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# Effect of some feed additives (yeast, fenugreek seeds and chamomile flowers) on some behavioral patterns and productive performance in pigeons (*Columba livia domestica*)

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**ABSTRACT**

This work was carried out at the poultry farm-Animal production belonging to faculty of agriculture, Benha university through the period from April to the end of September 2019 to study the effect of some feed additives (Yeast, Fenugreek seeds and Chamomile flowers) on some behaviors and productive performance of parent pigeons using 16 pairs of hybrid pigeons (Carrier × local Egyptian Baladi) with age of 6 months, they were distributed according to their mating system (sex ratio 1:1). Pigeons were divided into 4 treatments each of them composed of 4 pairs and were reared under the same managerial conditions. The obtained results revealed that pigeons fed on Yeast had high frequency of feeding, drinking and sitting on eggs also, it increased length of incubation period while, decreased hatchability %. Fenugreek seeds had high frequency of preening and sitting on eggs but, it decreased the length of incubation period. Both Fenugreek and chamomile flowers improved hatchability %. From this work, it can be concluded that addition of some feed additives (Yeast, Fenugreek seeds and Chamomile) had the ability to improve behaviors, reproductive and productive performance of adult pigeons.

## 1. INTRODUCTION

In Egypt, domestic pigeons are reared and popularly reared with people due to the delicious taste of their meat that contains highly nutritive substances as protein, vitamins, calcium and iron (Bhuyan et al., 1999). Pigeons are unique birds in their mating and brooding behaviors as young squabs depends mainly on their parents for feeding and welfare. Pigeons have 2 nests that use them alternatively one for squabs and the other is built to start new cycle before ending the first one (Mohammed et al., 2016). Female pigeon reaches to sexual maturity at about 7 months, eggs are laid 8-12 days after mating and breeding cycle of pigeons are about 2 months. After 18 days of incubation 2 eggs hatch, the hatched squabs feed on special substance secreted from pigeon crop called crop milk. (Hu et al., 2016).

Natural feed additives are widely used in diet to improve performance, increase dietary protein, energy utilization and maintain health of birds (Abdel-Aal and Attia, 1993). Yeast (*Saccharomyces Cerevisiae*) is one of probiotics that widely used in animal and poultry feed, its cell wall contains mannan-oligosaccharide and fructo-oligosaccharide that suppress enteric pathogenic bacteria and improve immune system in poultry, so it improves performance through increasing the body weight and feed conversion ratio (Santin et al., 2001).

Fenugreek (*Trigonella foenum greacum*) is one of natural feed additives that used, seeds of it have therapeutic effect as hypoglycemic, anti-inflammatory, anti-microbial activity and act as an appetizer that help in digestion, so it improves performance through increasing in live body weight , body weight gain and feed conversion ratio (Xue et al., 2007). Chamomile (*Matricaria Chamomilla*) contains active compounds as flavonoids and coumarins, so it is used as natural anti-microbial agent and inhibit growth of harmful intestinal micro-organisms , addition of it in diet improves growth performance and feed conversion ratio (Abaza et al., 2003).

## 2. MATERIAL AND METHODS

The present study was carried out at research center at faculty of Agriculture, Benha University during the period from April to end of September 2019.

*2.1. Experimental design:*

This experiment was designed to estimate the effect of some dietary feed additives as yeast, Fenugreek (Helpa) seeds and Chamomile flowers powder on pigeon′s behavioral patterns and productive traits.

*2.2. Experimental diet.*

A basal experimental mash diet was formulated according to Abou Kashaba et al. (2009), the diet was contained 15.5 % protein level and 3200 Metabolizable energy (ME) Kcal/kg.

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Table 1 Composition of the basal diet.

| Ingredient | (%) |
|---|---|
| Yellow corn | 68.50 |
| Soybean meal .44% | 22.00 |
| Oil | 5.20 |
| Limestone | 1.40 |
| Bone meal | 2.30 |
| Common salt | 0.30 |
| Vit. & Min. mixture | 0.30 |
| Total | 100 |

*2.3. Birds:*

16 pairs of adult pigeons about 6 months old (the age was known from the owner of the farm) were divided into 4 treatment groups; each group contained 4 pairs (identification of pairs occurred through leg bands) according to its treatment as following

| Group | | Treatment |
|---|---|---|
| 1- | Control | Fed basal diet |
| 2- | Fenugreek seeds | As control + 2% fenugreek seeds |
| 3- | Yeast | As control + 2% dried yeast |
| 4- | Chamomile | As control + 2% chamomile flowers powder |

*2.4. Experimental procedure:*

Experimental period was about 6 months and divided as following:

The first month from the experimental period was given for adaptation of pigeons for place, feed, pair formation and ensuring their ability for production and reproduction, so data was collected for 5 months.

