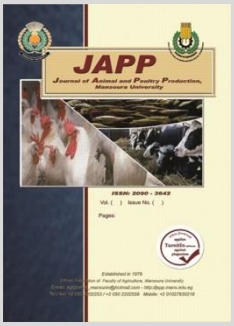
Journal of Animal and Poultry Production

Journal homepage: www.japp.mans.edu.eg
Available online at: www.jappmu.journals.ekb.eg

Effect of Dietary Addition of Chamomile Flower (*Matericaria chamomilla* L.) Powder on Productive Performance, Hatching Traits and Economic Efficiency of Sudani Duck Breeders

EL-Shhat, A. M.*; Mona A. Ragab; Soheir A. Shazly; Azza R. Fawzy and M. I. Seif-El Naser

Anim. Prod. Res. Inst., Agric. Res. Center, Minis. Agric. Dokki, Giza, Egypt.



ABSTRACT

A total of 261 Sudani ducks breeder (207 females and 54 drakes), 27-weeks old were used, weighed and divided into three experimental groups (each of three replicates) to investigate the effect of chamomile flower (*Matericaria chamomilla* L.) powder (CFP) addition at different levels (0, 1 and 3 g/kg diet) on productive performance, egg uniformity quality, hatchability and economic efficiency during the laying period. The results indicated that dietary CFP at level 1 g/kg significantly (P≤0.05) improved laying rate, egg number, egg mass, feed conversion ratio compared to the control group during the overall experimental period (27-39 weeks of age). In spite of, egg weight and egg uniformity, egg shape index, yolk index, haugh unit, yolk color score and hatchability percentage of fertile were not significantly affected by different levels of dietary CFP, while eggshell thickness was significantly increased. Feed consumption and fertile percentage of Sudani ducks were significantly decreased affected by levels of CFP. Economic efficiency was also improved for Sudani ducks fed diet supplemented with 1 g CFP/kg. From the obtained results, it could be concluded that dietary addition of 1 g CFP /kg for Sudani duck breeders during the laying period may be could improve productive performance, net revenue and the relative economical returns, besides reduce the feed consumption.

***Keywords*:** Chamomile flower powder, Sudani ducks, Productive and economic efficiency.

INTRODUCTION

Since ancient times, chamomile has been used as an herbal medication. It is still popular and it continue to use, because it contains different bioactive phytochemicals compounds that could provide some biological effects (Srivastava *et al*., 2010). Chamomile is used in various forms; dry powder of chamomile flower is suggested and traditionally used for established health problems. German chamomile (*Matericaria chamomilla* L.) is a standardized tea and herbal extracts are prepared from dried flowers of *Matricaria* species. It is one of the most widely medicinal plant used in the world (Singh *et al*., 2011). Different classes of bioactive constituents are present in chamomile, which have been used as medicinal preparations (Der and Liberti, 1988). Chamomile contains 0.24%–1.9% volatile oil, composed of a variety of separate oils. Around 120 secondary metabolites have been identified in chamomile, including 28 terpenoids and 36 flavonoids (McKay and Blumberg, 2000). The principal components of the essential oil extracted from *M. chamomilla* flowers are the terpenoids α-bisabolol and its oxide azulenes including chamazulene and acetylene derivatives (Pirzad *et al*., 2006). Other major constituents of the flowers include several phenolic compounds, flavonoids compounds such as apigenin, quercetin, and patuletin as glucosides, as well as various acetylated derivatives. Among flavonoids, apigenin is the most promising compound (Avallone *et al*., 2000).

There is more interest to use the herbal plants as potential alternative feed additives to promote growth of poultry. It has the advantages of being natural, safe, cheap and eco-friendly (Christaki *et al*., 2012). The chamomile is one of the most widely used medicinal plants in the world, because its pleasant taste and sedative effects (Srivastava *et al*., 2010). Traditionally, it has been also used for medicinal purposes as antioxidant, antimicrobial activities, anti-inflammatory action, antispasmodic and cholesterol-lowering activities due to their contents from flavones, a pigenin, essential volatile oil and chamazulene (McKay and Blumberg, 2000). The chamomile flower has positive effects on the digestive and respiratory systems, reduces stomach pain, it has an important role in enhancing immunity and reducing oxidative stress (Anderson, 2005). Khishtan and Beski (2020) recently demonstrated that dietary chamomile was reduced the negative impact of *Escherichia coli* on the gut integrity resulting in improvement of growth performance and immune system of broiler chicks.

Some previous studies like Ibrahim *et al*. (2014) and Gad *et al.* (2018) concluded that supplementing chamomile flower to ducks diet was decreased abdominal fat as compared to the control group. Al-Kassie and Khalel (2011) reported that chamomile flower could be used as a natural growth promoter in poultry diets for its antimicrobial properties. Abaza (2007); AL Haddad (2012) and Attia (2018) found that adding chamomile flower to laying diet improved egg production, egg weight and feed conversion ratio traits. Because of the financial returns and laying rate in demand for duck products such as hatchel eggs, ducklings' production has become more important in the poultry sector (Abd EL-hack *et al*., 2019). According to various reports of beneficial effects of chamomile on the performance of broiler chickens, and quail, while there is a lack of information on its effect on ducks breeder at least to our knowledge. Thus, the aim of the present research is to try to improve the productive performance of Sudani ducks breeder supplementing by

* **Corresponding author.**
E-mail address: abdelghany587@gmail.com
DOI: 10.21608/jappmu.2021.153596

chamomile flower (*Matericaria chamomilla* L.) powder (CFP) during the laying period.

