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RESEARCH ARTICLE

Effect of Mentha Piperita (Peppermint) Extract and its Juice on Egg Quality Traits during Different Storage Time in Laying Hens

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ABSTRACT

Much focus has been given on the use of herbs and herbal products to improve performance and to some extent the quality in freshly laid eggs but limited data are available regarding the impact of herbs on storage quality of eggs. The present study was designed to evaluate the effect of Mentha Piperita oil and mentha juice in feed and drinking water respectively, on egg quality traits in laying hens at different storage intervals. A total of 252 Babcock laying hens were divided into 7 groups and each group was further divided into 4 subgroups having 9 hens in each. Group A served as a control. Group A was fed basal diet without any supplementation. Group B, C and D were offered diets supplemented with mentha extract @ 50, 100 and 200 mg/kg of feed while groups E, F and G diets were having same doses of mentha juice in drinking water. At the end of the study (56 days), a total of 252 eggs (36 eggs from each group) were collected randomly. 84 eggs were analyzed at zero day of storage while other eggs were stored at 4°C temperature. Among these eggs, 84 were analyzed after 15 days and remaining 84 after 30 days of storage. The results revealed that egg quality traits like egg shell breaking strength (ESBS), yolk color (YC), haugh unit (HU) and egg weight showed non-significant difference (P>0.05) among all the groups at different storage intervals.

Key Words: Egg Quality, Mentha piperita, Haugh unit, Yolk color, Egg shell breaking strength.

Yumurtacı Tavuklarda Mentha Piperita(Nane) Ekstratının ve Özsuyunun Farklı Depolama Zamanlarında Yumurta Kalite Özelliklerine Etkisi

ÖZ

Yumurtacı tavuklarda bitkilerin ve bitkisel ürünlerin kullanımının performans ve taze yumurta kalitesine etkileri üzerine çalışmalar yapılmış olmasına rağmen depolama kalitesine üzerine etkileri hakkında oldukça sınırlı bilgi mevcuttur. Çalışma; Mentha Piperitaekstraktının ve özsuyunun sırasıyla yem ve su katkısı olarak kullanılmasının farklı depolama sürelerinde yumurta kalitesine etkisini araştırmak amacıyla planlanmıştır. Çalışmanın hayvan materyalini 252 Babcock ırkı yumurta tavuğu teşkil etmiştir. Hayvanlar 7 ana gruba ve devamında 4 alt gruba ayrılmış ve her alt grup 9 hayvandan oluşmuştur. A Grubu rasyonunda herhangi bir katkı kullanılmamış ve kontrol grubu olarak belirlenmiştir. B, C ve D grupları sırasıyla nane ekstraktını 50, 100 ve 200 mg/kg dozlarında yem katkısı olarak; E, F ve G grupları ise aynı dozlarda nane özsuyunu içme suyu katkısı olarak tüketmişlerdir. Çalışma sonunda (56 gün) 252 yumurta (her gruptan 36 yumurta olmak üzere) rastgele olarak toplanmıştır. 84 adet yumurta depolama öncesi analiz edilmiş, diğer örnekler +4°C'de depolanmıştır. Depolanan yumurtalardan 84 tanesinin analizleri depolamanın 15 gününde, geri kalan 84 yumurtanın ise analizleri depolamanın 30 gününde yapılmıştır. Çalışma sonucunda yumurta kalite parametrelerinden yumurta kabuğu kırılma mukavemeti, yumurta sarısı rengi, haugh birimi ve yumurta ağırlığı, farklı depolama sürelerinde gruplar arasında istatistiksel farklılık (P>0.05) göstermemiştir.

Anahtar Kelimeler: Yumurta Kalitesi, Mentha piperita, Haugh Birimi, Yumurta sarısı rengi, yumurta kabuğu kırılma mukavemeti.

