Egypt. Poult. Sci. Vol. (38)(III): (909-922) (2018) (**1808-1030**)

Egyptian Poultry Science Journal

http://www.epsj.journals.ekb.eg/

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

A NUTRITIONAL EVALUATION OF SUGAR BEET PULP AS UNTRADITIONAL FEEDSTUFFS IN GIMMIZAH CHICKEN DIETS DURING THE PERIOD FROM THREE UP TO EIGHT WEEKS OF AGE

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Received: 19/08/2018 Accepted: 19/09/2018

ABSTRACT: This research was conducted to study the effect of using sugar beet pulp (SBP) in the diets of Gimmizah chicks and its effect on the chicks performance of during the period from three to eight weeks of age. A total numbers of 400 one-day old unsexed Gimmizah chickens were firstly fed a control diet for two weeks. At same age, birds were equally divided into five treatments (80 birds each), each treatment were subdivided into four replicates (20 birds each). The treatments consisted of five levels of SBP (0, 5, 10, 15 and 20% of the diet), chicks were fed starter diets from the beginning of the third (3^{rd}) week up to 8 weeks.

Chicks fed diet containing 0% SBP had higher ($P \leq 0.001$) live body weight (LBW), body weight gain (BWG), feed intake (FI), growth rate (GR) and performance index (PI) during the period from 3-8 weeks. Inclusion of 5% SBP in the Gimmizah diets recorded better values ($P \leq 0.001$) of feed conversion ratio (FC), crude protein conversion (CPC) and caloric conversion ratio (CCR) during the period from 3 to 8 weeks (differences between 0, 5, 10 and 15% SBP were not significant). While, those fed 20% SBP in the diet had the lower values of LBW, BWG, FI, GR, PI and the worst values of FC, CPC and CCR during the same period. Chicks fed diet containing 5% SBP had the best values of economical and relative efficiency, while, those fed 20% SBP had the lowest values.

The obtained results show that the SBP could be used at a rate of 5% in the starter (from 3 to 8 weeks) diets of Gimmizah without any adverse effects on the chicks performance. But, the inclusion of SBP at 20% in the diet resulted in poor performance.

Key words: Sugar beet pulp-untraditional feedstuffs-performance and Gimmizah chicken.

INTRODUCTION

In Egypt, there is a gap between poultry feed requirements and the available feeds; hence there is an urgent need to explore for more available and also cheaper roughage chiefly agricultural by-products and food industry for feeding. Utilization of these agricultural residues from the food industries as feed ingredients for poultry is important to decrease feed cost, and improve the sustainable utilize of feed resources for poultry production.

Sugar beet is a significant industrial crop in temperate regions that provides about, a third of all sugar used in the world. Sugar beet is a crop with global production of 277.23 million tonnes, harvest 2016 (FAO, 2018). Egypt is one of the producers of sugar beet in the world. Egyptian production of sugar beet increased from 500 tonnes year 1961 and 2.890360 million tonnes year 2000 to 13.323369 million tonnes harvested in 2016 (FAO, 2018). Sugar beet pulp (SBP) is the residues collect after processing of sugar beet (Beta vulgaris L.) from the sugar industries that can a reason of environmental pollution. Egyptian dried SBP production were 732785.29 ton in year 2016 (based on one ton of the processing sugar beet yields 55 kg (5.5%) of dried SBP (Mirzaei-Aghsaghali and Maheri-Sis, 2008)).

Sugar beet pulp is chiefly use as ruminant feed, according to Bodas et al. (2007) and Mateos et al. (2012), dried SBP an agricultural low cost by product of sugar industry is used as a high quality feed for animals and poultry. Due to its availability, highly palatable and nutritional value, nutritionists and producers of poultry in production areas frequently use the SBP. Further more, dried SBP is added to some pet feeds to operate as a fibrous stool hardener. However, in early study conducted by Fraga et al. (1991) they reported that, SBP is not usually uses in poultry diets. Since of its low metabolisable energy value, high fiber content (20%), digestion characteristics include low rate of passage and high caecal retention time, which make it of slight value to meet the fiber requirements of poultry and of probable management problems associated with wet litter as a result of excessive water consumption. According to, Foster et al. (2001), the crude protein (CP) contents of dried SBP ranged from 7 to 8%, but, high fiber content, it's mainly composed of hemicellulose fraction (45–61%), 20–24% cellulose and 1–2% lignin. In another study, Hagstrom (2008) postulated that SBP is relatively low in CP (8-10%), while, being excellent source of digestible fiber.