MATERIALS AND METHODS

Birds and management:

The current research carried out at El-Serw Water Fowl Research Station, Damietta, Animal Production Research Institute, Agricultural Research Center, Egypt. It was conducted for 12 weeks through a completely randomized design, a total of 261 Sudani ducks breeder (207 females and 54 drakes), 27-weeks old were leg banded, individually weighed and randomly distributed into 3 treatments (each of 69 females and 18 drakes), each group of three replicates contains (23 females and 6 drakes). Averages of body weight for the 3 treatments were apparently uniform (average initial body weight was 1.54 kg). Live body weights were recorded at the beginning and at the end of the experiment. Ducks of each replicate were housed at stocking density 5.5 ducks /m^2 in an open system house equipped with fans and provided with outdoor area of the same dimensions. Lighting program was kept at 16 h. light/8 h. darkness per day, light schedule with 20 lux/m^2. The birds were kept under the same managerial, hygienic and environmental conditions. Mash feed and water were offered *ad-Libitum*. All the groups had the same basal breeder diet formulation based according to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001). It was formulated from plant origin and the ingredients and their amounts are presented in Table 1. The 1st treatment (T_1) was fed the basal diet and served as a control group, while the 2nd (T_2) and 3rd (T_3) treatments were fed the same basal diet inclusive of 1 and 3 g CFP /kg diet, respectively.

Table 1. The basal breeder diet composition and calculated analysis for laying Sudani ducks

Ingredients	%
Yellow corn	65.40
Soy bean meal (44% CP)	22.00
Corn gluten (60% CP)	3.30
Di-calcium phosphate	1.80
Limestone	6.70
Vit. & Min. premix[1]	0.30
NaCl	0.40
DL-Methionine (99%)	0.10
Total	100
Calculated analysis[2]	
Crude protein (CP, %)	16.82
Metabolisable energy (kcal / kg)	2807
Crude fiber (%)	3.18
Ca (%)	3.00
Available Phosphorus (%)	0.45
Lysine (%)	0.84
Methionine (%)	0.43
Methionine + Cysteine (%)	0.71
Na (%)	0.18
Feed price (EGP/kg)	5.84
The price of CFP (EGP/kg)	80.00

(1) Each 3kg of Vit. and Min. premix contains 10 million IU Vit. A; 2 million IU Vit. D3; 15 g Vit. E; 1.5 g Vit. K_3; 2 g Vit. B1; 5 g Vit. B2; 10 mg Vit. B12; 1.5 g Vit. B6; 60 g Niacin; 10 g Pantothenic acid; 1g Folic acid; 100 mg Biotin; 400 g Choline; 60 g Zinc; 4 g Copper; 0.4 g Iodine; 80 g Iron; 0.2 g Selenium; 60g Manganese; 0.1 g Cobalt; and carrier $CaCO_3$ to 3000 g; (2) According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001); CFP: Chamomile flower powder; EGP: Egyptian pound.

Productive performance:

Total egg number (TEN) was daily recorded and individually weighed to the nearest 0.01g for each replicate. Laying rate (LR) per each replicate for each period was calculated as;

$$\mathbf{LR}\ (\%) = \left(\frac{\mathbf{TEN}}{\mathbf{Total\ ducks}}\right) \times \mathbf{100}.$$

Egg Uniformity (EU, %) was defined as the percentage of eggs having weight values ranked in the range of ± 10% around the average weight of the treatment calculated according to North (1984). Feed consumption (FC) was weekly recorded, while egg mass (EM) was calculated by daily eggs weighting for each replicate then averaged and expressed per duck throughout the experimental periods (27-31, 31-35, 35-39 and 27-39 weeks of age. Feed conversion ratio (FCR, g feed/g eggs) was calculated through the same periods.

Egg quality measurements:

In the last week of the study, a total number of 90 eggs (30 from each treatment) were randomly collected for measuring egg quality traits, and weighed individually to nearest 0.01g. Egg width (EW) and egg length (EL) were measured using a digital caliper to the nearest 0.01 mm to calculate egg shape index (ESI) using the formula of Carter and Jones (1970);

$$\mathbf{ESI}\ (\%) = \left(\frac{\mathbf{EW}}{\mathbf{EL}}\right) \times \mathbf{100}.$$

Then, eggs were broken on table with a flat glass, yolk diameter measured by caliper, a 3- legged micrometer was used for measuring the height of yolk and albumen. Yolk index (YI) was estimated from ratio of yolk height to yolk diameter. Shell thickness (ST) was measured in three different parts (sharp, blunt and equatorial) by micrometer after it cleaned (Tyler, 1961). The Haugh unit (HU) were calculated for individual eggs using the following formula where, AH is albumin height (mm) and EW is egg weight (g);

$$\mathbf{HU}\ (\%) = \mathbf{100} \times \boldsymbol{log}\ (\mathbf{AH} + \mathbf{7.57} - \mathbf{1.7} \times \mathbf{EW}^{\mathbf{0.37}}).$$

Yolk color score (YCS) was visually assessed using the Roche Yolk Color Fans (Romanoff and Romanoff, 1949).