*2.5. Data collection and recording:*

*2.5.1. Behavioral observation and data collection:*

Behavioral observations were measured by using focal sample technique (Altmann, 1974) using a video camera that connected to a computer by using the I. spy program , the computer was located in a separated room away from the pigeons, so that the observer couldn't be seen by the pigeons. The recordings were saved on computer in such a way that the behavioral recordings could be analyzed later. Observations were carried out twice daily, the first period during morning started from 8-9 A.M and the second period during afternoon from 2-3 P.M for 3 for 3 un successive days/week.

The observed behavior was analyzed as following:

*2.5.1.1. Feeding*: Pigeon's head located inside the feeder (Zweers et al., 1981).

*2.5.1.1.2. Drinking*: Pigeon's head in contact with drinker (Grimminger, 1983).

*2.5.1.1.3. Preening*: Gently pecking or scratching its own feathers (Vriends, 1988).

*2.5.1.1.4. Sitting on egg*: Rate of males and females sitting on egg (according to Goodwin, 1983)

*2.5.1.1.5*. Productive performance of adult pigeons: Egg number, fertility % and hatchability % and incubation period (days) (Abo-Khashaba et al., 2009).

## 3. RESULTS AND DISCUSSION

Data presented in (table,2) showed that the effect of feed additives on frequency (by number) on feeding behavior of males and females in different groups. Frequency of feeding behavior in males after one month from the beginning of the experiment were 11±2.04, 17.25±2.02, 15.25±2.66 and 9.25±0.85 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that the frequency of feeding behavior was higher in Yeast group followed by Fenugreek, then by Chamomile compared with control group and there was a significant difference ($P<0.05$) between mean values.

Table 2 Effect of some feed additives (Yeast, Fenugreek and Chamomile) on feeding behavior in pigeons.

| Month | Group | Feeding behavior (Times) Males freq. | Females freq. |
|---|---|---|---|
| 1st month | Control | $11.00^{ab}$±2.04 | $10.75^{a}$±1.7 |
| | Yeast | $17.25^{a}$±2.02 | $11.00^{a}$ ±2.71 |
| | Fenugreek | $15.25^{ab}$±2.66 | $12.50^{a}$ ±1.55 |
| | Chamomile | $9.25^{b}$±0.85 | $7.25^{a}$ ±2.66 |
| 2nd month | Control | $19.75^{a}$ ±2.32 | $19.00^{a}$±0.82 |
| | Yeast | $13.00^{a}$ ±2.27 | $14.5^{bc}$±1.19 |
| | Fenugreek | $18.00^{a}$ ±3.34 | $11.00^{c}$±1.87 |
| | Chamomile | $15.00^{a}$ ±2.38 | $16.25^{ab}$±1.11 |
| 3rd month | Control | $10.75^{a}$ ±0.25 | $12.00^{a}$ ±1.87 |
| | Yeast | $13.25^{a}$ ±3.86 | $10.50^{a}$ ±1.94 |
| | Fenugreek | $19.25^{a}$ ±3.42 | $10.75^{a}$ ±2.81 |
| | Chamomile | $11.25^{a}$ ±1.65 | $7.25^{a}$ ±2.66 |
| 4th month | Control | $13.50^{a}$ ±2.06 | $11.75^{a}$ ±1.93 |
| | Yeast | $14.50^{a}$ ±4.25 | $11.75^{a}$ ±1.75 |
| | Fenugreek | $11.50^{a}$ ±1.71 | $10.75^{a}$ ±2.66 |
| | Chamomile | $15.75^{a}$ ±1.6 | $14.75^{a}$ ±2.84 |
| 5th month | Control | $55.00^{a}$ ±2.04 | $53.5^{a}$ ±4.66 |
| | Yeast | $58.00^{a}$ ±9.72 | $47.75^{a}$ ±3.86 |
| | Fenugreek | $64.00^{a}$ ±4.45 | $45.00^{a}$ ±4.02 |
| | Chamomile | $51.25^{a}$ ±2.39 | $45.5^{a}$ ±3.88 |

$^{a,b,c}$ Means with different superscripts in the same column differ significantly at ($p<0.05$).

These findings of Yeast were in an agreement with Vahdatpour et al. (2011) and Kumar et al. (2019), who explained that Yeast increased the feed intake due to active compounds of mannan-oligosaccharides that improved digestion and absorption of nutrients from the gut and disagreed with (Mohamed et al.2019 and Zhen et al .2019) who stated that Yeast had a decreased effect on feed intake.

Data of frequency of feeding behavior of females at the 1st month was 10.75±1.7, 11.00 ±2.71, 12.50 ±1.55 and 7.25 ±2.66 for Control, Yeast, Fenugreek and Chamomile groups, respectively and there was no difference between frequency of feeding behavior of females due to feed additives.

