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EFFECTS OF NATURAL FEED ADDITIVES AND PROBIOTICS ON PRODUCTIVE PERFORMANCE AND MEAT QUALITY OF PIGEON

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Abstract: *The purpose of this paper is to evaluate the effects of Moringa oleifera, Fenugreek (Trigonella Foenum-Graecum) seeds and yeast (Saccharomyces cerevisiae) on pigeon performance, carcass traits, pigeon meat quality and composition. Twenty four pairs of parent local Egyptian Baladi pigeons (20-22 month-old) were used in the experiment. Live body weight (LBW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR) and Feed efficiency were reported. The birds were slaughtered at the end of experiment (90days) and carcass meat attributes and composition were recorded. The best LBW, BWG, FCR and Feed efficiency were noticed when feeding yeast (Saccharomyces cerevisiae), while the best carcass weights, carcass yields, head and liver weights resulted with Moringa oleifera feeding. Also, the best result for cooking loss percent reduction was occurred when feeding with Moringa oleifera. All treatments improved the microbiological quality of pigeon meat, in particular fenugreek when compared with control. All treatments had no significant effects on color, odor or pH. The highest protein content in pigeon meat was estimated with Moringa oleifera followed by fenugreek, while the best reduction effect on fat contents occurred with yeast feeding.Thus, natural feed additives and probiotics could improve pigeon productive performance and meat quality.*

Keywords: *Safe additives, Yeast (Saccharomyces cerevisiae), pigeon performance, pigeon meat*

1. Introduction

Pigeon meat is tasty and nourishing, but little is known about pigeon rearing and its meat quality. Pigeon meat is very rich in proteins and other nutrients and pigeons can be simply reared. Addition of probiotics and feed additives as herbs can be used instead of antibiotics to enhance the health, performance, carcass characteristics and meat quality of birds [1].

Moringa oleifera has many uses; it is used to prevent underfeeding in infants, as a good source of iron, applied in culinary uses, and also applied for medical uses as an alternative to antibiotic [2]. Fenugreek (*Trigonella Foenum-Graecum*); a famous plant which is rich in calcium and can be used as vegetable, herbs, or as spice and applied in medical uses to reduce blood sugar and to improve digestion [3]. So, *Moringa oleifera* and Fenugreek can be used as feed additives in pigeon feed as good source of protein and improve protein utilization. Probiotics are bacteria or yeasts that birds or animals can be fed with to improve their growth performance parameters traits. Yeast (*Saccharomyces cerevisiae*) has been known as feed additive for its contents of high quality protein as it includes lysine and vitamin-B complex. Also, yeast enhances immune response, intestinal development, feed conversion ratio and decreases the toxic effect of aflatoxins. Consequently, yeast

(*Saccharomyces cerevisiae*) has good application in medicinal purposes [4].
The aim of this study is to evaluate the effects of addition of *Moringa oleifera*, Fenugreek (*Trigonella Foenum-Graecum*) and yeast (*Saccharomyces cerevisiae*) on pigeon performance, carcass characteristics and pigeon meat quality and composition when added to pigeon diet.

2. Materials and method

A total of 24 pairs of Parent local Egyptian Baladi pigeons (20-22 month-old), with an original average body weight of 330 ± 9 g were employed in this experiment (sex ratio of pigeons 1:1). Pigeon divided into four treatments of 6 pairs each (3 replicates of 2 pairs each). Birds were reared in the laboratory animal house in the Faculty of Veterinary Medicine, Assiut University, Assiut, Egypt. The birds housed in identical environmental conditions and rooms (4×4 m^2 floor and 6 m height). Feed was inhibited 8 hours before slaughter, but birds were watered till slaughtered.

2.1. *Treatments*

The four treatments were: 1) basal diet (control) (Table 1), 2) basal diet + 2% *Moringa oleifera*, 3) Basal diet +2% Fenugreek (*Trigonella Foenum-Graecum*) seeds, and 4) basal diet + 2% yeast (*Saccharomyces cerevisiae*). The basal diet was prepared according to Abou Khashaba et al [5]. Live body weight (LBW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR) and Feed efficiency (inverse of feed conversion ratio) were recorded weekly till the end of experiment (90days).
The birds were slaughtered at the end of experiment, scalding in hot water at 85°C, directly after slaughter. Carcass weight was calculated after head removal and evisceration. Also, weights of head, heart, liver and gizzard were recorded. In addition, the carcasses were kept frozen till pH, cooking loss, sensory and microbiological analyses were carried out.