Hatching traits:

Hatching traits were measured by collecting hatching eggs for 5 consecutive days during the experimental period in three hatches at 37, 38 and 39 weeks of age. For each hatch, a total of 450 hatching eggs (150 eggs per each treatment) were collected and stored in a cold humid area. Eggs were numbered and weighed to the nearest 0.01 g by using an electronic balance before setting in the incubator. Egg trays were randomly distributed and set in the 'Econom' incubator system, multi-stages and incubated at 37.4 ºC and 62-65% relative humidity. Eggs had been turned every 1 h until they transferred to the hatching compartment at the 31th day of incubation. Fertile eggs were counted at the 14th day of incubation. The hatching compartment was kept at 36.9 ºC and 76-78% relative humidity until the end of hatching through incubation period. The healthy hatched ducklings were counted at the end of the incubation period. Both hatchability percentages of set and fertile (F) eggs were calculated. The hatched ducklings were individually weighed using an electronic pan balance that was accurate to 0.01 g.

Economic efficiency:

Economic efficiency was calculated according to the input-output analysis (Heady and Jensen, 1954) depending on the local market prices of the basal diet, CFP and the ducklings at hatch. Net revenue was calculated by subtracting total cost from total revenue. The relative economical returns were calculated in relative to the control group.

Statically Analysis:

All the obtained data were statistically analyzed using the general linear model procedure SAS (2003) using the following model;

$$Y_{ik} = \mu + T_i + e_{ik}$$

Where: Y_{ik} = an observation; μ = Overall mean; T= Effect of CFP supplementation level; I = (0, 1 and 3); and e_{ik} = random error. The significant differences among mean were tested by Duncan's multiple range test (Duncan, 1955). The percentage values were transferred to percentage angle using arcsine equation before subjected to statistical analysis.

RESULTS AND DISCUSSION

Productive performance:

The results in Table 2 indicated that addition of CFP has significant (P≤ 0.05) differences among different treatments in LR, TEN and EM at 31-35, 35-39 and 27-39 weeks of age. The highest values of LR, TEN and EM were observed in T_2 had compared to T_1 and T_3, respectively. While, ducks fed the high level of CFP 3 g /kg (T_3) had no significant effect.

In the present data, the increasing of LR, TEN and EM without consuming extra feed can be attributed to that the birds utilized the supplemented diets more efficiently; consequently, FCR was improved. In harmony with the current findings, Platel and Srinivasan (2001) concluded that some herbs stimulated pancreatic digestive enzymes (lipase, amylase and proteases) and enhanced the activities of terminal digestive enzymes of the small intestinal mucosa leading to an acceleration of the digestion and a reduction in feed transit time in the alimentary tract. The improvement of the productive performance of Sudani ducks breeder or the treatments that fed CFP may be due to increased immunity in the bird's body and a decrease in the intestinal content of harmful microorganisms and thus raising the level of health and vitality of birds, which is reflected in their productive performance (Al-Obaidi, 2005). These were in agreement with Abaza (2007); Hamodi (2007); Poracova *et al.* (2007a); Abd El-Galil *et al.* (2010) and Attia (2018) who concluded that supplementation of chamomile of laying diets increased LR, TEN and EM. Several previous studies did not record any significant effects on LR, TEN and EM due to supplementing laying diets with chamomile (Poracova *et al.*, 2007b; Abu Taleb *et al*., 2008; Marques *et al.*, 2010; Tenório *et al.*, 2017 and Behnamifar *et al.*, 2018). Generally, disagreement between the current results and previous studies may be related to the differences in herbal sources, bird species, type of materials either a powder, extract or oil and the herbal concentrations, as well as the variations in the experimental conditions.

There was no statistically significant difference in EU or egg weight among the three treatments during the all periods of the experiment. The present results were agreed with Abaza (2007); Hamodi (2007); Marques *et al.* (2010); AL Haddad (2012) and Behnamifar *et al* (2018) who demonstrated that chamomile flower inclusion to layer diet had no effect on egg weight. On the contrary to the current results, Poracova *et al.* (2007a); Abd El-Galil *et al.* (2010) and Attia (2018) found that supplementation of chamomile of laying diets increased egg weight.

Ducks fed diets supplemented with different levels of CFP had significant (P≤0.01) decreased FC in comparison with the control group (Table 2). The birds fed diets supplemented with 3 g CFP/kg (T_3) had the lowest (P≤0.05) FC compared to the other groups at all experimental intervals. It could be observed that the decreasing of FC is negatively related to the levels of CFP in the diet. It is likely that chamomile supplementation had effect on feed palatability depending upon the tannin concentration; it may decrease FC (Dada *et al.*, 2015). Low FC for T_3 may be attributed to the fact that high level of CFP (3g/kg diet) leads to improve feed digestibility and inhibiting pathogenic organisms in the intestine that leads to reduced FC rate for birds. The current result is in the same line with those of Abaza (2007) who noted a reduction in FC by laying hens as result of adding chamomile into the diets. However, Abd El-Galil *et al.* (2010); Galib and Khalel (2011) and Pandian *et al.* (2013) who stated that supplementation of chamomile to laying Japanese quail or Rhode Island Red chickens diets, respectively, significantly increased FC in comparison with the control. Several previous studies did not record any significant effects on FC due to supplementing laying diets with chamomile (Abu Taleb *et al*., 2008; Marques *et al.*, 2010 and Tenório, *et al.*, 2017).

