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Research Article

Effect of Fenugreek and Yeast Additions to Japanese Quail Diet on Digestibility and Economical Responses

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Abstract

Four hundred fifty one day old, unsexed growing Japanese quail were distributed into 6 treatment groups to evaluate the effect of adding some additions at different levels, 0.5 or 0.1% of fenugreek seeds (FS), 0.5 or 1% of yeast culture (YC) and 0.5 plus 0.5% mixture of FS plus YC to Japanese quail diet, on digestibility and economical efficiency responses. Each treatment group contained 3 replicates, of 25 birds. The control diet had no additions. At the end of 6 weeks of age, a digestion trial was done to calculate the digestibility of nutrients. The economical efficiency was calculated by Egyptian pound (L.E) according to the prices of year 2015. The data revealed that, birds fed dietary 1% YC recorded the best (P≤0.05) value of dry matter digestibility followed by birds fed dietary 0.5% YC compared with other dietary treatments. Moreover, birds fed either YC at all levels or mixture of YC and FS in their diets recorded the greatest (P≤0.01) crude fiber and crude protein digestibility compared with other dietary treatments. The greatest (P≤0.01) values of ether extract digestibility were recorded for birds fed diets contain 0.1% YC or 0.5% FS. Economical efficiency, relative economical efficiency percent and net revenue items, recorded the highest values when birds fed dietary 0.5% FS followed by chicks fed control diet compared with other dietary treatments.

Keywords: Yeast; Fenugreek; Quails

Introduction

Recently, most antibiotics used for long periods in poultry production as a growth promoter have been forbidden because it is risky due to not only cross-resistance but also to multiple resistances (Shazali., *et al*. 2014). The ban on the use of growth promoters such as antibiotics in the European Union (Regulation 1831/2003/EC), the United States and nearly worldwide have prompted the search for alternative feed supplements in poultry production, not only the consumers but also either researchers or nutritionists.

Probiotics, such as yeast have the ability to stimulate digestion and aid in maintaining microbial equilibrium in the gut. Live yeast, such as Saccharomyces cerevisiae, contains numerous enzymes that could be released into the intestine and aid existing enzymes in the digestive tract in the digestion of feed. Also, yeast contains vitamins and other nutrients that may produce beneficial production responses [1]. Moreover, yeast supplementation can inhibit pathogenic bacteria and increase the number of anaerobic and cellulytic bacteriaas reported by Abdel Azeem [2] and Soliman., *et al* [3]. In addition, Celik., *et al* [4], Churchil., *et al*. [5] and Celik., *et al*. [6] showed that yeast additives reduce the toxic effects of Alfatoxin. While, Spring [7] and Santin., *et al*. [8] revealed that yeastcan improve immune response of birds. Performance of birds fed diets containing active dried yeast was improved [2,9]. Subrata., *et al*. [10] studied the effect of feeding yeast on the performance of broilers. They reported that carcass parameters did not differ that carcass traits and internal organs were not affected due to addition of yeast culture at lg/Kg broiler diet.

Seeds of Fenugreek (*Trigonellafoenum-graecum* L.) is reported to have many therapeutic effects such as hypoglycemic, hypocholesterolaemic, anthelmintic, antibacterial, antiinflammatory, antipyretic and antimicrobial properties [11,12]. Fenugreek seeds contain neurin, biotin and trimethylamine which tend to stimulate theappetite by their action on the nervous system [13]. Alloui., *et al*. [14] reported that 0.3% fenugreek had positive effects on growth performance of broiler chick whereas Abbas [15] found negative

effects on feed intake and no effect on live weight. Apart from a range of beneficial effects including growth promoting, having 24% CP and 3819 (ME) Kcal/Kg of energy and rich in vitamins and minerals, fenugreek can beregarded as a nutritious feed ingredient as well. El-Mallah., *et al*. [16] reported that 2%fenugreek in diets of turkey chicks significantly increased the digestibility of nitrogen free extract due to saponin present in fenugreek. Meanwhile, Elbushra [17] showed that supplementation of 0.5 and 1.5% fenugreek to broiler chicks significantly ($p< 0.05$) improve protein efficiency ratio values compared with the un-supplemented diets. The present study was undertaken to determine the digestibility coefficients and economical efficiency of growing Japanese quail as affected by dietary yeast culture or fenugreek seeds supplementation at levels of 0.5 and 1% or the mixture of both additions by levels of 0.5 and 0.5% of each.