Table 1
Composition and chemical analysis of the basal diet

Ingredients%	
Yellow corn	68.50
Soybean meal,44 %	22.00
Oil	5.20
Limestone	1.40
Bon meal	2.30
Common salt	0.30
Vit. & Min. mix.*	0.30
Total	100
Calculated values	
Raw protein, %	15.51
ME Kcal/kg	3201.36
Raw fiber,%	3.183
Ether Extract,%	2.813
Calcium, %	1.346
Available phosphorus, AP %	0.403
Lysine, %	0.806
Methionine,%	0.280
Methionine + cysteine %	0.533
C/P ratio	1/212

*Vit. & Min. mix: each 1kg contains: 10,000 IU Vit. A; 2,000 IU Vit D3 10 mg Vit. E; 1mg Vit. K; 1mg Vit. B1; 5mg Vit. B2; 1,5mg Vit B6; 0.1mg Vit. B12; 0.3mg; Niacin, 10 mg ; Panatothenic acid, 0.5 mg, Biotin; I mg Folic acid;250 mg choline chloride; 60 mg manganese; 30 mg iron; 50 mg zinc; 4 mg copper;0.3 mg iodine; 0.1 mg Seleinium and 0.1mg cobalt.** Calculated according to **NRC** [6].

2.2. *Carcass yield*

The birds slaughtered and the carcasses were weighed without head, neck, feet or viscera to give carcass weight. Carcass yield (dressing %) is the relation of the carcass weight to the live body weight (LBW) [7].
Carcass yield= carcass weight/ LBW × 100

2.3. Sensory analysis

Sensory analysis was carried out by using nine-point-hedonic scale for odor and color [8].

2.4. pH measurement

Ten grams of meat sample added to 100 ml of distilled water after slaughter for one hour. (Adwa two points pH calibration, Romania) [9].

2.5. Cooking loss

The sample was weighed at room temperature and placed at 80°C for 45 minutes then cooled at room temperature and it was weighed once again to calculate cooking loss [8].

Cooking loss= initial weight of sample-weight of sample after cooking/ initial weight of sample × 100

2.6. Microbiological analysis

Carcasses were rinsed by 100 ml of distilled water and ten-fold serial dilutions were prepared and plating on standard plate count agar for aerobic bacterial count, Violet red bile agar (VRB) for coliforms count, and Eosin methylene blue agar(EMB) for detection of *E.coli* count. The plates were incubated at 35±2 °C for 24-48 hours [10].

2.7. Chemical Analysis

The pigeon samples were analyzed for moisture, protein, fat, and ash contents according to the AOAC methods [11].

2.8. *Statistical analysis*

Data were analyzed using one way ANOVA with SPSS 13.00 software (SPSS Inc., Chicago, IL, USA).

3. Results and discussion

3.1. *Performance*

As shown in Table 2, performance effect of Moringa and Fenugreek improved feed intake as compared to yeast, but with less weight gain. This result is in accordance with Sanchez et al. [12] who found that an increased level of *Moringa oleifera* in the diet enhanced the feed intake and digestibility of the diet.

The authors owed the improvement in the feed conversion ratio and weight gain when feeding Moringa due to its high nutrient contents.[2] In contrast to Gakuya et al. [13] who found that feeding broiler with *Moringa oleifera* above 7.5% caused reduction in feed intake. Also, feeding fenugreek recorded high feed intake which in agreement with Elagib et al. [14] as a result of its high contents of galactomannan that improve appetite and digestion. There is a significant increase in body weight in control and treatments till the second month, then the weight continued to increase only with yeast feeding in the third month compared with control. The best overall mean body gain was observed when feeding with yeast followed by moringa. The best feed conversion ratio was recorded when feeding with yeast (*Saccharomyces cerevisiae*); which indicates less feed consumed to gain one kilogram per body weight, by comparing with other treatments and control. This result is in accordance with Paryad and Mahmoudi [15], who found that the addition of 1.5% yeast to the diet of broiler caused body weight gain and feed conversion ratio getting better. Also, Hosseini [16] and Onifade [17] observed that feeding broiler with yeast advanced body weight and feed conversion. In addition, Rutz et al. [18] reported that feeding with yeast extract enhanced the growth performance of broiler and accredited this to the effects of the nucleotide contents in yeast extract and to the occurrence of glucans/mannan/ fructo- oligosaccharides in yeast. On the other hand, Duru et al. [3] established that feeding of broiler chicks with higher levels of fenugreek (20 and 40g/kg) negatively affect the feed efficiency ratio and the weight gain.

