Animal Feed Science and Technology xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Animal Feed Science and Technology

journal homepage: www.elsevier.com/locate/anifeedsci

Effect of dietary supplementation of peppermint on performance, egg quality, and serum metabolic profile of Hy-Line Brown hens during the late laying period

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ARTICLE INFO

Article history:
Received 20 February 2014
Received in revised form 8 July 2014
Accepted 20 July 2014
Available online xxx

Keywords:
Egg quality
Laying hens
Peppermint
Production
Serum profile

ABSTRACT

This study was conducted to determine the effects of supplementation of dried peppermint (*Mentha piperita* L.) leaves in laying hen diets on laying performance, egg quality, and serum metabolic profile. A total of one hundred and fifty Hy-Line Brown laying hens (64-week-old), were assigned to five treatment diets including dry peppermint leaves at 0, 5, 10, 15, or 20 g/kg, respectively, for 12 weeks. Each treatment had six replicates with five hens each. Over the course of the trial, incremental dietary peppermint leaves significantly increased (linear, P<0.001) egg weight, egg production, egg mass and feed intake from 64–68, 68–72, 72–76 and 64–76 weeks of age. Moreover, feed conversion ratio was linearly decreased (P<0.001) with increasing levels of peppermint in laying hens diet. The inclusion of 20 g/kg peppermint resulted in overall best performance. Eggshell percentage, eggshell thickness and Haugh unit of hens fed diets supplemented with peppermint leaves were greater (P<0.01) than that of hens fed the control diet. However, peppermint supplementation did not influence other egg quality characteristics like albumen and yolk percentages and albumen height. Notably, serum cholesterol significantly decreased (P<0.001) but serum total proteins increased (P=0.015) with the increasing peppermint leaves levels. It can be concluded that peppermint leaves can be used as an effective feed additive to improve performance of laying hens during the late laying period.

1. Introduction

Phytogenic substances have several advantages over commonly used antibiotics since they are generally recognized as safe and are commonly used items in the food industry (Varel, 2002; Brenes and Roura, 2010). The plant family Lamiaceae has received the greatest interest in poultry feed, with peppermint, thyme and oregano as the most popular representatives (Burt, 2004). These medicinal plants active components which are often called phytobiotics or botanicals are secondary metabolites in medicinal plants with positives effects on animal health and productivity (Windisch et al., 2008; Ghazaghi et al., 2014).

Abbreviations: ADFom, acid detergent fibre; FCR, feed to egg mass ratio; HU, Haugh unit; H, albumen height; aNDFom, neutral detergent fibre assayed with a heat stable amylase; W, weight.

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http://dx.doi.org/10.1016/j.anifeedsci.2014.07.007
0377-8401/

Table 1
Ingredient composition and chemical analysis (g/kg) of the basal diet.

	g/kg
Ingredients	
Corn	679
Soybean meal	178
Soybean oil	8
Corn gluten meal	25
Di-calcium phosphate	19
Limestone	82
Vitamin and mineral mix[a]	2
DL-Methionine	2.5
Sodium chloride	4
Choline	0.5
Determined analysis	
Dry matter	889
Ash	114
Crude protein	182
Ether extract	42.4
ADF_{om}	41.2
$aNDF_{om}$	102
Calcium	37.1
Phosphorus	5.43
Starch	376
Sugar	42.1
Lysine	0.96
Methionine	0.39
Gross energy (MJ/kg)	16.0

[a] Provided the following per kg of diet: vitamin A, 12,000 IU; vitamin D_3, 7200 IU; vitamin E, 20 IU; vitamin B_1, 2.5 mg; vitamin B_2, 5 mg; vitamin K, 3 mg; vitamin B_{12}, 1.5 μg; pyridoxine, 0.225 μg; pantothenic acid, 10 mg; niacin, 35 mg; folic acid, 1.5 mg; biotin 125 mg; Mn, 90 mg; Cu, 7.5 mg; Zn, 65 mg; Fe, 50 mg; Se, 0.1 mg.

Peppermint (*Mentha piperita* L.) is widely used in herbal medicine and believed to be particularly beneficial in building the immune system and antimicrobial properties, as well as strong antioxidant properties and enhance appetite, mainly due to its active components (Dorman et al., 2003; Yalçin et al., 2012). The peppermint plant is an aromatic perennial herb cultivated in Egypt and in most part of the world, has traditionally been used in medicine. Peppermint leaves contains about 0.5–4% essential oils that is composed of 25–78% menthol, 14–36% menthone, 1.5–10% isomenthone, 2.8–10% menthyl acetate, 3.5–14% cineol (Grigoleit and Grigoleit, 2005; Bupesh et al., 2007; Aziz et al., 2011). Most of the farmers in Egypt region prefer to keep their hens to late production period for higher egg weight and economic aspects rather than substituting them with new birds. However, egg production and egg quality (*e.g.* shell and albumin characteristics) decreased as age advances (Nobakht et al., 2006).

There are few research reports available on its practical usage as feed additives in poultry nutrition especially on broilers and the results showed that peppermint leaves had a growth promoting efficacy at an early stage of broilers life (Ocak et al., 2008; Toghyani et al., 2010) but there is a scarcity of reports on its usage in layer diets. For this reason the present study was conducted to evaluate the potential of different levels of peppermint leaves as feed additives in laying hens during late period in order to observe their influence on feed intake, performance, egg quality and serum metabolic profile.

2. Materials and methods

2.1. Experimental birds, design and feed preparation

The present study was conducted in the breeding farm of agricultural research centre of the Agriculture faculty, South Valley University, Qena, Egypt. A total of one hundred and fifty Hy-Line Brown laying hens (average weight = 1,720 g, 64 weeks age)were assigned to five treatment diets including dry peppermint leaves at 0, 5, 10, 15, or 20 g/kg, respectively, for 12 weeks. Each treatment had six replicate cages with five hens each. Replicates were equally distributed into upper and lower cage levels to minimize the cage level effect. Five hens were housed in a 60 cm × 60 cm × 40 cm cage.

All hens were housed in an environmentally controlled house with temperature maintained at approximately 24 °C. The house had controlled ventilation and lighting (16L:8D). All hens were supplied with feed and water for *ad libitum* consumption. Animal housing and handling procedures during experimentation were in accordance with guidelines of the Institutional Animal Care and Ethics.

The hens were fed diets in mash form during the experiment (64–76 weeks of age). The basal diet was formulated (Table 1) according to recommendations of NRC (1994). The basal diet contained 0, 5, 10, 15 or 20 g/kg of dried peppermint leaves, respectively, for five treatment diets. First, the peppermint leaves of different levels were mixed separately in 3 kg of the

Please cite this article in press as: Abdel-Wareth, A.A.A., Lohakare, J.D., Effect of dietary supplementation of peppermint on performance, egg quality, and serum metabolic profile of Hy-Line Brown hens during the late laying period. Anim. Feed Sci. Tech. (2014), http://dx.doi.org/10.1016/j.anifeedsci.2014.07.007