This experiment was done at Animal and Poultry Production Farm, Department of Animal and Poultry Production, Faculty of Agriculture, Minia university, Minia, Egypt, during the period from 5 November to 20 December 2015, to evaluate haw far feed supplementation can affect on digestibility coefficients and economical efficiency of growing Japanese quail.

Material and Methods

Four hundred fifty one day old, unsexed growing Japanese quail were maintained in electrically heated battery cages housed in light and temperature controlled room. Free access water and feed were available during all time. The birds were divided into 6 groups (75 bird each) according to levels of yeast culture (0.5 and 1%) and fenugreek seeds (0.5 and 1%) or the mixture of both supplementations at levels of (0.5 and 0.5%) of each.

Each group contained 3 replicates of 25 birds. Diets: The basal diet contained adequate levels of nutrients for growing Japanese quail as recommended by the National Research Council [18], with no additions representing the control. Five additional diets were obtained by incorporating two levels (0.5 and 1%) of yeast culture or same previous levels of fenugreek seeds and the mixture of both supplementations at levels of 0.5 and 0.5% of each. The sequence of the 6 dietary treatments was as follow: Control (without additives), 0.5% yeast culture, 1% yeast culture, 0.5% fenugreek seeds, 1% fenugreek seeds and the mixture of both supplementations at levels of 0.5 and 0.5% of each. The composition of nutrients of the commercial basal diet is shown in Table 1.

Nutrients	Values
Metabolizable energy K cal/kg	3011
Crude protein,	23.00
Calcium, %	1.15
Available phosphorus,	0.51
Methionine and cysteine	0.80
Lysine, %	1.03

Table 1: The proximate analyses of the control diet.

At the beginning of the 7th weeks of age, Birds were fed on the same diets used during growing period which means no need for a preliminary period. So, the collection period started directly for 3 days. Daily feed intake was calculated and feces output was collected daily, scattered feed and feather were separated and taken out of the feces. The excreta which collected was sprayed with boric acid solution (2%) to prevent any loss in ammonia. Samples of the tested diets and collected feces for each treatment were pooled together, dried at 60ºC till constant weight, ground in a mill and then kept in glass cans for chemical analysis.

The economic efficiency of dietary treatments were estimated according to the prices of 2015 in Egyptian pound (LE). Economic evaluation for all experimental diets was calculated as the following steps for growing trails: 1- Feed/gain ratio (a), 2- Price/kg Feed (b) L.E., 3- Feed cost of 1kg weight gain (a × b), 4- Market price of one kg live weight (c) LE, 5- Net revenue{ c- (a × b) }

$$6\text{- Economical efficiency} = \frac{\text{Net revenue}}{\text{Feed cost}}$$

$$7\text{-Relative economical efficiency\%} = \frac{\text{Economical efficiency of treatments}}{\text{Economical efficiency of control}} \times 100$$

Presentation and analysis of data

Digestion coefficient was calculated as follow:

$$\text{Digestion coefficient} = \frac{\text{Digested nutrient}}{\text{Consumed nutrient}} \times 100$$

Where: digested nutrient = consumed nutrient – excreted nutrient in feces Chemical analysis of the experimental diets and excreta were undertaken according to the official methods of A.O.A.C [19]. Fecal nitrogen was determined according to Jakobsen., *et al*. [20].

Data were summarized using Microsoft® Excel 2010 (10.2614.2625) Microsoft Egypt, mssupport@gbrands.com. Data then transferred to analysis of variance using the General Linear Model, SAS software (SAS INSTITUTE, 1998. Mean values were separated, when significance is present, using Duncans Multiple Range Test [21]. The following statistical model was used. Yij = μ+ Ti +Eij Where: Yij = Experiment observations. μ = The overall mean. Ti= The effect of dietary treatment. i= 1, ----- 4. Eij = The experimental error.

