeds supplemented group had a significant (*P*<0.05) reduction in mortality (percent).

Net profit / Net revenue

Adding microencapsulated essential oil to the diet increased net profit per dozen eggs, which was highest in MEEO-I @ 100g/ton of feed (Rs.15.66) compared to MEEO-II @ 100g/ton of feed (Rs.15.11) and control diet across the 22-37 week period (Rs.14.49). Selma *et al.* (2020) [22] revealed that commercial layers supplemented with thyme essential oil, TEO + Vit C, TEO + Vit E, TEO + Vit A had a higher production cost per egg than the control group, in contradiction to the aforementioned findings.

Table 1: Effect of dietary supplementation of micro encapsulated essential oils on the feed cost per egg mass in commercial layers during 22-37 weeks of age.

S. No	Criterion	CD	MEEO-I	MEEO-II
1	Cost of feed per kg (Rs.)	24.01	24.09	24.08
2	Feed consumption/dozen eggs (kg)	1.441	1.387	1.410
3	Feed cost/dozen eggs (Rs.)	34.60	33.43	33.98
4	Selling price / dozen eggs (Rs.)	49.10	49.10	49.10
5	Net profit / dozen eggs (Rs.)	14.49	15.66	15.11
6	Net profit over control (Rs.)	-	+1.16	+0.61

Selling price of egg Rs:4.09, Avg. MEEO-I cost Rs: 900/kg, MEEO- II cost Rs:850/kg.

Conclusion

It can be concluded that adding microencapsulated essential oils to commercial layer diets enhances egg production, feed efficiency, serum cholesterol concentration, and Haugh unit score significantly (*P*<0.05). However, with the addition of essential oils to commercial layer diets, there was no significant (*P*>0.05) increase in yolk index and livability in the current study. The addition of microencapsulated essential oils to feed had a positive impact on net profit per dozen eggs when compared to the control diet.

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References

1. Abo-Ghanima M, Alagawany M, El-Hack M, Taha A, Elnesr S, Ajarem J, *et al.* Consequences of various housing system sand dietary supplementation of thymol, carvacrol and eugenol on performance, egg quality,blood chemistry and antioxidant parameters. Poultry Science. 2020;99(9):4384-4397.
2. Akhtar MS, Nasir Z, Abid AR. Effect of feeding powdered *Nigella sativa* L. seed sonpoultry egg production and suitability for human consumption. Veterinary Archive. 2003;73:181-190.
3. Bakkali F, Averbeck S, Averbeck D, Idaomar M. Biological effects of essential oils - A review. Food and Chemical Toxicology. 2008;46:446-475.
4. Bakry AMR, Abbas S, Majeed H, Abouelwafa M, Mousa A, Liang Li. Microencapsulation of oils: A comprehensive review of benefits, techniques, and applications. Comprehensive Reviews in Food Science and Food Safety. 2015;15:143-182.
5. Boka J, Mahdavi AH, Samie A, Jahanian R. Effect of different levels of blackcumin (*Nigella sativa* L.) on performance, intestinal *Escherichia coli* colonization and jejunal morphology in laying hens. Journal of Animal Physiology and Animal Nutrition, 2013, 98.
6. Bozkurt MF, Hippenstiel A, Abdel-Wareth S, Kehraus K, Kucukyilmaz K, Sudekum KH. Effects of selected herbs and essential oils on performance, egg quality and some metabolic activities in laying hens -A review. European