Recent study by Minarovicova et al. (2018) reported that the protein, fat and ash contents of SBP, 10.31, 0.42 and 3.56%, respectively. He also established that SBP contain a higher amount of total dietary fiber; insoluble dietary fiber and soluble dietary fiber (69.84%, 49.91% and 19.93%, respectively). The SBP raw proteins have a digestibility of 75% with enclose indispensable amino acids particular lysine; methionine; cysteine and threonine. The SBP is very low in ME (646 kcal/kg) and very high in CF (19.0%). In addition, SBP contain substantial amounts of CP (about 10.5%). Moreover, SBP is relatively high in Ca, however, being very low in P, Se, vit. B and has almost no vit. D or the precursor of vit. A (Hagstrom, 2008). Therefore, the objective of the present study was to investigate the effects of inclusion of SBP on the performance of Gimmizah

chickens, during the period from three to eight weeks.

MATERIALS AND METHODS

The present work was supported by Project of funded from Minist. of Agric. and Land Recl., Regional Councils for Agric. Res. and Extension, Fayoum, Egypt, entitled (effect of partial replacing of yellow corn by SBP on productive performance of poultry), during the period from April to May, 2016. Chemical analyses were performed in the laboratories of Poult. Depart., Fac. of Agric., Fayoum Univ., Egypt, according to the methods outlined by AOAC (2016). This research was conducted to study the effect of inclusion SBP in the diets on growth performance of Gimmizah chicks (local developed strain) from three to eight weeks of age.

A total numbers of 400 pedigreed one-day old unsexed Gimmizah chickens were firstly fed a control diet for two weeks. Chicks were wing banded, weighed (individually) to the nearest gram at the beginning of the third (3^{rd}) week of age (start of experiment), and randomly allotted to the dietary treatments. Chicks were equally divided into five treatments (80 birds each), each treatment were subdivided into four replicates (20 birds each). Then, birds were translated to electrically heated batteries (open system) through raised wire mesh floors. The treatments consisted of five levels of SBP (0, 5, 10, 15 and 20 %). Chicks were fed with starter diets (males and females) from the beginning of the third (3^{rd}) week up to 8 weeks of age contained 19% CP and 2800 Kcal/Kg diet.

Randomly air-dried SBP (a by-product of the sugar industry) samples were collected from the Fayoum Sugar Works Company (factory sugar in Atsa, Fayoum Governorate) in mash form (dried SBP is available as mash or pellets), harvest 2015. Its ground using a hammer mill for feeding, and chemical analysis at the laboratories of Regional Center for Food and Feed-RCFF, Giza, Egypt, the determined analysis of the representative sample of SBP is presented in Table 1. The composition and, calculated analysis (according to Sauvant et al. (2004); Bojana et al. (2015) and NRC 1982, 1994 and 1998) of the experimental diets are presented in Table 2. Trial diets (in mash form) were supplemented with vit. and min. mixture (each 3.0 Kg of the Vit. and Min. premix manufactured by Egypt Pharma Company and contains: Vit. A 10000000 IU; Vit. D3 2500000 IU; Vit. E 10000 mg; Vit. K3 1000 mg; Vit. B1 1000 mg; Vit. B2 5000 mg; Vit. B6 1500 mg; Vit. B12 10 mg; biotin 50 mg; folic acid 1000 mg; niacin 30000 mg; pantothenic acid 10000 mg; Zn 50000 mg; Cu 4000 mg; Fe 30000 mg; Co 100 mg; Se 100 mg; I 300 mg; Mn 60000 mg, choline chloride 300000 mg and complete to 3.0 Kg by calcium carbonate) and were formulated to gratify nutrient requirements (iso-nitrogenous and iso-caloric) of Gimmizah chickens according to the Egyptian Agriculture Ministry Decree No. 1498 (1996) issued via Minist. of Agric., Egypt. Fresh water from nipple drinkers [one nipple/cage] and mach form feed were supplied ad libitum during the experiment. Lighting, heating and the vaccination program were provided according to brooding and rearing standard protocols.

Chicks were weighed on individual basis to the nearest gram at the beginning of third (3^{rd}) and 8 weeks of age. Also, at the same ages, feed intake (FI) was recorded and body weight gain (BWG), feed conversion ratio (FC, g feed/g gain),

caloric conversion ratio (CCR), crude protein conversion (CPC) and growth rate (GR) was calculated. Performance index (PI) was calculated according to the equation described via North (1981) as follows, PI = (LBW, Kg/FC) x100. Accumulative mortality rate was also recorded during the experiment period. Chicks that died throughout the experimental period were weighed so, the data were used to adjust FI and calculations of FC. To calculate the sex effect chicks (males and females) were reared together and sex were determined at 8 weeks (chicks were wing banded at start of experiment). To calculate the economical efficiency for the diverse dietary treatments, the amount of feed consumed through the total experimental period was obtained and multiplied by the cost of one Kg of each experimental diet, which was estimated based upon local present prices at the experimental time.