Results and Discussion

Digestibility coefficients

The effects of dietary treatments on the digestibility coefficients of the nutrients such as dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fiber (CF) and nitrogen free extract (NFE) are presented in (Table 2). The data revealed that there are significant differences between dietary treatments in the digestibility coefficients for all nutrients of the diets. It could be noticed that birds fed dietary 1% yeast culture recorded the best (P≤0.05) value of dry matter digestibility followed by birds fed dietary 0.5% Yeast culture compared with other dietary treatments. The control 0.5% fenugreek seed and mixture diets presented the lowest (P≤0.05) values of dry matter digestibility. The lowest (P≤0.05) value of organic matter digestibility was receded for birds fed dietary 0.5% fenugreek seeds compared with other dietary treatments. However, adding studied feed additives at all levels except the previous level of fenugreek seeds had no effect (P≥0.05) on digestibility coefficients of organic matter compared with the control diet. Birds fed dietary 0.5% yeast control diet recorded the greater (P≥0.05) organic matter digestibility.

As shown in Table 2, birds fed either yeast culture at all levels or mixture of yeast culture and fenugreek seed in their diets recorded the greatest (P≤0.01) crude fiber digestibility compared with compared with other dietary treatments. Adding fenugreek seed at all levels did not affect (P≤0.05) on crude fiber digestibility compared with control diet. Birds fed either yeast culture at all levels or mixture of yeast culture and fenugreek seed in their diets recorded the greatest (P≤0.01) crude protein digestibility followed by the control diet compared with other dietary treatments. Adding fenugreek seed at all levels did not affect (P≤0.05) on crude protein digestibility compared with control diet. The greatest (P≤0.01) values of ether extract digestibility were recorded for birds fed diets contain 0.1% yeast culture and 0.5% fenugreek seed. The lowest (P≤0.05) value of nitrogen free extract digestibility was receded for birds fed dietary 0.5% fenugreek seeds and mixture compared with all dietary treatments.

Items	Treatments						SE	Sig
	Control	Fenugreek seed (%)		Yeast culture (%)		Mixture		
		0.5	1.0%	0.5	1.0	0.5-0.5%		
Dry matter, %	71.69b	68.75b	70.12b	73.14ab	80.18a	70.07b	2.51	*
Organic matter %	88.72a	86.50b	87.09ab	88.70a	87.38ab	87.23ab	0.56	*
Crude fiber, %	30.68^{b}	26.08^{b}	36.46^{b}	48.07^{a}	54.69^{a}	50.75^{a}	3.25	**
Crude protein, %	85.72ab	85.74b	84.90b	89.24a	89.64a	88.91a	1.40	**
Ether extract, %	88.75^{cb}	92.07^{a}	90.00^{ab}	91.61^{ab}	93.56^{a}	85.03^{c}	1.40	**
Nitrogen free extract, %	71.89^{ab}	67.62^{b}	68.74^{ab}	69.11^{ab}	79.23^{a}	64.93^{b}	3.17	*

Table 2: Effect of dietary treatments on digestibility coefficients of growing Japanese quail.

a and b values within columns with no common superscripts are significantly different (p<0.05).
significant * = (p<0.05) ±SE **= (p<0.01)

The improvement of nutrients digestibility by supplementing chicks diets with probiotic could be attributed to different stimulators such as change of enteric flora and reduction of E.coli population, lowering intestinal pH, synthesis of catabolic enzymes of favorable microorganism that help in releasing cell compound including amino acids, sugar, and fatty acids into the intestinal environment and involving active bacteria with the digestive processes and nutrient absorption in the intestinal tract [22]. Moreover, this improvement due to adding yeast may be attributed to altering metabolism by Manna oligosaccharide (MOS), which is a natural feed additive derived from yeast cell wall, has received profound scientific consideration in chickens due to its associated intestinal health benefits in the presence or absence of anti biotics. Thomas., *et al*. (2004) result in their excretion from the intestines [6]. In addition, The beneficial effects of adding these additives may be due to the improvement of endogenous digestive enzymes, secretions as reported by Jamroz., *et al.* (2002).