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INTRODUCTION

Poultry sector is one of the vibrant sectors of livestock and plays a vital role in economy of any country. Poultry is a readily available source of protein food comparatively cheaper and easier to grow in short period of time. Although poultry sector is well developed but still there is need to strength it and make safer the poultry products for human health. Poultry products like eggs and meat are relishly consumed by all kind of people (adults and children). Layer farming is one of the major segments of poultry industry, raised for table egg production. Unlike the external quality of eggs, the internal quality of eggs starts to decline soon after laid by the hens. As eggs are produced in million numbers daily and it takes time till dissemination to the end consumers after undergoing the storage to avoid spoilage. The storage time and temperature have critical impact on the egg quality parameters (Samli et al. 2005) and the other important factors which affect the quality of egg can be genetics factors (Johnson and Merritt 1955) and age of the flock (Williams 1992) . The quality deterioration while storage, during distribution process, puts major loss on farmer and or less liking of eggs by the consumers. Quality of eggs can be measured by analyzing albumen quality as a standard criterion (Jin et al. 2011). Haugh unit is calculated by albumen thickness and weight of egg (Haugh 1937), can serve as another indicator of albumen quality (Jin et al. 2011). Albumen height or HU is maximum in the freshly laid eggs while decreases with increase in storage time (Jin et al. 2011). Changes in the egg quality parameters like HU, yolk color, egg shell breaking strength and others have direct link with moisture loss through shell pores by evaporation and also escape of carbon dioxide from egg albumen (Hinton 1968, Shenstone 1968, Robinson 1987). To prevent the egg quality losses during storage times, the use of herbal products could be a useful tool in the industry. Much focus have been given on the use of herbs and herbal products to improve performance and to some extent on the quality in freshly laid eggs but limited research data are available for the impact of herbs on the storage quality of eggs. Many herbal products (Extracts, essential oils or powders) have been use by many researchers and found positive effects of these products on performance parameters including egg production and quality (Aji et al. 2011, Rahimi et al. 2011, Khan et al. 2012). Effect of herbal extracts on egg quality traits, such as yolk composition, shell thickness or Haugh Unit, were reported in limited studies, whereas the majority of reports did not identify substantial effects (Nichol and Steiner 2008, Navid et al. 2013). Among these phytogenics, Mentha may have a good potential to be used in poultry. Mentha also known as mint belongs to family Lamiaceae (mint family) (Harley et al. 2004) and has many species (13-18) (Bunsawat et al. 2004). The chemical components of peppermint oil are menthol, menthone, 1,8-cineole, methyl acetate, methofuran, isomenthone, limonene, b-pinene, a-pinene, germacrene-d, trans-sabinene hydrate and pulegone (Leung 1980). Like other herbal products it has good impact on performance and immune status of poultry, especially in layers. Supplementation of mint in feed of broiler result in improved growth performance, FCR and immunity (Durrani et al. 2008) and spearmint extract may improve egg production, egg shell thickness and yolk weight. Pennyroyal (M. Pulegium) powder and its extract has positive influence on egg production performance, egg quality, blood biochemical and immunity parameters in laying hens (Paymard et al. 2013). Limited studies are available on the use of Mentha Piperita extract and its juice in laying hens regarding egg quality traits during storage conditions. Keeping in view the above points, the present study was designed to investigate the effect of Mentha Piperita extract and its juice on egg quality traits during storage in laying hens.

MATERIALS and METHODS

This study was conducted at the experimental animal farm of Afyon Kocatepe University under the Project approved by BAPK (15.SAĞ.BİL.23). The ethics committee of faculty of Veterinary Medicine approved the conduct of study under the case AKUHADYEK-455.15, 21.05.2015. For this study 252 Babcock white laying hens were procured from private Layer Farm. The age of the birds was 21 weeks. The birds were given 4 days adaptation and preparation period in the new research place. Total duration of study was 60 days (4 days adaptation period and 56 days experimental period). Birds were kept in cages and provided 16 hours light and 8 hours dark period during the whole study. Birds were divided into 7 random groups containing 36 birds in each group and then each group was further subdivided into 4 replicates containing 9 birds in each. A basal diet was formulated according the NRC (1994) recommendations to meet the bird's requirement. Group A served as control group and was provided basal diet. Groups B, C, and D were provided basal diet supplemented with mentha oil at the rate of 50mg/kg feed, 100mg/kg feed and 200mg/kg feed respectively. While the groups E, F and G was offered only basal diet but these groups were provided drinking water containing mentha juice at the rate of 50mg/L of water, 100mg/L of water and 200mg/L of water respectively. The mentha oil was procured from the commercial private company. Mentha juice was extracted by the blending of clean fresh mentha plant leaves and