Table 2. Effects of adding chamomile flower powder on productive performance of Sudani duck breeders

Age (weeks)	Chamomile flower powder level (g/kg diet)			Pooled SEM (±)	*P*-value
	0 (T_1)	1 (T_2)	3 (T_3)		
	Laying rate (%)				
27-31	49.66	46.26	41.93	2.64	0.1428
31-35	52.50 ^{ab}	57.90 ^{a}	47.92 ^{b}	2.05	0.0379
35-39	54.31 ^{b}	68.08 ^{a}	51.99 ^{b}	3.06	0.0266
27-39	51.50 ^{b}	57.41 ^{a}	47.24 ^{b}	2.24	0.0498
	Total egg number per duck				
27-31	13.190	12.95	11.74	0.74	0.1414
31-35	14.70 ^{ab}	16.22 ^{a}	13.42 ^{b}	0.57	0.0430
35-39	15.21 ^{b}	19.06 ^{a}	14.56 ^{b}	0.86	0.0305
27-39	43.26^{ab}	48.22 ^{a}	39.68 ^{b}	1.94	0.0482
	Egg Uniformity (%)				
27-31	67.14	67.40	63.40	4.77	0.7961
31-35	69.95	64.53	63.08	2.56	0.2204
35-39	79.00	77.28	80.81	2.09	0.5275
27-39	71.35	69.74	69.10	2.38	0.8027
	Egg Weight (g)				
27-31	64.77	62.10	63.57	0.73	0.1067
31-35	68.90	68.17	68.87	0.26	0.1585
35-39	71.37	70.93	71.53	0.10	0.0735
27-39	68.57	68.00	69.03	0.33	0.1606
	Egg mass per duck (g)				
27-31	900.61	804.37	746.34	**48.39	0.1135
31-35	1012.83 ^{ab}	1105.05 ^{a}	924.07 ^{b}	38.29	0.0466
35-39	1085.31 ^{b}	1332.17 ^{a}	1041.28 ^{b}	60.35	0.0329
27-39	2966.34 ^{ab}	3279.26 ^{a}	2739.22 ^{b}	122.89	0.0414
	Feed consumption per duck (g)				
27-31	4850.00 ^{a}	4649.00 ^{b}	4511.00 ^{b}	43.45	0.0043
31-35	4939.67 ^{a}	4885.67 ^{a}	4767.00 ^{b}	32.96	0.0256
35-39	5280.33 ^{a}	5131.67 ^{b}	5014.67 ^{b}	39.50	0.0091
27-39	15070.00 ^{a}	14666.33 ^{b}	14292.67 ^{c}	70.60	0.0007
	Feed conversion ratio (g feed/ g EM)				
27-31	5.39	5.78	6.04	0.37	0.2964
31-35	4.88 ^{ab}	4.42 ^{b}	5.16 ^{a}	0.21	0.0326
35-39	4.87 ^{a}	3.80 ^{b}	4.82 ^{a}	0.26	0.0465
27-39	5.08	4.47	5.22	0.20	0.1043

a, b: Means in the same row within each item bearing different superscripts are significantly different (*P*≤0.05); SEM: Standard error of mean.

Regarding the FCR, ducks fed diet supplemented with 1 g CFP/kg (T_2) had the lowest value (P≤0.05) of FCR in comparison with the other groups, it was observed that T_2 improved FCR by about 9.5 and 22.0% as compared to the control group during the periods 31-35 and 35-39 weeks of age, respectively as shown in Table 2. FCR is an indicator of how

much feed is used and converted into egg mass. The use of CFP improves FCR by inhibiting pathogenic organisms in the intestine, as well as it stimulates the thyroid gland hormones such as triiodothyronine and thyroxin, that acts as antimicrobial and fungal agents in the digestive system (Al-Mashhadani, 2007). The positive improvement of FCR in the CFP-treated groups may be related to the active compounds into CFP, which influence the gastrointestinal ecosystem mostly through inhibition of pathogenic microorganisms in the digestive system (Yarosh *et al*., 2006). Increasing production of digestive enzyme, improving utilization of digestion of digestive products and enhancing liver function (Patel *et al*., 2007 and Windisch *et al*., 2008). These results also agreed with Abd El-Galil *et al.* (2011); Attia (2018) who observed a significant improvement in FCR for the treatment with dietary CFP. Inversely, several previous studies did not record any significant effects on FCR due to supplementing laying diets with chamomile (Abaza, 2007; Abu Taleb *et al*., 2008; Tenório *et al.*, 2017 and Behnamifar *et al.*, 2018). No mortality was recorded among all treatments in the present study, and this may be due to the CFP and/or its bioactive components as a promising feed additive used in this experiment.