Frequency of feeding behavior in males at the 2nd month between different groups was 19.75±2.23, 13.00±2.27, 18.00±3.34 and 15.00±2.38 for Control, Yeast, Fenugreek and Chamomile groups, respectively and there was no difference between frequency of feeding behavior of males due to feed additives.

Data of Frequency of feeding behavior in females at the 2nd month was 19±0.82, 14.5±1.19, 11±1.87 and16.25±1.11 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that the frequency of feeding in females was higher in Chamomile followed by Yeast and Fenugreek seeds, respectively compared with control which had the higher value of feeding behavior and there was a significant difference ($P<0.05$) between different groups. These findings of chamomile coincided with Mahmmod (2013), but disagreed with Mahmmod et al. (2017), Behnamifar et al. (2018) and Attia (2018).

Data of frequency of feeding behavior in both males and females at the 3rd month showed that there was no difference in frequency of feeding due to feed additives between different groups. It was 10.75±0.25, 13.25±3.86, 19.25±3.42 and 11.25±1.65 for Control, Yeast, Fenugreek and Chamomile groups, respectively and data of frequency of feeding in females at the 3rd month was12.00±1.87, 10.50±1.94, 10.75±2.81 and 7.25±2.66 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Also, there was no difference in frequency of feeding of both sexes during the 4th month of the experiment due to feed additives. The Frequency of feeding in males was 13.50 ±2.06, 14.50 ±4.25, 11.50±1.71 and 15.75±1.6 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Data of frequency of feeding in females at the 4th month was 11.75±1.93, 11.75 ±1.75, 10.75±2.66 and 14.75±2.84 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

The same was recorded during the 5th month, the frequency of feeding in males was 55.00 ±2.04, 58.00 ±9.72, 64.00 ±4.45 and 51.25 ±2.39 for Control, Yeast, Fenugreek and Chamomile groups, respectively. Frequency of feeding in females at the 5th month was 53.5±4.66, 47.75±3.86, 45.00±4.02 and 45.5±3.88 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Data tabulated in table (3) showed that effect of feed additives on (frequency) of drinking behavior of pigeons.

The mean values of frequency of drinking behavior in males after one month from the beginning of the experiment were 3.00±1.22, 8.25±1.49, 5.25±1.8 and 3.50±0.87 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that frequency of drinking behavior was higher in Yeast followed by Fenugreek, then by Chamomile compared with control one and there was a significant difference ($P<0.05$) among groups. Mean values of frequency of drinking behavior in females among different groups were 1.75±1.18, 7.25±0.63, 5.50±0.65 and 3.50±1.19 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that frequency of drinking behavior was higher in Yeast followed by Fenugreek, then by Chamomile compared with control one and there was a significant difference ($P<0.05$) among groups due to feed additives.

These findings were in an agreement with former researchers (Vahdatpour et al., 2011; Kumar et al., 2019), who explained that Yeast increased feed intake, improved digestion, increased absorption of water and nutrient from the gut, maintained homeostasis, electrolytes of cells and improved enzymes activity, so all these processes need more water intake to complete its action.

During the 2nd and 3rd months of the experiment, presented data in table, 3 showed no difference between the control and the treatment groups in both sexes.

Frequency of drinking behavior in males at the 4th month among different groups was 6.25±0.63, 3.50±0.87, 4.00±0.58 and 4.00±0.58 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that the frequency of drinking behavior was higher in control followed by Fenugreek and Chamomile, then by Yeast and there was a significant difference ($P<0.05$) among groups due to feed additives. These results was in an agreement with Alloui et al. (2012) and Hamid (2018), who noted that Fenugreek had the ability to stimulate appetite (feeding and drinking) due to presence of galactomannan active compounds and disagree with Duru et al. (2013) and Whab et al. (2019), who said that F.S had a decreased effect for appetite.

Table 3 Effect of some feed additives (Yeast, Fenugreek and Chamomile) of drinking behavior in pigeons.