filtered for the use in experiment. Mentha oil was mixed in the diet on the daily basis freshly along with sunflower oil to prevent any loss or oxidative spoilage. Similarly juice was also poured on daily basis in fresh drinking water. Ad libitum feed and fresh drinking water were provided during the whole trial period. Treatment protocol, ingredient composition of feed and its calculated and analyzed nutrient compositions are shown in table 1, 2 and 3 respectively. At the end of the study (56 days), 36 eggs from each group were collected randomly. Thus a total of 252 eggs were collected randomly. 84 eggs (12 from each group, 3 from subgroup) were analyzed on the same day (0day of storage) while remaining 168 eggs were stored at +4°C. Half (84) of the stored eggs (12 eggs from each groups by random collection, 3 from each subgroup) were analyzed for egg quality parameters like egg breaking strength (ORKA Egg Force Reader, EF 0468-2011), haugh unit, egg yolk color and egg weight (SANOVO Engineering Egg Analyzer, EA0333, Denmark) after 15 days of storage and remaining half of the eggs after 30 days of storage.

STATİSTİCAL ANALYSİS

Kolmogorov_Smirnov test was used to see the normality distribution of data. Logarithmic transformation was used on the data which did not show normality distribution. For independent variables, one way ANOVA was applied using Post Hoc with Bonferroni and Tamhane's T2 according to equality of variances. For dependent variables, to see statistical differences repeated measures ANOVA was used and post-hoc with Bonferroni and Tamhane's T2 according to equality of variances. To determine significance $P<0.05$ was used. Mean±SEM was showed in tables.

RESULTS

The results of the study showed that the egg shell breaking strength remained non-significantly different ($P>0.05$) in all groups at 0 day, 15th day and 30th day of storage, except group A which showed significantly reduced ($P<0.05$) value at day 15th of storage in among the group analysis with respect to time (Table 4). Similarly, the yolk color of eggs also showed no difference ($P>0.05$) in all groups during at 0 day, 15th day and 30th day of storage (Table 5). Haugh unit results also showed non-significant difference ($P>0.05$) between all the groups during 0 day, 15th day and 30th day of storage as compared with control group (Table 6). The results of egg weight also showed no change ($P>0.05$) in all groups as compared with the control group during the whole study at 0 day, 15th day and 30th day of storage (Table 7).

DISCUSSION

In the present study, egg shell breaking strength (ESBS) did not change significantly at 4°C storage temperature during 0, 15 and 30 days storage period as compared with control group between the groups as well as among the groups with reference to different time periods except in group A which showed significantly reduced ESBS at 15th day of storage while 0 day and 30th days ESBS remained same. This trend among group A might have no importance as other groups did not show any such pattern. It has been reported that egg shell weight and shell percentage decreased significantly with increase in storage time (Jin et al. 2011) at 5°C and 29°C temperature while no change was observed at 21°C temperature. Similar findings were published by Samli et al. (2005). In another study, it was reported that changes in shell weight were unclear with increasing storage time till 10 days (Silversides and Scott 2001). Likewise, in the present study no decrement in ESBS has been observed during different storage time at 0 day, 15th day and 30th day in supplemented groups. The yolk color (YC) results also showed no difference in mentha supplemented groups as compared with the non supplemented control group. It showed no effect of storage time on egg yolk color but in another study yolk color significantly decreased with increase in storage time in normal fed groups (Jin et al. 2011) at 5°C while similar to our results Maria Elena et al. (2006) demonstrated that yolk color was not change during different storage time periods at 4°C but changed negatively at 20°C. In the present study both control group and other mentha oil and juice supplemented groups did not show any change in egg yolk color during storage at different days. Haugh unit results also showed no significant difference in all the groups during different storage time periods of 0, 15 and 30 days. However, a prominent numerical difference in HU was seen at different storage times. The HU values showed numerically higher values among the groups during 15th and 30th day among the group when compared with reference to time of storage, but showed even no numerical or very less numerical difference in between the groups as compared with control group at different storage time periods. Similar to present study Jin et al. (2011) described that in normal fed laying hens, eggs HU did not change at 5°C with increase in storage time. Some other researchers (Samli et al. (2005, Tona et al. 2004, Akyurek and Okur 2009) also reported that HU did not change with increasing storage time at 5°C but can decrease dramatically at higher temperature. Egg weight also showed no change in all the treatments groups even between the groups and or among the group analysis at different storage time periods. Similarly, Jin et al. (2011) has reported no significant loss of egg weight with increasing