Egg quality traits:

Results in Table 3, shows the effect of dietary CFP on egg quality traits of Sudani ducks breeder. No significant differences were observed among the experimental groups in egg weight, ESI, YI, YCS, and HU. However, ST of eggs was significantly increased as a result of CFP addition to the diets. It could be observed that the thickening of eggs is positively related to the levels of CFP in the diet by about 7.9 and 10.6% as compared to the control group. The effect of CFP on egg quality traits was inconsistent, some results stated by previous researchers agreed with the presented data and others disagreed. These results were consistent with Abaza (2007); Hamodi (2007) and Behnamifar *et al.* (2018) who reported that adding chamomile flower to laying diet did not have any significant achievement on hens' egg quality traits. While, AL Haddad (2012) found that the addition of chamomile flower to layer diet significantly increased YI and YCS. In this respect, Attia (2018) also observed a significant improvement in YCS and ESI as result of adding chamomile into the diets of laying hens. Furthermore, Abd El-Galil *et al.* (2010) concluded that increasing level of dietary chamomile flower led to significantly increase of ESI in comparison with the control group. Meanwhile, YI was decreased by increasing level of dietary chamomile flower (Abd El-Galil *et al.*, 2010 and Attia, 2018).

Table 3. Effects of adding chamomile flower powder on egg quality traits of Sudani duck breeders

Parameters	chamomile flower powder level g/kg diet			Pooled SEM (±)	*P*-value
	0 (T_1)	1 (T_2)	3 (T_3)		
Egg weight (g)	70.85	70.62	71.21	0.12	0.2128
Egg shape index (%)	78.71	79.05	79.12	3.38	0.9591
Shell thickness (mm)	34.10 ^{b}	36.80 ^{ab}	37.70 ^{a}	03.43	0.0480
Yolk index (%)	41.70	42.29	41.60	3.54	0.8955
Yolk color score	7.00	6.80	6.60	0.60	0.3538
Haugh unit (%)	74.13	82.11	78.38	1.85	0.3362

a,b: Means in the same row within each item bearing different superscripts are significantly different (*P*≤0.05); SEM: Standard error of mean.

Hatching parameters:

Data in Table 4 shows that hatch of fertile and duckling weight at hatch were insignificantly affected by adding different levels of CFP in Sudani ducks breeder diet. While, fertility was significantly (P≤0.05) liner decreased by supplementing different levels of CFP than those in the control group (T_1). It could be observed that the fertility percentage was negatively related to the levels of CFP in the diet by about 4.0 and 14.7% as compared to the control group. It is may be attributed to the biological function of chamomile components such as phytoesterol activities (Gosztola *et al.,* 2006 and Saberi *et al*., 2014). The current findings are in the same line with those obtained by Behnamifar *et al.* (2018) who found a reduction in the fertility as a result of adding chamomile into diets of laying Japanese quails. Inversely with the current result herein, Abd El-Galil *et al.* (2010) stated that supplementation of chamomile to laying Japanese quail's diet significantly increased the fertility in comparison with the control group.

Table 4. Effects of adding chamomile flower powder on hatching parameters of Sudani duck breeders

Parameters	Chamomile flower powder level (g/kg diet)			Pooled SEM (±)	*P*-value
	0 (T_1)	1 (T_2)	3 (T_3)		
Fertility (%)	92.11^{a}	88.43^{a}	78.59 ^{b}	2.44	0.0303
Hatch of fertile (%)	73.76	77.58	72.48	3.13	0.5913
Duckling weight at hatch (g)	46.82	46.63	47.73	0.59	0.4239

a,b: Means in the same row within each item bearing different superscripts are significantly different (*P*≤0.05); SEM: Standard error of mean.

Body weight:

Body weight gain (BWG) of Sudani ducks breeder significantly changed, when fed diets supplemented with different levels of CFP in T_2 and T_3 had significant (P≤0.05) decreased with about 10.1 and 48.4%, respectively in comparison with the control group (Table 5). While, final body weight (FBW) was not significantly affected among all treatments. This effect may be due to the effective ingredients of chamomile, which reduce the lipid accretion by stimulating the bile acids secretion that reduces the intestinal fat absorption (Ibrahim *et al.*, 2014). However, diet supplemented with 5.0 g chamomile /kg had no effect on BWG of laying hen (Abaza, 2007). The current result is conflicted with those obtained by Hamodi (2007); Abd El-Galil *et al.* (2010) and Attia (2018) who found that both FBW and BWG significantly increased by increasing dietary levels of chamomile compared to the control group. The contradiction between the results might be due to the birds' age, species and tested chamomile sources or supplementation levels.

Table 5. Effects of adding chamomile flower powder on chang of body weight of Sudani duck breeders

Parameters	Chamomile flower powder level (g/kg diet)			Pooled SEM (±)	*P*-value
	0 (T_1)	1 (T_2)	3 (T_3)		
Initial body weight (g)	1534.40	1540.80	1541.07	32.33	0.9865
Final body weight (g)	1776.53	1758.40	1666.13	45.64	0.2629
Body weight gain (g)	242.13^{a}	217.60^{a}	125.06^{b}	23.30	0.0123
Chang of body weight (%)	15.75^{a}	14.12^{a}	8.12^{b}	1.41	0.0346

a,b: Means in the same row within each item bearing different superscripts are significantly different (*P*≤0.05); SEM= Standard error of mean.