Statistical analysis of results was performed using the General Linear Models procedure of the SPSS software (SPSS, 2007), according to the follow general model:

$Y_{ijk}= \mu+L_i+S_j+LS_{ij} +e_{ijk}$

Where: Y_{ijk}: observed value. μ: overall mean.

L_i: level of SBP effect (i: control (R), 5% SBP, 10% SBP, 15% SBP and 20% SBP). S_j: sex effect (j: female and male) LS_{ij}: interaction effect of level of SBP by sex effect. e_{ijk}: random error.

Treatment means indicating significant differences ($P\leq0.01$ and $P\leq0.05$) were tested using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Results in Table 3 showed that inclusion of SBP in Gimmizah diets at different levels caused a significant ($P\leq0.001$) decrease in LBW at 6 and 8 weeks and BWG during the periods from 3-6, 7-8 ($P\leq0.009$) and 3-8 weeks of age. The initial LBW of Gimmizah chicks did not differ ($P>0.05$) among the treatment groups. Chicks fed 0% SBP in the diet had heaver LBW and BWG during the previous periods; however, those fed 20% SBP in the diet had the lower values of LBW at 6 and 8 weeks, and BWG during the periods from 3-6, 7-8 and 3-8 weeks of age (Table 3).

Concerning sex effect (Table 3), males had significantly ($P\leq0.001$) heaver LBW (at 6 and 8 weeks) and BWG during the periods from 3-6, 7-8 and 3-8 weeks of age than females. Interaction due to level of SBP X sex had insignificantly ($P>0.05$) affected LBW (at the beginning of third (3^{rd}) and 6 weeks) and BWG during the periods from 3-6 and 3-8 weeks, while, caused a significant effected LBW ($P\leq0.04$) at 8 weeks and BWG ($P\leq0.004$) during the period from 7 to 8 weeks of age (Table 3). Chicks fed control diet with males had heaver LBW at 8 weeks and BWG during the period from 7 to 8 weeks; however, those fed 20% SBP in the diet with females had the lower values (Table 3).

The nutritional effect observed in this experiment coincides with the results of the previous research. For example, Abdel-Hafeez et al. (2018) found that birds fed diets containing 7.5% SBP without enzyme supplementation in broiler diets was significantly ($P\leq0.01$) lower LBW and BWG than those fed the control diet. The marked decrease in the LBW in the groups fed SBP was due to high content of soluble fibrous fractions (pectins) which are dispersible in water, as a result, increase digesta viscosity and bulk, ensuing in delayed gastric emptying, caused by distension of the duodenum, this may be partially

attributed to increased intestinal transit time, so, reducing FI. Further, a raise in digesta stickiness may reduce the flow rate of digestive enzymes into the digesta. Therefore, hampering nutrient absorption in non ruminants animals and impair poultry performance, delay in the productive cycle (Sklan et al., 2003; Jimenez-Moreno et al., 2013 and Abdel-Hafeez et al., 2018). Accordingly, the response of chickens to the insertion of fiber in the diet may vary with the type and level of fiber used. So, commercial diets for young birds have formulated to include less than 2.5 to 3% CF, because, an increase of fiber may have opposite effects on FI, nutrient digestibility and growth performance (Sklan et al., 2003 and Jimenez-Moreno et al., 2011). Moreover, the insertion of moderate amounts of fiber in the diet improve HCl, in addition to nutrient digestibility and growth performance in chickens fed low fiber diets (Jimenez-Moreno et al., 2009). As well as, improve productivity in the lack of growth promoters (Gonzalez-Alvarado et al., 2007).

