Emam, R. M. S. and Abdel Wahed, H. M. **(2018).** Effect of inclusion of sugar beet pulp in the diets on the performance and egg quality of Gimmizah laying hens. ***Egyptian J. Nutrition and Feeds*, 21 (*Accepted*)**

EFFECT OF INCLUSION OF SUGAR BEET PULP IN THE DIETS ON THE PERFORMANCE AND EGG QUALITY OF GIMMIZAH LAYING HENS

Emam, R.M.S.[1] and Abdel Wahed, H.M.[2]
[1] Poult. Depart., Faculty of Agric., Fayoum University, Egypt.
[2]Anim. Prod. Institute, Agric. Res. Center, Ministry of Agric., Dokki, Giza, Egypt.

Abstract: This research was conducted to study the effect of inclusion of sugar beet pulp (SBP) in the diets on the performance of Gimmizah laying hens during the period from 9 to 27 weeks of age. Hens were previously fed with starter diets from the beginning of the 3 weeks up to 8 weeks, and then hens fed in the present study on grower diets from the beginning of 9 up to 19 weeks, pre lay diets from the beginning of 20 up to 23 weeks and layer diets from the beginning of 24 up to 27 weeks. At the beginning of 9 weeks, a total of 180 females were continue feeding on the same treatments (which its fed in the starter period), which, consisted of five levels of SBP (0, 5, 10, 15 and 20% SBP) until 27 weeks (five treatments/four replicates (9 pullets/ replicate)).

Hens fed diet containing 5% SBP had significantly higher live body weight (LBW) at the beginning of 9 weeks, performance index (during the period from 9 to 19 weeks) and recorded better values of feed conversion ratio (FC), crude protein conversion (CPC) and caloric conversion ratio (CCR) during the period from 9 to 19 weeks. Birds fed the control diet had higher LBW at 19 weeks and body weight gain, during the period from 9 to 19 weeks. Hens fed diet containing 10% SBP consumed significantly higher feed intake (FI), during the period from 9 to 19 weeks. Also, hens fed 10% SBP reached to sexual maturity earlier than the other treatments (the early in age at sexual maturity is coincided with a significant increase of average egg number (EN) per hen and laying rate% during the period from day of laying first egg until 23 weeks).

Hens fed diet containing 20% SBP had significantly higher values of egg weight and FI, and the lower values were recorded with the hens fed diet containing 0.0% SBP during the period from 24 to 27 weeks of age. Gimmizah laying hens fed diet containing 0.0% SBP had better values of CPC and CCR during the period from 24 to 27 weeks of age, but, the differences between 0, 5, 10 and 15% SBP were not significant. The worst corresponding values of CPC and CCR were recorded with the hens fed diet containing 20% SBP during the period from 24 to 27 weeks of age. Feeding different levels of SBP insignificantly affected EN, egg production, FC and egg quality during the period from 24 to 27 weeks of age.

Conclusion: The obtained results show that, SBP could be used at a rate of 10% in the growing (9 to 19 weeks), pre-lay (20 to 23 weeks) and layer (24 to 27 weeks) diets of Gimmizah laying hens without any adverse effects on the pullet or hen performance and egg quality. But, the inclusion of SBP at 20% in the diet resulted in poor performance.

Key words: Sugar beet pulp, untraditional feedstuffs, performance, egg quality and Gimmizah layer.

INTRODUCTION:

It is well known that feed cost comprises to about 60 up to 70% of the total production costs of poultry industry. In Egypt, yellow corn (YC) constitutes approximately 60% of poultry feeds. Because, most the corn production in Egypt is consumed as human food and the increase of world prices for cereal grains especially YC and soybean meal (as a result of increased use of these ingredients for ethanol or energy production) has made dietary containing alternative feedstuffs chiefly agricultural by-products and food industry (locally available), are more suitable to poultry producers. As well as, can fulfill the nutritional requirements and reduce poultry feed or production costs**.** The major restrictions of using those agricultural by-products as feed are its low palatability, low digestibility, low energy, low crude protein (CP) and high crude fiber (CF) contents than traditional feedstuffs they replace.