Economics evaluation:

Data in Table 6 shows that Sudani ducks breeder fed 1 g CFP/kg diet (T_2) during the laying period results in the highest net revenue value (92.3 EGP) than the control group (63.5 EGP). Sudani ducks in T_2 improved relative economic efficiency (REE) with about 43.3% as compared to those in

T_1. While the high level of CFP (3 g/kg diet; T_3) had a lowest net revenue and REE. The highest net revenue value of Sudani ducks in T_2 may be related to the improvement of LR, FCR (Table 2). These results indicated that the diets containing CFP with level 1 g /kg (T_2) have highest REE than the other experimental diets. This is an improvement may be due to improve TEN, FCR and therefore reduce the cost of feeds by addition of CFP. These results are agreement with those obtained by Abaza (2007); Abd El-Galil *et al*. (2010) and Gad *et al.* (2018) who found that the economic efficiency was noticeable improved as a result of dietary addition of the chamomile flower.

Table 6. Economic efficiency of Sudani duck breeders fed basal diet supplemented with chamomile flower powder during the experimental periods (27-39) weeks of age.

Items	chamomile flower powder level (g /kg diet)		
	0 (T_1)	1 (T_2)	3 (T_3)
Feed consumption (kg)	15.07	14.67	14.29
Feed cost (EGP)	88.01	86.85	86.88
Egg number/duck	43.26	48.22	39.68
Egg available to incubate/duck[1]	41.10	45.81	37.70
Fertility (%)	92.11	88.43	78.59
Hatch of fertile (%)	73.76	77.58	72.48
Number of day-old ducklings[2]	27.92	31.43	21.47
Cost of hatching process[3] (EGP)	41.10	45.81	37.70
Total cost (EGP)[4]	187.78	190.56	182.50
Total revenue (EGP)[5]	251.28	282.87	193.23
Net revenue (EGP)	63.5	92.31	10.73
Economic efficiency (%)	33.82	48.44	5.88
Relative economic efficiency (%)	100.00	143.25	17.39

(1) The egg available to incubate was calculated as 95% of the total egg number.

(2) Number of day-old ducklings = egg available to incubate × Fertility × Hatch of fertile.

(3) Egg hatching cost was 1 EGP at the experimental time; EGP: Egyptian pound.

(4) Total cost = (Feed cost / 0.60) + Egg hatching cost. Where: Feed cost was calculated as 60% of the total cost.

(5) According to the local market price of 1 day-old duckling was 9 EGP at the experimental time.

CONCLUSION

Based on the currently results, it could be concluded that the diet included of CFP especially at 1 g/kg during the laying period of Sudani ducks breeder had positive effect on LR, EM, FCR and egg ST. These improvement related to CFP that reflected on feed utilization, as well as net return and economic efficiency of rearing Sudani ducks under Egyptian conditions. Therefore, we recommend the promising addition of CFP into the diet of Sudani ducks for raising the economic output.

REFERENCES

Abaza I. M. (2007). Effect of using fenugreek, chamomile and radish as feed additives on productive performance and digestibility coefficients of laying hens. Poult Sci., 27: 199-218.

Abd El-Galil, K.; Mahmoud, H. A.; Hassan, A. M. and Morsy, A. S. (2010). Effect of chamomile flowers meal as feed additives in laying Japanese quail diets on productive and reproductive performance. J. Anim. Poult. Prod., Mansoura Univ., 1:517 -533.

Abd EL-hack, M.; Hurtado, C.; Toro, D.; Alagawany, M.; Abdelfattah, E. and Elnesr, S. (2019). Fertility and hatchability in duck eggs. World's Poultry Science Journal, 75(4): 599-608.

Abu Taleb, A. M.; Hamodi, S. J. and El Afifi, S. H. F. (2008). Effect of using some medicinal plants (anise, chamomile and ginger) on productive and physiological performance of Japanese quail. Isotope & Radiative Research, 40:1061-1070.

AL Haddad, H. S. A. (2012). Effect of supplementing *Anthemis nobilis* (Chamomile) flower powder to diet of commercial layers on some egg quality traits. Tekrit Agric. Sci. J., 12: (4) 35-40.

Al-Kassie, G. A. M and Khalel, E. K. (2011). The potency of chamomile flowers (*Matericaria chamomilla* L.) as feed supplements (growth promoters) on productive performance and hematological parameters constituents of broiler. Int. J. Poult. Sci., 10:726-729.

Al-Mashhadani, H. E. (2007). Effect of supplemental chamomile flower powder to the diet on performance and microorganism in the duodenum and colon of laying hens and broilers. M.SC. Thesis. College of Agric., Univ. of Baghdad, Iraq.

Al-Obaidi, A. S. A. (2005). Effect of supplementing different levels of ground black seeds (*Nigella sativa*) on production and immunological traits and intestinal flora of broiler chickens. Ph.D. Thesis College of Agric., Univ. of Baghdad, Iraq.