storage time till 10 days at 5°C and 21°C temperature in normal diet fed layers. Our results were also supported by the findings of Samli et al. (2005) and Akyurek and Okur (2009) who also reported no egg weight loss at 5°C temperature during storage of 10 days.The present study results showed no changes in egg quality traits. Like our study, available literature is also explaining that in normal diet fed laying hens, there is no effect of storage time at 4C temperature, but higher temperatures have detrimental effects on egg quality. Although enough data is available on the use of herbs and their products on egg quality traits of freshly laid eggs but no data is available for the use of herbal products on egg quality parameters analysis during different storage time periods. More research with multiple temperature and storage time frame is needed to investigate the effect of different dose levels of mentha oil and juice on egg quality parameters at higher temperature which is causing quality losses to eggs.

CONCLUSION

The result data from the current study indicated that supplementation of Mentha Piperita oil and its juice in the laying hen's diet had no significant effect on egg quality traits during storage for 15 and 30 days at 4°C. It is recommended to conduct more extensive research studies to explore the effect of this herbal product on egg quality parameters during prolonged storage at higher temperature which are more detrimental to egg quality traits.

Table 1. Dietary Treatment Protocol of different diets for different groups

Group	Treatment	Treatment
A (control)	Basal Diet	Normal water
B	Basal diet supplemented with mentha oil 50mg/kg feed	Normal water
C	Basal diet supplemented with mentha oil 100mg/kg feed	Normal water
D	Basal diet supplemented with mentha oil 200mg/kg feed	Normal water
E	Basal Diet	Drinking water supplemented with mentha juice 50mg/L
F	Basal Diet	Drinking water supplemented with mentha juice 100mg/L
G	Basal Diet	Drinking water supplemented with mentha juice 200mg/L

Table 2. Ingredient Composition of Feed (%)

Feed Ingredients	**Inclusion %**
Corn	52.0
Sunflower meal	8.1
Soybean meal	12.2
Full fat soya	12.0
Limestone	9.0
Meat and Bone meal	3.7
Sun flower oil	1.5
Vitamin -Mineral mix*	0.25
Methionine	0.15
Salt	0.3
Rovabio**	0.1
Rovaphos***	0.7

*Providedper kg of diet:Vitamin A:12.000.000 IU, Vitamin D3:3.000.000IU, Vitamin E:35.000, Vitamin K3:3.500 , Vitamin B1:2.750IU, Vitamin B2:5.500IU, Nicotinamid: 30.000IU,Ca-D Panthotenate: 10.000IU, Vitamin B6: 4.000IU, Vitamin B12-15IU, Folic acid:1.000IU, D-Biotin: 50IU,Cholin clorid:150.000IU, Manganese: 80.000mg, Iron: 60.000 mg, Zinc:60.000 mg, Copper:5.000 mg, Iodine:2.000 mg, Cobalt: 500 mg, Selenium: 150 mg, Antioxidant:15.000 mg, **Provided per kg of diet: 10 million IU Beta xylanase, 17.5 million IU Beta glucanase, ***Provided per kg of diet: 500.000 mg phytase

Table 3. Analyzed and Calculated Nutrient Composition of Feed on Dry Matter Basis

Nutrient	Analyzed (%)	Calculated (%)
DM	89.88	88.50
Ash	14.29	13.50
Fat	6.85	6.50
CF	5.3	4.60
CP	18.60	18.00
Starch	28.11	
Sugar	3.75	
ME (Kcal/kg)	2721.87	2800
Ca		4.00
P		0.44
Na		0.17
NFE	44.84	

Table 4. Effect of *Mentha Piperita* oil and its juice on egg shell breaking strength (ESBS) at 0, 15 and 30 days of storage.