Sugar beet is a major industrial crop in temperate regions that making about, a third of all sugar produced in the world. A crop with Egyptian production of 13.323369 million tonnes, harvested in 2016 **(FAO, 2018).** Dried sugar beet pulp (SBP) is very cheap and abundant one by-product accumulates after processing of sugar beet (*Beta vulgaris L.*) as of the sugar industries. For example**,** in Egypt, about 732785.29 tonnes of dry matter of this by-product are available for feeding year 2016 (supposing that each ton of the processing sugar beet yields 5.5% of dried SBP **(Mirzaei-Aghsaghali and Maheri-Sis, 2008))**.

Sugar beet pulp is chiefly is used as a ruminant feed. In this regard, **Mojtahedi and Danesh Mesgaran (2009) and Olmos and Hansen (2012)** indicated that SBP is mostly used in animal nutrition as a source of energy and is characterized by an increased content of pectins and glucans (soluble fiber), which is fermented primarily to acetate. Moreover**, Agar *et al.* (2016)** showed that, SBP a complex material is mainly composed of insoluble hemicelluloses, cellulose and soluble pectin, in addition to small amounts of lignin. **Mateos *et al.* (2012) and**

Nobakht and Hamedi (2014) reported that dried SBP is an agricultural low cost by product of sugar industry and could be used as a high quality feed for animals and poultry. Sugar beet pulp may be fed either wet or dry and possibly sold in either meal or pelleted form.

Sugar beet fiber are characterized by 1- low phytate, which is of particular distress to nutritionists because of its possible unfavorable impacts on mineral absorption and 2-enhance water binding and retention capacity, which is of particular important for the baking manufacture **(Filipovic *et al.,* 2007).** Pectins content, in SBP may improve digesta stickiness that preventing the absorption of metal ions and assist their elimination via the feces. Betaine is naturally occurring product present in large quantities in sugar beet. On the other hand, **Garcia *et al.* (1993)** found that SBP contains highly digestible fiber pectin and sugar that provide further insight on the use SBP as an energy source for poultry.

The chemical composition of SBP according to, **Papadomichelakis *et al.* (2004),** include the protein contents of dried SBP which ranged from 8 to 11%, but, high CF content (17–22%/dry weight), mainly composed of hemicellulose fraction (45–61%), 20–24% cellulose and 1–2% lignin as well as 7–8% protein (**Foster *et al.,* 2001**). Although, its CF content is high and its digestion coefficient is suitable due to its low lignin content **(El-Ashry *et al.,* 2000)**. Sugar beet pulp contains 70% mostly as non starch polysaccharides **(Serena and Bach Knudsen, 2007)** and less CP but more lysine than wheat grain.

Almirall *et al.* (1997) found that increasing SBP inclusion from 0.0 to 15% in the diet of Hi-sex laying hens had no effect on cumulative feed consumption during period from 22 to 55 weeks of age. However, they also found that, inclusion of SBP in the diets caused a significantly ($P \leq 0.05$) differences for egg production (EP) and egg weight (EW). While, **Roberts *et al.* (2007)** reported that no significant effect of increasing dietary fiber was observed on EP, EW, feed consumption or feed conversion (FC) during period from 23 to 58 weeks of age in Hi-line W-36 hens. Feeding 4% SBP caused the highest values of albumen, yolk, shell, and Haugh unit score, but decreased the eggshell thickness (**Nobakht and Hamedi, 2014**).

Alagawany and Attia (2015) observed that no significant effect of increasing dietary SBP was observed on feed consumption, FC, egg number (EN) and EW.

Therefore, the objective of the present study was to investigate the effects of inclusion of SBP on the performance and egg quality of Gimmizah laying hens, during the period from 9 to 27 weeks.