Anderson, M. D. (2005). Herbal products, part 6 chamomile products. Pham. J. 191 – 193.

Attia, F. A. (2018). The influence of supplementing chamomile and turmeric powder on productive performance and egg quality of laying hens. Egypt. Poult. Sci., 38 (II): 451-463.

Avallone, R.; Zanoli, P.; Puia, G.; Kleinschnitz, M.; Schreier, P. and Baraldi, M. (2000). Pharmacological profile of apigenin, a flavonoid isolated from *Matricaria chamomilla*. Biochem Pharmacol., 59: 1387–1394.

Behnamifar, A.; Rahimi, S.; Torshizi M. A. and Zade Z. M. (2018). Effect of chamomile, wild mint and oregano herbal extracts on quality and quantity of eggs, hatchability, and some other parameters in laying Japanese quails. J. of Medicinal Plants and By-Products, 2: 173-180.

Carter, T. C. and Jones, R. M. (1970). The hen's egg shell shape parameters and their interrelations. Br. Poult. Sci., 11: 179-187.

Christaki, E.; Bonos, E.; Giannenas, I. and Paneri, P. F. (2012). Aromatic plants as a source of bioactive compounds - a review. Agri., 2:228-243.

Dada, R.; Toghyani, M. and Tabeidian, S. A. (2015). The effect of chamomile flower (*Matricaria chamomilla*) extract and powder as growth promoter on growth performance and digestive organs of broiler chickens. Res. Opinions in Animal and Vet. Sci., 5:290-294.

Der, M. A. and Liberti, L. (1988). Natural product medicine: A scientific guide to foods, drugs, cosmetics. Stickley, F. Co., George, Philadelphia, USA.

Duncan, D. B. (1955). Multiple range and multiple F-test. Biometrics.11:1-42.

Feed Composition Tables for Animals and Poultry Feedstuffs Used in Egypt. (2001). Technical Bulletin No., 1, Central Lab. For Food and Feeds Ministry of Agric. Res. Cent. Egypt.

Gad, H. A.; EL-Shhat, A. M. and Hamed, B. M. (2018). The effect of addition of chamomile flowers powder Sudani duckling diets during growing period on growth performance, blood parameters and economic efficiency. Egypt. Poult. Sci., 38 (III): 861-876.

Galib, A. M. A. and Khalel E. K. (2011). The potency of chamomile flowers (*Matericaria chamomilla* L.) feed supplements (growth promoters) on productive performance and hematological parameters constituents of broilers. Int. J. Poult. Sci., 10: 726-729.

Gosztola, A. B.; Nemeth E.; Kozak A.; Sarosi S. Z. and Szabo K. (2006). Comparative evaluation of Hungarian chamomile (*Matricaria recutita* L.) populations. 1st Int. Symp. on chamomile Research, Develop. and Prod., pp: 34.

Hamodi, S. J. (2007). The use of chamomile flowers (*Matricaria recutita*) in layer hens diet. Egyptian Journal of Nutrition and Feeds, 10 (2): 289-301.

Heady, E. O. and Jensen H. R. (1954). Farm management economics. Prentic-Hall, Inc. Englewood Clidds, New Jersey, USA.

Ibrahim, A. M.; El Ghamry, A. A.; El. Allawy, H. M. H.; Ali, F. A. F. and Magrabi, N. (2014). The effect of chamomile flower as feed additive on fat deposition in certain subcutaneous tissues, carcass quality and growth performance in Pekin duck. Global Veterinaria, 13 (5): 767-773.

Khishtan, A. T. M. and Beski S. S. M. (2020). Delivery route of chamomile on growth and subsequent physiology of broiler ckickens under *E. coli* challenge. Iraqi J. of Agric. Sci., 51(4): 1058-1073.

Marques, R. H.; Gravena, R. A.; Silva, J. D.; Hada, F. H; Silva, V. K; Munari, D. P. and Moraes, V. M. B. (2010). Chamomile herbal medicine as an additive for quails in the laying Rev. Bras. Saude Prod. An., 11(4): 124 - 998.

McKay, D. L. and Blumberg, J. B. (2000). A review of the bioactivity and potential health benefits of chamomile tea (*Matricaria recutita* L.). Phytother Res., 20:519–530.

North, M. O. (1984). Commercial chickens' production manual. 3rd edition. AVI Publishing Company Inc. Westport, Connecticut.

Pandian, C.; Sundaresan, A.; Omprakash, A. V., Babu, M. and Prabakaran, R. (2013). Effect of phytobiotics on production performance in Rhode Island Red (RIR) chicken. Indian J. Anim. Nutr., 30:188-190.

Patel, D. S.; Shula E. and Gupta, S. (2007). A pigenin and cancer chemprevention: Progress, potential and promise (review). Int. J. Oncol., 30: 233-245.

Pirzad, A.; Alyari, M. R.; Shaliba, S. and Zehtab-Salmasi, M. A. (2006). Essential oil content and composition of German chamomile (*Matricaria chamomilla* L.) at different irrigation regimes. J Agron., 5:451–455.

Platel, K. and Srinivasan, K. (2001). A study of the digestive stimulant action of select spices in experimental rats. J. Food Sci. and Technol., 38:358-361.