| Month | Group | Drinking behavior (Times) Males freq. | Females freq. |
|---|---|---|---|
| 1st month | Control | $3.00^{b}$±1.22 | $1.75^{c}$±1.18 |
| | Yeast | $8.25^{a}$±1.49 | $7.25^{a}$ ±0.63 |
| | Fenugreek | $5.25^{ab}$±1.8 | $5.50^{ab}$±0.65 |
| | Chamomile | $3.50^{b}$±0.87 | $3.50^{bc}$±1.19 |
| 2nd month | Control | $8.00^{a}$ ±1.35 | $5.00^{a}$ ±1.47 |
| | Yeast | $5.50^{a}$ ±1.04 | $6.25^{a}$ ±1.11 |
| | Fenugreek | $5.50^{a}$ ±1.85 | $7.50^{a}$ ±0.65 |
| | Chamomile | $6.00^{a}$ ±0.41 | $4.25^{a}$ ±0.75 |
| 3rd month | Control | $4.25^{a}$ ±0.48 | $4.00^{a}$ ±0.71 |
| | Yeast | $5.50^{a}$ ±1.66 | $4.25^{a}$ ±1.6 |
| | Fenugreek | $4.75^{a}$ ±1.11 | $5.75^{a}$ ±1.31 |
| | Chamomile | $3.50^{a}$ ±1.85 | $2.75^{a}$ ±0.48 |
| 4th month | Control | $6.25^{a}$ ±0.63 | $5.25^{a}$ ±0.48 |
| | Yeast | $3.50^{b}$±0.87 | $6.75^{a}$ ±2.39 |
| | Fenugreek | $4.00^{b}$±0.58 | $5.50^{a}$ ±0.87 |
| | Chamomile | $4.00^{b}$±0.58 | $5.25^{a}$ ±0.48 |
| 5th month | Control | $6.50^{a}$ ±1.04 | $8.25^{a}$ ±1.44 |
| | Yeast | $6.25^{a}$ ±1.75 | $7.00^{ab}$±0.71 |
| | Fenugreek | $3.25^{a}$ ±1.49 | $5.50^{ab}$±1.71 |
| | Chamomile | $2.50^{a}$ ±0.29 | $4.00^{b}$±0.71 |

$^{a,b,c}$ Means with different superscripts in the same column differ significantly at ($p<0.05$).

Frequency in females at the 4th month was 5.25±0.48, 6.75±2.39, 5.50±0.87 and 5.25±0.48 for Control, Yeast, Fenugreek and Chamomile groups, respectively and there was no difference in frequency of drinking due to feed additives.

In males during the 5th month, data revealed that there was no difference in frequency of drinking due to feed additives. The frequency of drinking in males at the 5th month was 6.50±1.04, 6.25±1.75, 3.25±1.49and 2.50±0.29 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Frequency of females at the 5th month was 8.25±1.44, 7.00±0.71, 5.50±1.71 and 4.00±0.71 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that the frequency of drinking behavior was higher in Yeast followed by Fenugreek, then by Chamomile compared with control that had the higher value and there was a significant difference ($P<0.05$) among groups due to feed additives. These findings were in an agreement with Shareef and Al-Dabbagh (2009), Vahdatpour et al. (2011) and Kumar et al. (2019).

Data tabulated in table (4) showed that the frequency of preening behavior of males and females among groups. There was no difference in the frequency of preening due to feed additives in both sexes at the 1st month, the frequency of preening was 16.25±3.84, 11.25±1.49, 9.00±1.58 and 13.25±1.44 for Control, Yeast, Fenugreek and Chamomile groups, respectively. Frequency of preening in females was 12.00±2.16, 11.5±1.94, 16.5±3.66 and 8.75±1. for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Frequency of preening in males during the 2nd month was 7.25±2.69, 10.00±4.38, 12.5±4.09 and 5.75±0.75 for

Control, Yeast, Fenugreek and Chamomile groups, respectively and there was no difference in frequency of preening due to feed additives. Frequency of preening in females at 2nd month was 6.50±1.32, 6.75±1.31, 14±4.24 and 5.00±0.71 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that the frequency of preening behavior was higher in Fenugreek followed by Yeast, then by Chamomile compared with control and there was a significant difference (P<0.05) among groups due to feed additives. These results come in an agreement with Alobaidy (2012), and El Shoukary and Mousa (2018), who said that fenugreek seeds had the ability to improve pigeon's behavior, welfare and increased displacement preening.

Data of frequency of preening in males at the 3rd month was 4.50±0.96, 10.00±2.12, 6.00±1 and 9.00±1.68 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that the frequency of preening behavior was higher in Yeast followed by Chamomile, then by Fenugreek compared with control and there was a significant difference (P<0.05) among groups due to feed additives. The highest result of yeast was in an agreement with Mahmoud and Mahmoud (2016), who noted that birds that present under stress and fed on probiotics showed an increase in frequency of preening and body care. Mean values of frequency of preening in females during the 3rd month were 6.00±0.58, 7.50±1.94, 6.00±1.22 and 6.25±0. for Control, Yeast, Fenugreek and Chamomile groups, respectively and there was no difference in frequency of preening due to feed additives. Data of frequency of preening in both sexes at the 4th month showed that there was no difference in the frequency of preening due to feed additives. In males, it was 7.25±1.44, 9.50±1.55, 7.75±2.75 and 4.50±1. for Control, Yeast, Fenugreek and Chamomile groups, respectively, while in females it was 5.25±1.44, 6.25±1.25, 7.75±1.65 and 4.25±0.85 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Table 4 Effect of some feed additives (Yeast, Fenugreek and Chamomile) on preening behavior in pigeons.