Results in Table 4 revealed that inclusion of SBP in the Gimmizah diets at different levels caused significant ($P \leq 0.001$) differences in FI during the periods from 3-6, 7-8 and 3-8 weeks. Gimmizah chicks fed control diet had higher FI during the previous periods studied (this may be due to the high LBW and BWG values recorded for this group). Generally, the FI was significantly decreased with inclusion of SBP in the diets from 5 to 20% when compared with those fed control diet. Sex had insignificant effect on FI during all ages studied (3-6 and 7-8 weeks), except, the period from 3 to 8 weeks, which was significantly affected (Table 4). The present results agree with this finding of Jimenez-Moreno et al. (2011) who found that birds fed 7.5% SBP in the diet tended to eat less feed than birds fed the control diet during the period from one to 12 days. During the starter, grower and over all experimental periods, the FI of birds fed diets including 7.5% SBP was insignificantly lower than the control (Abdel-Hafeez et al., 2018). Concerning FC, CPC and CCR (Tables 4 and 5), results showed the inclusion of SBP in the Gimmizah diets at different levels caused significant ($P \leq 0.001$) differences in FC, CPC and CCR during all periods studied (3-6 and 3-8 weeks), except, the period from 7 to 8 weeks, which was insignificant. Chicks fed control diet recorded better values of FC, CPC and CCR than those fed other treatments during the period from 3 to 6 weeks. Inclusion of 5% SBP in the Gimmizah diets recorded better values of FC, CPC and CCR during the period from 3 to 8 weeks (differences between 0, 5, 10 and 15% SBP were not significant). While, those fed 20% SBP in the diet had the worst values of FC, CPC and CCR during the same period. On the other hand, in the current study, an increase in the level of fiber was not affected CCR except, the level of 20% SBP. Perhaps, part of the CF of the SBP was fermented in the gastro intestinal tract (GIT) providing additional energy to the chicks (Jorgensen et al., 1996). Similar results were reported by Pettersson and Razdan (1993), who demonstrated that broiler performance had improved when 23g SBP/Kg diet was included in the diet although; a further increase to 46 or 92g SBP/Kg diet had opposite effects. Also, in this respect, Jimenez-Moreno et al. (2011) found that, an increase in fiber insertion from 2.5 to 7.5% impaired linearly LBWG and FC from one to 18 days of age but, FC was alike for chicks

fed the diet containing 7.5% fiber than for birds fed the control diet. However, Gonzalez-Alvarado et al. (2007) and Jimenez-Moreno et al. (2009) reported that fiber insertion in broilers diets enhanced BWG and FC, consequently, the insertion of reasonable amounts of fiber (especially of a soluble fiber source) in diets may enhance nutrient digestibility and performance in young chicks. Moreover, Hetland and Svihus (2001) and Tabook et al. (2006) observed high FI and no effects on performances, as insoluble fiber was included at moderate amounts in broiler diets.

By contrast, the inclusion of moderate amounts of CF in the diets, have no effect on BWG and high FI of chickens (Hetland and Svihus, 2001) and digesta viscosity (Svihus and Hetland, 2001), but, improved starch digestibility (Hetland and Svihus, 2001 and Svihus and Hetland, 2001). Also, the inclusion of CF in the diet of pullets increased FI by 3.6% and improved BWG by 4.1% from hatching to 5 week of age; as a result, FC was not affected (Guzman et al., 2015). Live body weight, uniformity will not be affected when reasonable amounts of CF are added in the diet (Guzman et al., 2015). Therefore, additional dietary CF might be more helpful in young broiler than in young pullets, under practical conditions. Pullets fed diets containing 4% CF were less efficient than pullets fed diets with 2% CF (Guzman et al., 2015). A worse in feed efficiency in broiler from one to 18 days when the level of inclusion SBP in the diet increased up to 7.5% (Jimenez-Moreno et al., 2013), and from one to 21 days when the SBP of the diet was increased from 2.3 up to 4.6% or 9.2% (Pettersson and Razdan, 1993). Using SBP as the alternative feeds in the diets of broiler impaired FC (Abdel-Hafeez et al. 2018). While, Pettersson and Razdan (1993) found that the inclusion of 92 g SBP/kg diet had no effect on CP digestibility.

Concerning sex effect, (Tables 4 and 5) males had significantly better FC than females during the all periods studied, and CPC and CCR ($P \leq 0.001$) during the periods from 3 to 6 and 3 to 8 weeks. No significant effect was observed for CPC and CCR during the period from 7 to 8 weeks (Table 5). Interaction effect had insignificantly ($P > 0.05$) affected FI, FC, CPC and CCR during all periods studied (Tables 4 and 5).Results in Table 6 revealed that inclusion of SBP in Gimmizah diets at different levels caused a significant ($P \leq 0.001$) effect on GR and PI during all periods studied (Table 6), except, GR during the period from 7 to 8 weeks of age, which was insignificant affected. Chicks fed 0% SBP in the diet had higher GR during the periods from 3-6 and 3-8 weeks and PI during the periods from 3-6, 7-8 and 3-8 weeks (differences between 0 and 5% SBP were not significant during the overall period). However, those fed 20% SBP in the diet had the lower values of GR and PI during the previous periods (Table 6). Concerning sex effect (Table 6), males had significantly higher GR and PI ($P \leq 0.001$) than females during the all periods studied, except, GR during the period from 7 to 8 weeks. The results cleared that interaction due to level of SBP X sex had insignificantly affected GR and PI during all periods studied (Table 6).