MATERIALS AND METHODS

The present work was supported by Project of, effect of partial replacing of YC by SBP on productive performance of poultry, funded from Minist. Of Agric. and Land Recl., Regional Councils for Agric. Res. and Extension, Fayoum, Egypt, during the period from June to October, 2016. Some chemical analyses (moisture, protein, fat and ash%) were performed in the laboratories of Poult. Depart., Fac. of Agric., Fayoum Univ., Egypt, according to the methods outlined by **A.O.A.C (2016).** This study was undertaken to assess the effects of inclusion of SBP in the diets on the growth, productive performance and egg quality of Gimmizah laying hens (local strain) from 9 to 27 weeks of age**.**

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 (harvest 2015). It was ground using a hammer mill for feeding, and chemically analyzed (amino acids, fiber and fiber fractions%, gross energy Kcal/Kg and betaine, g/kg) at the laboratories of Regional Center for Food and Feed-RCFF, Dokki, 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 (grower, pre lay and laying diets) are presented in Tables (2, 3 and 4).

Chicks were fed with starter diets (previously study, **Emam, 2018**) contained 19% CP and 2800 Kcal/Kg diet from the beginning of the three weeks up to eight weeks, and then hens fed in the present study on grower diets (females only) from the beginning of 9 up to 19 weeks, pre lay diets from the beginning of 20 up to 23 weeks and layer diets from the beginning of 24 up to 27 weeks. Chicks (males and females) were reared together and sexes were determined and separated at 8 weeks. Then, at the beginning of 9 weeks of age, a total of 180 females were translated to electrically heated batteries with wire mesh floors. Also, those hens were fed previously (**Emam, 2018)** from 3 up to 8 weeks of age on five different diets (0, 5, 10, 15 and 20% SBP), then in the present study were continue feeding on the same treatments (which its fed in the starter period), which, consisted of five levels of SBP (0, 5, 10, 15 and 20% SBP) until 27 weeks (5 treatments, 36 pullets each), each treatment contain 4 replicates (9 pullets each)). Each replicate was reared in wire cage (3 hens per cage) for 27 weeks. The experimental diets (in mash form) were supplemented with vit. and min. mixture and were formulated to gratify nutrient requirements (iso-nitrogenous and iso-caloric) of Gimmizah birds 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 mash form feed were supplied *ad libitum* during the experiment. Lighting, heating (open system) and the vaccination program were provided according to brooding and poultry rearing standard protocols.

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

Items		The present study	NRC, 1998	Sauvant *et al.*, 2004	Feedstuffs ingredient analysis table, 2017	Feedipedia, 2018
Protein and amino acids%	Crude protein	8.40	8.60	8.10	8.00	8.90
	Aspartic	0.65	-*	0.65	-	0.80
	Therionine	0.44	0.38	0.40	0.40	0.48
	Serine	0.47	-	0.46	-	0.57
	Glutamic	0.80	-	0.83	-	1.02
	Glycine	0.38	-	0.38	-	0.47
	Alanine	0.48	-	0.43	-	0.53
	Valine	0.67	0.45	0.55	0.40	0.69
	Isoleucine	0.32	0.31	0.36	0.30	0.44
	Leucine	0.53	0.53	0.57	0.60	0.71
	Tyrosine	0.55	0.40	0.47	-	0.52
	Phenylalanine	0.34	0.30	0.37	0.30	0.45
	Hisitidine	0.33	0.23	0.30	0.02	0.38
	Argnine	0.40	0.32	0.40	0.30	0.45
	Proline	0.43	-	0.39	-	0.48
	Cystine	0.13	0.06	0.11	0.01	0.13
	Lysine	0.67	0.52	0.64	0.60	0.63
	Methionine	0.18	0.07	0.15	0.01	0.17
Fiber and fiber fractions%	Crude fiber	19.01	-	17.30	21.00	19.40
	Neutral detergent fiber	43.97	42.40	40.50	-	47.10
	Acid detergent fiber	23.38	24.30	20.60	-	23.80
	Acid detergent lignin	3.91	-	1.90	-	2.70
	Hemicelluloses	20.59	-	-	-	-
	Celluloses	19.46	-	-	-	-
	Lignin	3.28	-	-	-	-
Moisture %		6.20	9.00	10.90	9.00	11.20
Fat%		0.56	0.80	0.90	0.50	0.90
Ash%		2.10	-	6.80	3.80	7.10
Energy, Kcal/kg	Gross	3962 .0	-	3633.0	-	4087.0
	Metabolizable	-	2495.0	2677.0	2345.0	2700.0
Betaine, g/kg		3.98	-	-	-	-

-* Data Not Available

Table 2: Composition and analysis of the experimental diets during the period from nine to nineteen weeks of age.