| Month | Group | Preening behavior (Times) Males freq. | Females freq. |
|---|---|---|---|
| 1st month | Control | 16.25$^{a}$±3.84 | 12.00$^{a}$ ±2.16 |
| | Yeast | 11.25$^{a}$ ±1.49 | 11.5$^{a}$ ±1.94 |
| | Fenugreek | 9.00$^{a}$ ±1.58 | 16.5$^{a}$ ±3.66 |
| | Chamomile | 13.25$^{a}$ ±1.44 | 8.75$^{a}$ ±1.31 |
| 2nd month | Control | 7.25$^{a}$ ±2.69 | 6.50$^{ab}$±1.32 |
| | Yeast | 10.00$^{a}$ ±4.38 | 6.75$^{ab}$±1.31 |
| | Fenugreek | 12.5$^{a}$ ±4.09 | 14$^{a}$ ±4.24 |
| | Chamomile | 5.75$^{a}$ ±0.75 | 5.00$^{b}$±0.71 |
| 3rd month | Control | 4.50$^{b}$±0.96 | 6.00$^{a}$ ±0.58 |
| | Yeast | 10.00$^{a}$ ±2.12 | 7.50$^{a}$ ±1.94 |
| | Fenugreek | 6.00$^{ab}$±1 | 6.00$^{a}$ ±1.22 |
| | Chamomile | 9.00$^{ab}$±1.68 | 6.25$^{a}$ ±0.75 |
| 4th month | Control | 7.25$^{a}$ ±1.44 | 5.25$^{a}$ ±1.44 |
| | Yeast | 9.50$^{a}$ ±1.55 | 6.25$^{a}$ ±1.25 |
| | Fenugreek | 7.75$^{a}$ ±2.75 | 7.75$^{a}$ ±1.65 |
| | Chamomile | 4.50$^{a}$ ±1.32 | 4.25$^{a}$ ±0.85 |
| 5th month | Control | 5.75$^{a}$ ±1.03 | 5.00$^{a}$ ±1.08 |
| | Yeast | 8.00$^{a}$ ±1.96 | 5.50$^{a}$ ±1.89 |
| | Fenugreek | 5.50$^{a}$ ±0.29 | 5.00$^{a}$ ±1.41 |
| | Chamomile | 7.00$^{a}$ ±0.91 | 6.25$^{a}$ ±0.63 |

$^{a,b,c}$ Means with different superscripts in the same column differ significantly at (p<0.05).

Frequency of preening in both sexes at the 5th month showed that there was no difference in the frequency of preening. In males, it was 5.75±1.03, 8.00±1.96, 5.50±0.29 and 7.00±0. for Control, Yeast, Fenugreek and Chamomile groups, respectively. While the frequency of preening in females was 5.00 ±1.08, 5.50±1.89, 5.00±1.41and 6.25±0.63 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Data in table (5) illustrated that during the 1st , 2nd , 3rd , 4th and 5th months of the experiment, there was no difference between the control and the treated groups in both sexes for sitting on egg due to feed additives.

Table 5 Effect of some feed additives (Yeast, Fenugreek and Chamomile) on sitting on egg in pigeons.

| Month | Group | Sitting on egg (Times) Males freq. | Females freq. |
|---|---|---|---|
| 1st month | Control | 2.25$^{a}$±1.03 | 4.00$^{a}$ ±0.58 |
| | Yeast | 0.50$^{a}$ ±0.29 | 2.25$^{a}$ ±1.03 |
| | Fenugreek | 1.25$^{a}$ ±0.95 | 2.50$^{a}$ ±1.89 |
| | Chamomile | 2.25$^{a}$ ±1.03 | 5.25$^{a}$ ±2.87 |
| 2nd month | Control | 3.00$^{a}$ ±1.78 | 4.00$^{a}$ ±2.35 |
| | Yeast | 6.00$^{a}$ ±0.91 | 8.00$^{a}$ ±0.71 |
| | Fenugreek | 6.75$^{a}$ ±2.29 | 8.25$^{a}$ ±3.2 |
| | Chamomile | 6.25$^{a}$ ±2.25 | 6.00$^{a}$ ±2 |
| 3rd month | Control | 6.00$^{a}$ ±0.41 | 7.25$^{a}$ ±0.75 |
| | Yeast | 4.75$^{a}$ ±1.11 | 9.00$^{a}$ ±1.78 |
| | Fenugreek | 3.25$^{a}$ ±1.18 | 6.75$^{a}$ ±1.55 |
| | Chamomile | 4.00$^{a}$ ±0.41 | 7.50$^{a}$ ±1.44 |
| 4th month | Control | 3.75$^{a}$ ±1.18 | 5.75$^{a}$ ±1.75 |
| | Yeast | 2.75$^{a}$ ±1.25 | 6.25$^{a}$ ±1.65 |
| | Fenugreek | 4.00$^{a}$ ±1.58 | 5.50$^{a}$ ±1.85 |
| | Chamomile | 2.75$^{a}$ ±0.63 | 4.75$^{a}$ ±1.18 |
| 5th month | Control | 3.25$^{a}$ ±1.7 | 3.50$^{a}$ ±1.19 |
| | Yeast | 3.75$^{a}$ ±1.11 | 4.50$^{a}$ ±0.65 |
| | Fenugreek | 2.75$^{a}$ ±1.38 | 2.75$^{a}$ ±1.38 |
| | Chamomile | 5.00$^{a}$ ±0.41 | 5.25$^{a}$ ±0.85 |