Mortality rate:

The mortality rate was 5% in Gimmizah chicks fed diet-containing 15 or 20% SBP, however, the percentage of mortality was 1.25, 1.25 and 2.5% in

Gimmizah chicks fed the control diets, 5 and 10% SBP, respectively during the period from 3 to 8 weeks. Nearly all of the mortality occurred during the first week of the experiment. Therefore, the optional levels of dietary CF in poultry diets could be depend on the age of the chicks in addition to on the physicochemical properties of the fiber source used. In this respect, Sklan (2001) suggest that, the GIT of chicks is immature at hatch and its does not arrive at physiological maturity until 15-21 days.

Economical efficiency (EEf):

Data in Table 7 showed that EEf value was improved in birds fed diet containing 5% SBP as compared with those fed the control diet during the period from 3 to 8 weeks of age. Birds fed diet containing 5% SBP had the best values of economical and relative efficiency (0.963 and 103.82%, respectively) as compared with those fed the control diet. While, those fed diet containing 20% SBP had the lowest values of economical and relative efficiency (0.759 and 81.92%, respectively).

CONCLUSION

The obtained results show that the SBP could be used at a level of 5% in the starter (from 3 to 8 weeks) diets of Gimmizah without any adverse effects on the chicks performance. This can assist in improving the chicks production; reduce feeding expenses and partly solving the problem of present deficiency of traditional feed ingredients. But, the inclusion of SBP at 20% in the diet resulted in poor growth performance.

ACKNOWLEDGEMENTS

The authors would like to express thanks the Projects Funding and Granting Unit, Minist. Of Agric. and Land Recl., Regional Councils for Agric. Res. and Extension, Fayoum, Egypt, for the assist in financial support of this studies (especially Professor Dr. Ashry, M.R.K.). These through the funding of the Project (effect of partial replacing of yellow corn by SBP on productive performance of poultry). Also, the authors gratefully acknowledge to the staff of the sugar factories for providing the SBP.

Table (1): Chemical composition of sugar beet pulp used in the present study (on air dried basis).

Protein and amino acids%					**Fiber and fiber fractions%**		
	Amino acids					**Fiber fractions**	
Crude protein 8.4	Aspartic	0.65	Leucine	0.53	Crude fiber 19.01	Neutral detergent fiber	43.97
	Therionine	0.44	Tyrosine	0.55		Acid detergent fiber	23.38
	Serine	0.47	Phenylalanine	0.34		Acid detergent lignin	3.91
	Glutamic	0.80	Hisitidine	0.33		Hemicelluloses	20.58
	Glycine	0.38	Argnine	0.40		Celluloses	19.46
	Alanine	0.48	Proline	0.43		Lignin	3.28
	Valine	0.67	Cystine	0.13			
	Isoleucine	0.32	Methionine	0.18			
	Lysine	0.67					
Moisture %		6.2	Fat%	0.56	Ash	2.1%	
Gross energy		3962 cal/g			Betaine	3.98 g/k	

Table (2): Composition and analysis of the experimental diets.