3.2. *Carcass parameters*

Moringa showed an improving effect on the carcass yield (dressing %), while yeast and fenugreek showed lower carcass yield

than the control (Table 3). Qwele et al. [19] reported that addition of *Moringa oleifera* to broiler finisher ratio with or without corn maize increased carcass weight. Also, Hosseini [16] found that addition of yeast caused reduction in the carcass weight, and somewhat similar result was recorded by Onwurah and Okejim [20] who found that levels of yeast at 1.5g/L and 2 g/L in water for broiler chicken gave dressing percentage of 64.51 and 69.13, respectively. On the other hand, Elagib et al. [14] found that feeding of broiler chicks with fenugreek gave dressing percentage of 69, while cinnamon and ginger gave dressing percentage of 72.05 and 73.65, respectively. Also moringa had significantly improved head and liver weights than other treatments. These results showed similarity to Sarker et al. [2] who revealed that addition of *Moringa oleifera* to nourish commercial chicken broiler significantly improved heart and liver weights and dressing percentages.

Table 2

Effect of *Moringa oleifera,* Fenugreeks seed, and yeast (*Saccharomyces cerevisiae*) on pigeon performance

Parameters	control	*Moringa oleifera*	Fenugreeks seed	Yeast
Feed intake (kg)				
1st month	0.65 ± 0.03 b	0.97 ± 0.03 a	0.85± 0.01 a	0.55 ± 0.02 b
2nd month	0.50 ± 0.05 b	0.85 ± 0.11 a	0.75 ± 0.01 a,b	0.50 ± 0.03 b
3rd month	0.49± 0.02 b	0.85± 0.06 a	0.74 ± 0.06 a	0.65± 0.08 b
Monthly FI of a replicate	0.53± 0.02 b	0.89 ± 0.05 a	0.78 ± 0.03 a	0.55 ± 0.03 b
Total FI	1.64 b	2.67 a	2.34 a	1.7 b
Body weight (kg)				
1st month	1.36 ± 0.03	1.37 ± 0.008	1.37 ± 0.005	1.37± 0.01
2nd month	1.38± 0.023 b	1.44± 0.01 a,b	1.55± 0.02 a	1.44± 0.012 a,b
3rd month	1.40 ± 0.03 a,b	1.38 ± 0.02 b	1.37 ± 0.02 b	1.50 ± 0.01 a
Over all (mean)	1.38 ± 0.01 b	1.39 ± 0.02 b	1.43 ± 0.02 a	1.44 ± 0.01 a
Body gain (Kg)				
1st month	0.03± 0.0002 c	0.08± 0.002 a	0.07 ± 0.002 a,b	0.06± 0.0007 b
2nd month	0.02± 0.013 c	0.07±0.005 b	0.18± 0.003 a	0.07±0.006 b
3rd month	0.02± 0.02 b	-0.06± 0.001 c	-0.18± 0.013 c	0.06±0.009 a
Monthly BWG of a replicate (mean)	0.02± 0.012 c	0.03± 0.003 b	0.02± 0.006 c	0.06± 0.003 a
Total BWG for a replicate	0.07 c	0.09 b	0.07 c	0.19 a
FCR	23.4	29.7	33.4	8.9
Feed efficiency	4.3 b	3.4 b	3 b	11.2 a

a, b, c - differences between means in the same row with different letters are significantly different (P<0.05).

Table 3

Effect of *Moringa oleifera,* Fenugreeks seed, and yeast on carcass and organ characteristics of pigeon

Parameters	Control	*Moringea oleifera*	Fenugreeks seed	Yeast
L.B.W(g)	343.5 ± 32.6	340 ± 23.5	330± 3.41	335.5± 10.61
Carcass weight(g)	245 ± 39.5 a	255 ± 28.26 a	212.5 ± 1.02 b	220 ± 10.31 b
Carcass yield %	71.3 b	75 a	64.4 c	65.6 c
head(g)	16.5 ± 0.28 b	17 ± 1.09 a	16.2 ± 0.21 b	15 ± 0.92 c
heart(g)	3.06 ± 1.49	3.83± 0.13	3.12 ± 0.19	3.24 ± 0.04
liver(g)	6.45 ± 0.69 a,b	7.01 ± 0.89 a	6.81 ± 0.62 a,b	5.81 ± 0.22 b
gizzard(g)	6.73 ± 1.54	6.43 ± 0.52	7.45 ± 0.55	7.21 ± 0.52

a, b, c - differences between means in the same row with different letters are significantly different (P<0.05)
Values are means of replicate