$^{a,b,c}$ Means with different superscripts in the same column differ significantly at (p<0.05).

Data tabulated in table (6) revealed that the effect of some feed additives on some productive performance in adult pigeons. The incubation period in the 1st cycle was 17.75±0.25, 18.25±0.25, 17.75±0.48 and 17.5±0.29 days and incubation period in 2nd cycle was 17.75 ±0.25,18.25 ±0.25 and 18.25 ±0.48 and 17.5±0.29 days for Control, Yeast, Fenugreek and Chamomile groups, respectively and there was no any significant difference in incubation period in 1st and 2nd cycles due to feed additives. Data cleared that the incubation period in the 3rd cycle was 17.25 ±0.48, 18.5 ±0.5, 18 ±0 and 17.5 ±0.29 days for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that the incubation period in 3rd cycle was increased in Yeast followed by Fenugreek, then by Chamomile and there was a significant difference (P<0.05) among groups due to feed additives. The increased incubation period of Yeast disagreed with (Abo-Khashaba et al .2009) who indicated that Yeast decreased egg laying period and egg cycle in pigeons. Decreased effect of Fenugreek seeds agreed with (Kassem et al., 2006; El Shoukary, 2016) who mentioned that Fenugreek had a short incubation period due to the effect of it on stimulation and release of FSH that increased rate of maturation and ovulation of eggs. Chamomile decreased incubation period, due to it contained essential oils and flavonoids that stimulate ovulation (Panda, 2005).

Regarding the fertility percentage in 1st cycle was 100±0, 75 ±14.43, 87.5 ±12.5 and 87.5 ±12.5, in 2nd cycle fertility percentage was 100±0, 87.5 ±12.5, 100±0 and 100±0 and in 3rd cycle fertility percentage was 87.5 ±12.5, 100 ±0, 100 ±0 and 100 ±0 for Control, Yeast, Fenugreek and Chamomile groups, respectively and there was no difference in the fertility % in 1st ,2nd and 3rd cycles due to feed additives.

Regarding the hatchability percentage it was 100 ±0, 75 ±14.43, 87.5 ±12.5 and 87.5 ±12.5 for Control, Yeast, Fenugreek and Chamomile groups, respectively and there was no difference in the hatchability percentage in 1st cycles due to feed additives. Data of 2nd cycle showed that hatchability percentage was 100±0, 75±14.43, 100±0 and 100 ±0 for Control, Yeast, Fenugreek and Chamomile groups, respectively. From the obtained results, it was observed that the hatchability percentage in 2nd cycle was increased in Fenugreek and Chamomile, then by Yeast and there was a significant difference (P<0.05) among groups due to feed additives. The effect of yeast disagreed with Abo-Khashaba et al. (2009), as it improved fertility and hatchability percentage. There was no difference in the hatchability percentage in 3rd cycle due to feed additives. It was 87.5 ±12.5, 100±0, 100±0 and 100 ±0 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Regarding the egg number there was no difference in egg number in 1st, 2nd and 3rd cycles due to feed additives. In 1st cycle was 2 ±0, 2 ±0, 1.75 ±0.25 and 2 ±0 in 2nd cycle was 2±0, 2±0, 2±0 and 2±0 and in 3rd cycle was 2 ±0, 2 ±0, 2 ±0 and 1.75 ±0.25 for Control, Yeast, Fenugreek and Chamomile groups, respectively.