Item, %		Level of sugar beet pulp%				
		0.00	5.00	10.00	15.00	20.00
Feed Ingredients	Yellow corn, ground	62.35	59.36	55.96	50.32	44.49
	Sugar beet pulp, ground	0.00	5.00	10.00	15.00	20.00
	Wheat bran	4.27	1.90	0.00	0.00	0.00
	Soybean meal (44%CP[1])	29.50	29.96	30.35	30.47	30.66
	Calcium carbonate	1.35	1.27	1.15	1.05	0.96
	Sodium chloride	0.39	0.37	0.35	0.33	0.30
	Vit. and Min. premix	0.30	0.30	0.30	0.30	0.30
	Dicalcium phosphate	1.75	1.75	1.80	1.80	1.80
	Vegetable oil[2]	0.00	0.00	0.00	0.64	1.40
	DL–Methionine	0.09	0.09	0.09	0.09	0.09
	Total	100.0	100.0	100.0	100.0	100.0
Calculated analysis:						
Protein and amino acids	Crude protein	19.00	19.00	19.00	19.00	19.00
	Lysine	0.98	1.01	1.03	1.05	1.07
	Methionine	0.39	0.39	0.39	0.39	0.39
	Methionine+Cystine	0.71	0.71	0.71	0.71	0.71
	Arginine	1.207	1.206	1.206	1.208	1.212
	Threonine	0.713	0.728	0.743	0.756	0.769
	Valine	0.882	0.896	0.911	0.924	0.939
Crude fiber and fiber fractions	Crude fiber	3.91	4.56	5.26	6.09	6.93
	Neutral detergent fiber	11.71	12.68	13.81	15.48	17.14
	Acid detergent fiber	5.074	5.894	6.759	7.780	8.804
	Acid detergent lignin	0.57	0.68	0.79	0.96	1.13
	Hemicelluloses	5.284	5.466	5.767	6.517	7.260
	Celluloses	3.992	4.728	5.495	6.363	7.235
	Lignin	0.870	0.934	1.009	1.117	1.224
Fat	Ether extract	2.73	2.58	2.43	2.88	3.45
	Linoleic acid	1.497	1.430	1.354	1.593	1.896
Minerals	Calcium	1.00	1.00	1.00	1.00	1.00
	Available phosphorus	0.45	0.45	0.45	0.45	0.45
	Potassium	0.838	0.838	0.841	0.855	0.870
	Sodium	0.171	0.171	0.172	0.173	0.170
	Chloride	0.276	0.267	0.258	0.249	0.233
Betaine		0.036	0.043	0.052	0.071	0.089
ME, kcal./Kg		2805.4	2809.4	2804.3	2800.4	2802.4
Cost (£.E./ton)[3]		5242.8	5169.1	5082.0	5022.1	4969.8
Relative cost[4]		100.00	98.59	96.93	95.79	94.79

[1] Crude protein [2] Mixture from 75% soybean oil and 25% sunflower oil.

[3] According to the local market price at the experimental time.

[4] Assuming the price of the control group equal 100.

Table (3): Effect of inclusion of sugar beet pulp in the diets on live body weight (LBW, g) and body weight gain (BWG, g) of Gimmizah chicks.

Items		LBW, g (age, weeks)			BWG, g (age period, weeks)		
		3[1]	6	8	3-6	7-8	3-8
Level of sugar beet pulp% (L)							
0.00		85.26	288.29^{a}	412.43^{a}	205.23^{a}	124.14^{a}	329.37^{a}
5.00		86.84	256.36^{b}	381.01^{b}	171.62^{b}	119.15^{ab}	294.31^{b}
10.00		84.55	245.17^{b}	355.15^{b}	159.06^{b}	108.31^{bc}	269.25^{b}
15.00		87.07	253.13^{b}	360.56^{b}	168.20^{b}	104.79^{bc}	275.76^{b}
20.00		85.88	216.18^{c}	314.60^{c}	132.42^{c}	98.42^{c}	230.84^{c}
SEM[2]		1.81	7.51	10.82	6.45	5.46	10.08
P-value		0.859	<0.001	<0.001	<0.001	0.009	<0.001
Sex effect (S)							
Female (F)		84.503	236.97^{b}	337.95^{b}	152.83^{b}	99.62^{b}	253.16^{b}
Male (M)		87.332	266.68^{a}	391.54^{a}	181.78^{a}	122.31^{a}	306.65^{a}
SEM		1.160	4.830	7.200	4.270	3.630	6.700
P-value		0.090	<0.001	<0.001	<0.001	<0.001	<0.001
L * S							
0.00	F	83.235	263.71	357.06^{bcd}	183.53	93.35^{c}	276.88
	M	87.286	312.88	467.80^{a}	226.93	154.9^{a}	381.85
5.00	F	86.650	248.18	369.94^{bcd}	164.24	114.3^{bc}	282.00
	M	87.032	264.53	392.07^{b}	179.00	124.0^{b}	306.62
10.00	F	82.143	225.82	323.44^{de}	142.45	98.25^{bc}	240.84
	M	86.951	264.53	386.86^{b}	175.66	118.4^{bc}	297.65
15.00	F	87.189	245.53	344.47^{bcd}	156.33	98.93^{bc}	255.27
	M	86.941	260.73	376.65^{bc}	180.06	110.7^{bc}	296.26
20.00	F	83.300	201.62	294.86^{e}	117.57	93.24^{c}	210.81
	M	88.452	230.73	334.33^{cde}	147.27	103.6^{bc}	250.87
SEM		2.670	9.85	14.57	8.69	7.85	13.57
P-value		0.758	0.449	0.040	0.632	0.004	0.063

$^{a–e}$ Means in a column with different superscripts differ significantly ($P \leq 0.05$).