Groups	ESBS 0 day	ESBS Initial (15th day)	ESBS Final (30th day)	P
A	55.99±1.84[a]	44.42±2.56[b]	49.10±2.73[a]	0.02
B	49.60±3.41	47.59±3.66	47.81±2.58	0.92
C	44.70±2.33	39.90±2.99	41.00±2.71	0.40
D	46.72±2.11	44.29±1.41	48.21±4.09	0.58
E	48.68±2.55	50.78±3.34	46.35±2.37	0.49
F	46.83±2.62	44.32±1.84	47.13±3.28	0.44
G	47.96±3.06	43.92±1.53	49.64±1.20	0.21
P	0.09	0.15	0.42	

Superscripts a,b,c indicates the significant differences ($p<0.05$) among the same group with respect to time.
A control, B supplemented with 50mg/kg, C with 100mg/kg of feed, D with 200mg/kg of feed, E 50mg/L, F 100mg/L and G 200 mg/L of drinking water

Table 5. Effect of *Mentha Piperita*oil and its juice on yolk color (YC) at 0, 15 and 30 days of storage.

Groups	YC 0 day	YC 15th day	YC 30th day	P
A	11.18±0.58	11.60±0.78	12.09±0.49	0.70
B	11.67±0.58	11.30±0.94	13.22±0.22	0.07
C	11.67±0.57	12.50±0.68	12.73±0.43	0.24
D	12.09±0.37	12.33±0.40	12.73±0.41	0.50
E	10.42±0.51	12.20±0.81	12.64±0.41	0.06
F	11.92±0.29	12.33±0.55	12.42±0.53	0.31
G	11.67±0.55	13.00±0.17	12.73±0.33	0.11
P	0.28	0.64	0.72	

A control, B supplemented with 50mg/kg, C with 100mg/kg of feed, D with 200mg/kg of feed, E 50mg/L, F 100mg/L and G 200 mg/L of drinking water

Table 6. Effect of *Mentha Piperita*oil and its juice on haugh unit value (HU) at 0, 15 and 30 days of storage.

Groups	HU 0 day	HU 15th day	HU 30th day	P
A	63.53±8.49	77.13±3.55	79.91±1.29	0.07
B	72.48±3.84	72.51±6.87	76.56±1.96	0.56
C	63.50±8.01	70.89±3.85	78.48±1.85	0.40
D	70.15±5.85	79.00±1.64	70.85±4.17	0.29
E	69.52±5.71	76.24±1.30	73.94±1.80	0.41
F	50.40±8.36	72.13±4.89	73.45±1.90	0.11
G	57.43±9.74	78.17±3.71	73.58±1.63	0.06
P	0.32	0.69	0.08	

A control, B supplemented with 50mg/kg, C with 100mg/kg of feed, D with 200mg/kg of feed, E 50mg/L, F 100mg/L and G 200 mg/L of drinking water

Table 7. Effect of *Mentha Piperita*oil and its juice on egg weight at 0, 15 and 30 days of storage.

Groups	0 day egg weight	15th day egg weight	30th day egg weight	p
A	58.95±0.87	59.52±1.76	58.08±0.73	0.47
B	58.74±0.70	61.16±1.73	59.12±0.97	0.67
C	61.26±0.99	63.88±3.44	61.67±1.05	0.38
D	61.61±1.24	64.42±1.76	58.30±1.27	0.70
E	59.78±0.74	58.44±1.03	60.78±1.28	0.40
F	61.67±1.42	62.39±2.70	62.09±2.55	0.34
G	58.39±0.85	59.99±1.40	58.20±1.24	0.16
P	0.08	0.24	0.22	

A control, B supplemented with 50mg/kg, C with 100mg/kg of feed, D with 200mg/kg of feed, E 50mg/L, F 100mg/L and G 200 mg/L of drinking water

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