Table 6 Effect of some feed additives (Yeast, Fenugreek and Chamomile) on some productive performance of adult pigeons.

| Cycle | Incubation period (Day) | | | |
|---|---|---|---|---|
| | Control | Yeast | Fenugreek | Chamomile |
| 1st cycle | 17.75a±0.25 | 18.25a ±0.25 | 17.75a ±0.48 | 17.50 a ±0.29 |
| 2nd cycle | 17.75a ±0.25 | 18.25a ±0.25 | 18.25a ±0.48 | 17.50 a ±0.29 |
| 3rd cycle | 17.25b ±0.48 | 18.50a ±0.50 | 18.00ab ±0.00 | 17.50 ab ±0.29 |
| | | Fertility % | | |
| 1st cycle | 100.00 a ±0.00 | 75.00a ±14.43 | 87.50a ±12.5 | 87.50a ±12.50 |
| 2nd cycle | 100.00 a ±0.00 | 87.5.00a ±12.50 | 100.00a ±0.00 | 100.00a ±0.00 |
| 3rd cycle | 87.50a ±12.50 | 100.00a ±0.00 | 100.00a ±0.00 | 100.00a ±0.00 |
| | | Hatchability% | | |
| 1st cycle | 100.00a ±0.0 | 75.00a ±14.43 | 87.50a ±12.50 | 87.50a ±12.50 |
| 2nd cycle | 100.00a ±0.0 | 75.00b ±14.43 | 100.00a ±0.00 | 100.00a ±0.00 |
| 3rd cycle | 87.50a ±12.5 | 100.00a ±0.00 | 100.00a ±0.00 | 100.00a ±0.00 |
| | | Egg number | | |
| 1st cycle | 2.00 a ±0.00 | 2.0a ±0.00 | 1.75 a ±0.25 | 2.00a ±0.00 |
| 2nd cycle | 2.00 ±0.00 | 2.0 ±0.00 | 2.00 ±0.00 | 2.00 ±0.00 |
| 3rd cycle | 2.00a ±0.00 | 2.0a ±0.00 | 2.00a ±0.00 | 1.75a ±0.25 |

a,b,c Means with different superscripts in the same raw differ significantly at (p<0.05).

## 4. CONCULOSIONS

From the obtained results, we can conclude that addition of some feed additives (Yeast, Fenugreek seeds and Chamomile flowers) had the ability to improve some behavioral patterns and productive performance of adult pigeons.

## 5. REFERENCES


1. Abaza, I. M., Asar, M.A., El-Shaarrawi , G.E. and Hassan, M.F. 2003. Effect of using Nigella seed, Chamomile flower, Thyme flower and Harmala seed as feed additives on performance of broiler. Egypt. J. Agric. Res. 81 (2), 735-749.
2. Abdel-Aal, E.S.M. and Attia, R.S. 1993. Characterization of black cumin (Nigella sativa) seeds Proteins. Alex Sci Exch. 14, 483-496.
3. Abou Khashaba, H.A., Mariey, Y.A., Ibrahem, M.A. 2009. nutritional and management studies on the pigeon: effect of selenium source and level on pigeons performance." Egypt Poultry Science. 29 (4), 971-992.
4. Alloui, N.S., Ben Aksa, M.N., Ibrir, F. 2012. Utilization of fenugreek (Trigonella Foenumgraecum) as growth promoter for broiler chickens. Journal of World Poultry Research 2(2), 25-27.
5. Alobaidy, R.N. 2012. Effect Of Fenugreek Seeds and Olive Leaves Ration Supplementation On Productive And Physiological Performance of Laying Breeder Hens (Isa Brown)," MSc Thesis, College of Agriculture and forestry, University of Mosul. Iraq.
6. Altmann, J. 1974. Observational study of behavior and sampling methods. behavior 49 (3/4), 227-267.
7. 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 (2), 451-463.
8. Behnamifar, A., Rahimi, S., Torshizi, M.A.K., 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. Journal of Medicinal Plants and By-products 2, 173-180.
9. Bhuyan, P., Nath, D., Hazarika, M. 1999. Influence of age and sex on nutritive value (proximate composition) of squab and pigeon meat. Indian Vet J 76, 530–532.
10. Duru, M., Erdoğan, Z., Duru, A., Küçükgül, A., Düzgüner, V., Kaya, A., Şahin, A. 2013. Effect of seed powder of a herbal legume fenugreek (Trigonella foenum-graceumL.) on growth performance, body components, digestive parts, and blood parameters of broiler chicks. Pakistan J. Zool., vol. 45(4), 1007-1014.
11. El Shoukary, R.D. 2016. Changes in some behaviors, welfare, performance and meat quality of pigeons in relation to heat stress and some feed additives. Ph. D Thesis, Faculty of Veterinary Medicine, Assiut University.
12. El Shoukary, R.D. and Mousa, M.A. 2018. The impact of some feed additives on behavior, welfare and performance of heat-stressed pigeon squabs. IOJPH - International open Journal of Applied Science 1(1), 15-29
13. Goodwin, D. 1983. Behavior in physiology and behavior of pigeon. (M. Abs, ed.) Academic Press, New York. Pp.285-303.