[1]At the beginning of the third week [2] Pooled SEM

Table (4): Effect of inclusion of sugar beet pulp in the diets on feed intake (FI, g) and feed conversion (FC) of Gimmizah chicks.

Items	FI, g (age period, weeks)			FC (age period, weeks)		
	3-6	7-8	3-8	3-6	7-8	3-8
Level of sugar beet pulp% (L)						
0.00	648.01^{a}	372.62^{a}	1020.6^{a}	3.590^{c}	4.065	3.631^{b}
5.00	605.32^{c}	333.66^{c}	938.98^{c}	4.148^{bc}	3.393	3.459^{b}
10.00	622.78^{b}	340.64^{b}	963.43^{b}	4.381^{ab}	3.782	3.949^{b}
15.00	615.69^{b}	346.54^{b}	962.24^{b}	4.140^{bc}	4.163	3.945^{b}
20.00	571.12^{d}	328.36^{c}	899.47^{d}	4.839^{a}	4.362	4.427^{a}
SEM[1]	2.81	2.61	3.59	0.210	0.280	0.170
P-value	<0.001	<0.001	<0.001	0.002	0.175	0.003
Sex effect (S)						
Female (F)	611.17	341.96	953.14^{b}	4.553^{a}	4.261^{a}	4.235^{a}
Male (M)	614.00	346.77	960.76^{a}	3.886^{b}	3.646^{b}	3.529^{b}
SEM	1.860	1.730	2.310	0.140	0.190	0.110
P-value	0.285	0.051	0.020	0.001	0.020	<0.001
T * S	Not significant					

$^{a–d}$ Means in a column with different superscripts differ significantly ($P \leq 0.05$).
[1] Pooled SEM

Table (5): Effect of inclusion of sugar beet pulp in the diets on crude protein conversion (CPC) and caloric conversion ratio (CCR) of Gimmizah chicks.

Items	CPC (age period, weeks)			CCR (age period, weeks)		
	3-6	7-8	3-8	3-6	7-8	3-8
Level of sugar beet pulp% (L)						
0.00	0.683^{b}	0.773	0.727^{b}	1.010^{b}	1.144	1.075^{b}
5.00	0.762^{ab}	0.645	0.691^{b}	1.128^{ab}	0.955	1.023^{b}
10.00	0.946^{a}	0.719	0.821^{ab}	1.397^{a}	1.062	1.131^{b}
15.00	0.787^{ab}	0.791	0.779^{b}	1.160^{ab}	1.166	1.148^{ab}
20.00	0.919^{a}	1.021	0.977^{a}	1.354^{a}	1.504	1.293^{a}
SEM[1]	0.060	0.110	0.060	0.090	0.160	0.060
P-value	0.013	0.172	0.027	0.014	0.180	0.020
Sex effect (S)						
Female (F)	0.900^{a}	0.887	0.894^{a}	1.329^{a}	1.309	1.228^{a}
Male (M)	0.739^{b}	0.693	0.704^{b}	1.091^{b}	1.023	1.040^{b}
SEM	0.040	0.070	0.040	0.060	0.100	0.040
P-value	0.004	0.052	0.002	0.004	0.052	<0.001
T * S	Not significant					

$^{a–b}$ Means in a column with different superscripts differ significantly ($P \leq 0.05$).
[1] Pooled SEM

Table (6): Effect of inclusion of sugar beet pulp in the diets on growth rate (GR) and performance index (PI) of Gimmizah chicks.

Items	GR (age period, weeks)			PI (age period, weeks)		
	3-6	**7-8**	**3-8**	**3-6**	**7-8**	**3-8**
Level of sugar beet pulp% (L)						
0.00	1.091[a]	0.343	0.719[a]	9.848[a]	15.56[a]	12.73[a]
5.00	0.983[b]	0.374	0.687[ab]	7.946[b]	14.76[ab]	11.50[ab]
10.00	0.948[b]	0.364	0.656[b]	6.868[b]	12.21[bc]	9.492[bc]
15.00	0.997[b]	0.332	0.671[b]	7.397[b]	11.94[bc]	9.756[bc]
20.00	0.878[c]	0.365	0.617[c]	5.457[c]	10.62[c]	8.017[c]
SEM[1]	0.030	0.015	0.015	0.480	0.900	0.630
P-value	<0.001	0.290	<0.001	<0.001	0.001	<0.001
Sex effect (S)						
Female (F)	0.933[b]	0.348	0.639[b]	6.506[b]	10.99[b]	8.747[b]
Male (M)	1.026[a]	0.364	0.700[a]	8.501[a]	15.04[a]	11.85[a]
SEM	0.020	0.010	0.010	0.320	0.600	0.420
P-value	<0.001	0.248	<0.001	<0.001	<0.001	<0.001
T * S	Not significant					

[a–c] Means in a column with different superscripts differ significantly ($P \leq 0.05$). [1] Pooled SEM

Table (7): Effect of inclusion of sugar beet pulp in the diets on economical efficiency (EEf) of Gimmizah chicks.