Abd El-Latif., *et al.* [23] who add herbal medicinal plants to the diet asserted the biological role for herbal medicinal plants in activities of metabolic functions and biosynthesis of hormones It is of great importance to note that the results of the digestion trial were coincided generally with the positive response in growing performance and feed utilization of quail fed fennel seeds meal.

The previous results are in agreement Abd EL-latif., *et al* [24]. indicated that, addition of medicinal herbal plants had a significant effect on improving digestibility coefficient and nutritive values. Moreover, Abd El-Samee (2002) they found that adding probiotic (Avi-Bac) (Bio-Top) respectively to broiler diets significantly increased the average values of digestibility coefficient of (OM, CP, EE, CF and NFE). Also, Abd El-Gawad., *et al*. (2004) they found that probiotics (Premalac, Lacture and Biobadus) improved he nutrients digestibility when compared with control.

Economical efficiency

The effect of dietary treatments on the economical efficiency are presented in (Table 3). It could be noticed that, adding fenugreek seed to growing Japanese quail diets at level of 0.5% recorded the highest values of economical efficiency, relative economical efficiency percent and net revenue followed by chicks fed control diet compared with other dietary treatments. The previous improvement in economical efficiency, relative economical efficiency and net revenue of dietary 0.5% fenugreek seed may be due to improvement of feed conversion of birds fed this compared with other dietary treatments.

Items	Treatments					
	Control	Fenugreek seed (%)		Yeast culture (%)		Mixture
		.5	1%	0.5	1	.5-.5%
Price of 1 kg of addition	0	12	12	15	15	13.5
Price of addition	0	0.060	0.120	0.075	0.150	0.135
Price of 1 kg control diet, L.E	3.5	3.5	3.5	3.5	3.5	3.5
Total price (1kg)	3.5	3.56	3.62	3.575	3.65	3.635
Feed/ gain ratio (a)	5.99	5.77	6.81	6.29	6.14	6.13
Cost of 1 kg feed (b) L.E	3.5	3.56	3.62	3.575	3.65	3.635
Feed cost of kg weight gain (a*b)	20.965	20.54	24.65	22.48	22.41	22.28
Market price of 1 kg live weight (c)	40	40	40	40	40	40
Net revenue (c-(a*b), L.E	19.03	19.45	15.34	17.51	17.58	17.71
Economical efficiency	0.908	0.947	0.623	0.779	0.784	0.795
Relative economical efficiency (%)	100.00	104.32	68.59	85.81	86.42	87.57

Table 3: Effect of dietary treatments on economical efficiency of the experimental diet (L.E in 2015).

As a result of increasing feed intake with no improvement in body gain of birds fed either dietary yeast or fenugreek seed at all levels except 0.5% fenugreek seed the economical efficiency, relative economical efficiency and net revenue did improved compared with control diet.

Kwsar Galley and Abd EL-Latif [25], found that, the feed cost of 1 kg weight gain was reduced to 5.363 and 5.077 L.E by adding 1 and 2% yeast to the control diet, respectively, compared with 5.665 for the control diet. In addition, Abaza [26], reported that, the best relative economical efficiency was recorded by the hens fed 5 kg radish/ton diet, followed by hens fed 1 kg kemzyme/ton diet, then hens fed 5 kg chamomile/ton diet and those fed 5 kg fenugreek/ton diet, respectively. Also, Moustafa [27] found that economic evaluation for egg production was improved by using 0.05% fenugreek.

Conclusion

From the above results it could be concluded that, using of yeast culture and fenugreek seeds or the mixture of both supplementations in growing Japanese quail diet enhanced the digestibility of nutrients of diet. The highest economical efficiency was calculated for birds fed 0.5% fenugreek seeds.

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