14. Griminger, P. 1983. Digestive system and nutrition . In physiology and behavior of pigeon (M. Abs, ed.) Academic press London New York, pp.19-39.
15. Hamid, H.H.A. 2018. Effect of Feeding of Adding Fenugreek Oil on the Performance and Blood Serum Profile of Broiler Chicks; M.S Thesis, Sudan University of Science and Technology College of Graduate Studies.
16. Hu, X.C., Gao, C.Q., Wang, X.H., Yan, H.C., Chen, Z.S. and Wang, X.Q. 2016. Crop milk protein is synthesized following activation of the IRS1/Akt/TOR signaling pathway in the domestic pigeon (Columba livia). Br Poult. Sci 57, 855–862.
17. Kassem, A., Al-Aghbaria A., AL-Haborib, M., Al-Mamary, M. 2006. Evaluation of the potential antifertility effect of fenugreek seeds in male and female rabbits. Contraception, 73, 301–306.
18. Kumar, S., Yadav, S.P., Chandra, G., Sahu, D.S., Kumar, R., Maurya, P.S., Yadav, D.K., Jaiswal, V., Ranjn, K. 2019. Effect of dietary supplementation of yeast (*Saccharomyces cerevisiae*) on performance and hemato-biochemical status of broilers; Indian Journal of Poultry Science 54 (1), 15-19.
19. Mahmmod, Z.A. 2013. The effect of Chamomile Plant (Matericaria chamomile L.) As Feed Additives on Productive Performance, Carcass Characteristics and Immunity Response of Broiler. International Journal of Poultry Science 12 (2), 111-116.
20. Mahmmod, Z.A., Abdulrazaq, H.S., Shokri, N.K., Sadiq, R.M. 2017. Influence of supplementation three type of Phytogenic plants in diet on growth Performance, intestinal microflora and immunity of Broiler Cobb-500. Journal of Zankoy Sulaimani 19– 2 (Part-A), 43-52
21. Mahmoud, F.A. and Mahmoud, M.E. 2016. Impact of a Probiotic (PROBAC Plus®) Supplementation on Behaviors and Biochemical Parameters of Broiler Chicken Exposed to Heat Stress. Global Veterinaria 16(6), 579-589.
22. Mohamed, R., Shukry, M., Balabel, T.A, El-bassiouny, A., Rehmani, M.I.A. 2016. Assessment of Plasma Prolactin and Nest Defense Behavior During Breeding Cycle of Pigeon (Columba livia domestica). J Environ Agric Sci 7, 19–22.
23. Panda, H. 2005. Handbook on medicinal Herbs with uses. Asia Pacific Business Press Inc. 106-E, Kamla Nagar, Delhi-110 007, India.
24. Santin, E., Maiorka , A., Macai , M., Grecco, M., Sanchez , J.C., Okada, T.M. 2001. Performance and intestinal mucosa development of broiler chickens fed dies containing Saccharomyces cerevisiae cell wall. J Appl Poult. Res 10, 236-244.
25. Shareef, A.M. and Al-Dabbagh, A.S.A. 2009. Effect of probiotic (Saccharomyces cerevisiae) on performance of broiler. Iraqi Journal of Veterinary Sciences, 23(1), 23-29.
26. Vahdatpour, T., Nikpiran, H., Moshaveri, A., Ahmadzadeh, A., Riyazi, S.R., Vahdatpour, S. 2011. Effects of active, inactive and compounded Saccharomyces cerevisiae on growth-related hormones and performance of Japanese quails (Coturnix Japonica). African Journal of Biotechnology 10 (67), 15205-15211.
27. Vriends, M.M. 1988. Pigeon: a complete pet owner's manual in the ring doves (Strepropelia risoria). Horm behav 19, 80 -86.
28. Xue, W.L., Li, X.S., Zhang, J., Liu, Y.H., Wang, Z.L. and Zhang, R.J. 2007. Effect of Trigonella foenum graecum (Fenugreek) extract on blood glucose, blood lipid and hematological properties in streptozotocin induced diabetic rats. Asia Pac J Clin Nutr 16(1), 422-426.
29. Zhen, Y.G., Zhao, W., Chen, X., Li, L.J., Lee, H.G., Zhang, X.F. and Wang, T. 2019. Effects of yeast culture on broiler growth performance, nutrient digestibility and caecal microbiota. South African Journal of Animal Science , 49(1):99-108
30. Zweers, G. A., van Pelt, H. C., Beckers, A. 1981. Morphology and mechanics of the larynx of the pigeon (*Columba livia* L.): A drill-chuck system (Aves). Zoomorphology 99(1), 37–69.