Poultry Science, 2014, 78.
7. Bozkurt M, Alcicek A, Cabuk M, Kucukyilmaz K, Catli AU. Effect of an herbal essential oil mixture on growth, laying traits, and egg hatching characteristics of broiler breeders. Poultry Science. 2009;88(11):2368-2374.
8. Bozkurt M, Kucukyilmaz K, Catli AU, Cinar M, Bintas E, Coven F. Performance, egg quality, and immune response of laying hens feddiets supplemented with mannanoli go saccharide or anessential oil mixture under moderate and hot environ mental conditions. Poultry Science. 2012;91(6):1379-1386.
9. Cabuk M, Eratak S, Alcicek A, Bozkurt M. Effects of herbal essential oilmixture as dietary supplement on egg production in quail. The Scientific World Journal. 2014;10:573-470.
10. Cetingul IS, BayramI Akkaya AB, Uyarlar C, Yardimci M, Sahin E, Hand Sengor E. Utilization of oregano (*Origanum onites*) in laying quails (*Coturix coturnix japonica*). The effects of oregano on performance, carcass yield, liver and some blood parameters. Archiva Zootechnica. 2007;10(2):57-65.
11. DADF, 2019. http://www.vetextension.com/livestock-animal production-statistics-of-india.
12. Duncan DB. Multiple range and multiple Ftests". Biometrics. 1955;11:1-42.
13. Gerzilov V, Nikolov A, Petrov P, Bozakovan, Penchev G, Bochukov A. Effect of a dietary herbal mixture supplementon the growth performance, egg production and health status in chickens. Journal of Central European Agriculture. 2015;16(2):10-27.
14. Li XL, He WL, Wang ZB, Xu TS. The effects of Chinese herbal mixture on performance, egg quality and blood biochemical parameter so flaying hens. Journal of Animal Physiologyand Animal Nutrition. 2016;100(6):1041-1049.
15. Marume U, Mokagane J, Shole C, Hugo A. *Citrullus lanatus* essential oils inclusion in diets elicit nutraceutical effects on egg production, egg quality, and physiological characteristics in laying hens. Poultry Science. 2020;99(6):3038-3046.
16. Migliorini MJ, Boiago MM, Roza LF, Barreta M, Arno A, Robazza WS, *et al.* Oregano essential oil (*Origanum vulgare*) to feed laying hens and its effects on Animal Health. Brazilian Academy of Sciences, 2019, 91.
17. Miguel MG. Antioxidant and anti-inflammatory activities of essential oils: A short review. Molecules. 2010;15(12):9252-9287.
18. Olgun O. The effect of dietary essential oil mixture supplementation on performance, egg quality and bone character is tics in layin ghens. Annals of Animal Science. 2016;16(4):1115-1125.
19. Omer A, Ahmed S, Abdel MS, El-Mallah G, Bakr A, Fattah M. Nutritional impact of inclusion of garlic (*Allium sativum*) and onion (*Allium cepa*) powder in laying hens diets on their performance, egg quality and some blood constituents. Bulletin of the National Research Centre. 2019;43:23.
20. Ozek K, Wellmann KT, Ertekin B, Tarım B. Effects of dietary herbal essentialoil mixture and organic acid preparation on laying traits, gastrointestinal tract characteristics, blood parameters and immune response of laying hens in a hot summer season. Journal of Animal and Feed Sciences. 2011;20(4):575-586.
21. Prakash B, Singh P, Kedia A, Dubey NK. Assessment of some essential oil sas food preservatives based on antifungal, anti-aflatoxin, antioxidant activities and *in vivo* efficacy in food system. Food Research International. 2012;49:201-208.
22. Selma BB, Yusuf K, Mahmut K, Savas S, Berrin KG, Eray A, *et al*. Effects of thyme essential oil and A, C, and E vitamin combinations to diets on performance, egg quality, MDA, and 8-OHdG of laying hens under heat stress. Journal of Applied Animal Research. 2020;48(1):126-132.
23. Singh RA. Poultry Production; 2nd edition. Kalyani Publishers, Daryaganj, New Delhi, 2006. (India)-110 002.
24. Uphadhaya SD, Kim IH. Efficacy of phytogenic feed additives on performane, production and health status of monogastric animals - A review. Annals of Animal Science. 2017;17:929-948.
25. Wang H, Liang S, Li X, Yang X, Long F, Yang Xin. Effects of encapsulated essential oils and organic acids on laying performance, egg quality, in test in a morphology, barrier function, and micro of lora count of hens during the early laying period. Poultry Science. 2019;98(12):6751-6760.
26. Yalcin S, Reisli Z, Suzan Y. Effect of garlic powder on the performance, eggtraits and blood parameters of laying hens. Journal of the Science of Food and Agriculture. 2006;86:1336-1339.
27. Yesilbag D, Gezen SS, Biricik H, Meral Y. Effects of dietary rosemary and oregano volatile oil mixture on quail performance, egg traits and egg oxidative stability. British Poultry Science. 2013;54(2):231-237.