Items	Level of sugar beet pulp%				
	0.00	**5.00**	**10.00**	**15.00**	**20.00**
a	1.0206	0.9390	0.9634	0.9622	0.8995
b	524.25	516.91	508.20	502.21	496.98
a x b =c	535.05	485.37	489.61	483.25	447.02
d	0.4124	0.3810	0.3552	0.3606	0.3146
e	2500.0	2500.0	2500.0	2500.0	2500.0
d x e = f	1031.1	952.53	887.88	901.40	786.50
f – c =g	496.03	467.16	398.26	418.15	339.48
g/c = EEf	0.9271	0.9625	0.8134	0.8653	0.7594
r	100.00	103.82	87.74	93.34	81.92

a…….average feed intake (Kg/bird).
b…….price/Kg feed (P.T.), based on average local market price of diets during the experimental time.
c...…..feed cost (P.T.). d…….average LBW (Kg/ bird).
e……..price/Kg live weight (P.T.), according to the local market price at the experimental time.
f……..total revenue (P.T.). g...….net revenue (P.T.).
EEf.…economical efficiency (net revenue per unit feed cost).
r……..relative efficiency (assuming that economical efficiency of the control group (0.00% sugar beet pulp) equals 100.

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الملخص العربي

التقييم الغذائي للب بنجر السكر كمادة علف غير تقليدية في علائق كتاكيت الجميزة خلال الفترة من ثلاثة إلي ثمانية أسابيع من العمر

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صمم هذا البحث لدراسة تأثير احتواء العلائق علي لب بنجر السكر علي أداء كتاكيت الجميزة خلال الفترة من بداية الاسبوع الثالث حتي عمر ثمانية أسابيع. تم استخدام 400 كتكوت جميزة عمر يوم غير مجنس وتم تغذيتها علي العليقة الضابطة لمدة أسبوعين. تم تقسيم الكتاكيت عند بداية الاسبوع الثالث إلي خمسة معاملات (كل معاملة 80 طائر)، ثم قسمت كل معاملة إلي أربعة مكررات (كل مكرر 20 طائر). احتوت المعاملات التجريبية علي خمسة مستويات من لب بنجر السكر (صفر، 5، 10، 15، 20 % لب بنجر السكر). غذيت الكتاكيت علي عليقة البادئ من بداية الأسبوع الثالث حتي ثمانية أسابيع من العمر.

كانت الكتاكيت المغذاه علي عليقة تحتوي علي صفر% لب بنجر السكر الأعلى معنوياً في وزن الجسم، ووزن الجسم المكتسب، كمية الغذاء المأكول، معدل النمو، الأداء الإنتاجي خلال الفترة من 3 إلي 8 أسابيع. كتاكيت الجميزة المغذاه علي 5% لب بنجر السكر كانت الأفضل معنوياً في قيم كفاءة تحويل كل من الغذاء، البروتين والطاقة خلال الفترة من 3 إلي 8 أسابيع (الاختلافات بين صفر، 5، 10، 15% لب بنجر السكر غير معنوية). بينما سجلت الكتاكيت المغذاه علي 20% لب بنجر السكر أقل قيم لوزن الجسم الحي، وزن الجسم المكتسب، كمية الغذاء المأكول، معدل النمو، الأداء الإنتاجي وكانت الأسوء معنوياً في قيم كفاءة تحويل كل من الغذاء، البروتين والطاقة خلال نفس الفترة. كان لإناث كتاكيت الجميزة المغذاه علي عليقة تحتوي علي 5% لب بنجر السكر أعلي قيم كفاءة اقتصادية ونسبية، بينما سجلت الكتاكيت المغذاه علي 20% لب بنجر السكر أقل قيم كفاءة اقتصادية ونسبية .

من نتائج البحث يتضح أنه يمكن استخدام لب بنجر السكر بنسبة 5% في عليقة البادي (من 3 إلي 8 أسبوع من العمر)، بدون أي تأثير عكسي علي أداء الكتاكيت. بينما احتواء العليقة علي 20% لب بنجر السكر أدت إلي أداء سيئ.