3.3. *Meat quality*

The effects of treatments on pH, color or odor were non-significant. This is in agreement with Loddi et al. [21] when reported that addition of any of probiotics or antibiotics did not affect the sensory characters of broiler meat. Higher cooking loss observed in fenugreek and yeast, but non-significant in the case of moringa as compared with the control. On the contrary Qwele et al. [19] recorded that the addition of moringa lowered the cooking loss of broiler breast meat. Alternatively, Milewski and Zaleska [22] found that the addition of *Saccharomyces cerevisiae* dried yeast to lamb feed had no effect on the cooking loss percent. Also, Pelicia et al. [4] observed that feeding yeast with prebiotics to free-range broiler chicken increased the cooking loss percent, but decreased pH of broiler meat. Feeding with fenugreek gave the best reduction effect on APC, coliforms and *E.coli* counts, followed by Moringa and yeast as compared with control. The result is in agreement with Sharma et al. [23] who found that fenugreek had a reduction effect on *E.coli* and ascribed this to its flavonoids and phenol contents which have antibacterial and antioxidants effects (Table 4).

Table 4

Effect of *Moringa oleifera*, Fenugreeks seed, and yeast on sensory, physicochemical and microbiological quality of pigeon meat

Treatments	Color	Odor	pH	Cooking loss (%)	APC (CFU/ml)	Coliforms (CFU/ml)	*E.coli* (CFU/ml)
Control	7.4	7.2	6.7	22^{b}	$1.7x10^{6a}$	$1x10^{3}$	1x10
Moringa oleifera	7.6	7.2	6.7	26^{b}	$2.3x10^{4b}$	<10	<10
Fenugreeks seeds	7.4	7	6.6	37^{a}	$1.6x10^{4b}$	<10	<10
Yeast	7.6	7.2	6.7	32^{a}	$5.8x10^{4b}$	$1x10^{2}$	1x10

a, b, c - differences between means in the same column with different letters are significantly different (P<0.05)

3.4. *Chemical analysis*

As shown in Table 5, yeast has the best effect on decreasing fat contents which is good for heart diseases prevention, but had no significant effect on protein contents.

These findings are in contrast to Milewski and Zaleska [22] who reported that the addition of *Saccharomyces cerevisiae* dried yeast in lamb ration increased fat contents, but in agreement that no effect on protein contents as compared to control. *Moringa oleifera* has a good effect on the increase in protein content and decrease in fat contents as compared with the control. Also, fenugreek caused increase in the protein contents. As well, the authors reported that moringa and fenugreek are considered good sources of protein [2, 3].These results are in compliance with Khaksefidi and Rahimi [24] who recognized that the addition of probiotics to chicken broiler diet improved the protein and moisture content in meat.

Table 5

Effect of *Moringa oleifera*, Fenugreeks seed, and yeast on proximate composition of pigeon meat

Treatments	Moisture%	Protein%	Fat%	Ash%
Control	$71.90 \pm 2.34^{a,b}$	18.54 ± 1.51^{b}	7.30 ± 1.73^{a}	2.12 ± 0.31^{a}
Moringa oleifera	$72.22 \pm 2.57^{a,b}$	19.71 ± 1.91^{a}	6.43 ± 1.46^{b}	1.52 ± 0.57^{b}
Fenugreeks seeds	71.19 ± 2.24^{b}	19.52 ± 1.64^{a}	7.42 ± 1.57^{a}	$1.77 \pm 0.58^{a,b}$
Yeast	73.15 ± 2.78^{a}	18.82 ± 1.74^{b}	5.95 ± 1.84^{b}	$1.96 \pm 0.54^{a,b}$

a, b, c - differences between means in the same column with different letters are significantly different (P<0.05)

4. Conclusion

Addition of yeast (*Saccharomyces cerevisiae*) to pigeon diet could improve pigeon performance (LBW, BWG, FCR and Feed efficiency), while *Moringa oleifera* enhanced some carcass traits (carcass weights, carcass yields, head and liver weights). Also, *Moringa oleifera* reduced the cooking loss percent. All treatments, in particular fenugreek improved the microbiological quality of pigeon meat when compared with control, but had no significant effects on color, odor or pH. The highest protein contents in pigeon meat were estimated with *Moringa oleifera* followed by fenugreek**,** while the best reduction effect on fat contents occurred with yeast feeding. So, these natural feed additives and probiotics could improve pigeon performance, carcass traits and meat quality and composition when added to pigeon diet.

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