Poracova, J.; Blascakova, M.; Zahatnanska, M.; Taylorova, B.; Sutiakova, I. and Saly, J. (2007a). Effect of chamomile essential oil application on the weight of eggs in laying hens Hisex Braun. Acta Horticulturae., 749: 203-206.

Poracova, J.; Zahatnanska, M.; Blascakova, M.; Taylorova, B.; Sutiakova, I.; Tanishima, K.; Takabayashi, H. and Cheng, B.J. (2007b). Effect of chamomile essential oil on eggs production and weight of laying hens Hisex Braun. Acta Horticulturae., 749: 207-210.

Romanoff, A. L. and Romanoff, A. J. (1949). In "The Avian egg", John Wiley and Sons; Inc., New York, USA.

Saberi, H.; Jabri M. A.; Souli A.; El-Benna J. and Sakly M. (2014). Antidiarrheal and antioxidant activities of chamomile (*Matricaria recutita* L.) decoction extract in rats. J Ethnopharm., 152: 327-332.

SAS (2003). SAS user's guide statistics. SAS Institute Inc. Version 9.3. Cary, NC, USA.

Singh, O.; Khanam, Z.; Misra, N. and Srivastava, M. K. (2011). Chamomile (*Matricaria chamomilla* L.): An overview. Pharmacogn Rev., 5(9): 82–95.

Srivastava, J. K.; Shankar, E. and Gupta, S. (2010). Chamomile: A herbal medicine of the past with bright future. Mol Med Report., 3(6): 895–901.

Tenório, K. I.; Sgavioli, S.; Roriz, B. C. and Ayala, S. C. (2017). Effect of chamomile extract on the welfare of laying Japanese quail. Revi. Bras. Zootec., 46 (9):760-765.

Tyler, C. (1961). Shell strength: Its measurement and its relationship to other factors. Br. Poult. Sci. 16: 131-143.

Windisch, W.; Schedle, K.; Plitzner, C. Z. and Kroismayer, A. (2008). Used of phytogenetic products as feed additives for swine and poultry. J. Anim. Sci., 86: E140-E148.

Yarosh, D. B.; Galvin, J. W.; Nay, S. L.; Pena, A. V.; Canning, M. T. and Brown, D. A. (2006). Anti-inflammatory activity in skin by biomimetic of *Evodia rutaecarpa* extract from traditional Chinese medicine. J. Dermatol. Sci., 42: 13-21.

تأثير الإضافة الغذائية لمسحوق زهرة البابونج على الأداء الإنتاجي وصفات التفريخ والعائد الاقتصادي لأمهات البط السوداني

عبد الغنى محمد الشحات *، منى أحمد رجب ، سهير عبد النبي شاذلي ، عزه رفعت فوزي و محمد إبراهيم سيف النصر

معهد بحوث الإنتاج الحيواني ـ مركز البحوث الزراعية ـ وزارة الزراعة ـ الدقي ـ جيزة – مصر

أستخدم في هذه الدراسة عدد 261 من أمهات البط السوداني (207 أنثى و54 ذكر) عمر 27 أسبوع وذلك لدراسة تأثير إضافة مستويات مختلفة من مسحوق زهرة البابونج للعليقة (صفر، 1، 3 جم / كجم عليقة) على أداء الإنتاجي وصفات جودة البيض وتجانسه وصفات التفريخ والعائد الاقتصادي خلال فترة إنتاج البيض (عمر 27 -39 أسبوع). حيث تم وزن وتقسيم الطيور إلى ثلاث مجموعات تجريبية (69 أنثى و18 ذكر لكل مجموعة في ثلاث مكررات) وكذلك قسمت العليقة المستخدمة إلى ثلاثة أجزاء ليضاف إلى كل منها أحد المستويات المستخدمة من مسحوق زهرة البابونج المجففة وتم تقديمها للمجموعات التجريبية خلال فترة التجربة. أوضحت النتائج أن إضافة مسحوق زهرة البابونج للعليقة بمعدل 1 جم / كجم أدى إلى تحسن معنوي في كلا من معدل انتاج البيض وعدد البيض وكتلته ومعدل تحويل العلف بالمقارنة بمجموعة الكنترول. كما زاد صافي العائد وكذا الكفاءة الاقتصادية النسبية بإضافة مسحوق زهرة البابونج للعليقة بمستوى 1 جم/كجم مقارنة بمجموعة الكنترول. بينما انخفض استهلاك العلف ونسبة الخصوبة معنويا بإضافة المستويات المختلفة من مسحوق زهرة البابونج للعليقة بالمقارنة بمجموعة الكنترول. ولم تتأثر باقي الصفات المختبرة. ومن النتائج المتحصل عليها يمكن التوصية بإن إضافة 1 جم مسحوق زهرة البابونج/ كجم من علائق أمهات البط السوداني خلال فترة إنتاج البيض (عمر 27 -39 أسبوع) ذات تأثير إيجابي على معدل إنتاج البيض ووزن البيض ومعدل تحويل العلف وبالتالي تحسين الأداء الإنتاجي وصفات التفريخ فضلا عن تحسن صافي العائد والكفاءة الاقتصادية النسبية بجانب تقليل استهلاك العلف.