Item,%		Level of sugar beet pulp%				
		0.00	**5.00**	**10.00**	**15.00**	**20.00**
Feed Ingredients	**Yellow corn, ground**	64.86	61.79	58.70	55.71	52.19
	Sugar beet pulp, ground	0.00	5.00	10.00	15.00	20.00
	Wheat bran	19.30	17.00	14.72	12.31	10.61
	Soybean meal (44%CP[1])	12.34	12.80	13.26	13.75	14.08
	Calcium carbonate	1.33	1.25	1.15	1.05	0.95
	Sodium chloride	0.38	0.36	0.34	0.32	0.29
	Vit. and Min. premix[2]	0.30	0.30	0.30	0.30	0.30
	Dicalcium phosphate	1.44	1.45	1.48	1.51	1.53
	DL–Methionine	0.05	0.05	0.05	0.05	0.05
	Total	100.0	100.0	100.0	100.0	100.0
Calculated analysis:						
Protein and amino acids	**Crude protein**	14.00	14.00	14.00	14.00	14.00
	Lysine	0.63	0.64	0.67	0.69	0.71
	Methionine	0.29	0.29	0.29	0.29	0.29
	Methionine+Cystine	0.54	0.54	0.54	0.54	0.54
	Arginine	0.831	0.830	0.830	0.829	0.829
	Threonine	0.502	0.517	0.531	0.546	0.560
	Valine	0.646	0.661	0.675	0.690	0.704
Crude fiber and fiber fractions	**Crude fiber**	4.41	5.08	5.74	6.39	7.10
	Neutral detergent fiber	15.99	16.99	17.99	18.95	20.14
	Acid detergent fiber	5.485	6.312	7.142	7.959	8.840
	Acid detergent lignin	1.030	1.134	1.238	1.339	1.460
	Hemicelluloses	9.404	9.603	9.807	9.978	10.331
	Celluloses	4.022	4.763	5.506	6.241	7.017
	Lignin	1.277	1.343	1.410	1.473	1.553
Fat	**Ether extract**	3.14	2.99	2.83	2.68	2.53
	Linoleic acid	1.507	1.439	1.370	1.303	1.226
Minerals	**Calcium**	0.90	0.90	0.90	0.90	0.90
	Available phosphorus	0.38	0.38	0.38	0.38	0.38
	Potassium	0.699	0.699	0.700	0.700	0.704
	Sodium	0.173	0.174	0.174	0.172	0.171
	Chloride	0.272	0.263	0.253	0.256	0.228
Betaine		0.114	0.121	0.129	0.136	0.146
ME, kcal./Kg		2700.7	2703.0	2704.8	2708.3	2701.1
Cost (£.E./ton)[3]		4366.1	4292.3	4214.7	4133.3	4045.0
Relative cost[4]		100.00	98.31	96.53	94.67	92.65

[1] Crude protein [2] Each 3.0 Kg of the Vit. and Min. premix manufactured by Egypt Pharma Company and contains: Vit. A 10000000 IU; Vit. D_3 2500000 IU; Vit. E 10000 mg; Vit. K_3 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.

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

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

Table 3: Composition and analysis of the experimental diets during the period from twenty to twenty-three weeks of age.

Item,%		Level of sugar beet pulp%				
		0.00	**5.00**	**10.00**	**15.00**	**20.00**
Feed Ingredients	**Yellow corn, ground**	64.15	60.15	54.37	48.55	42.80
	Sugar beet pulp, ground	0.00	5.00	10.00	15.00	20.00
	Wheat bran	1.44	0.00	0.00	0.00	0.00
	Soybean meal (44%CP[1])	27.85	28.18	28.35	28.53	28.68
	Calcium carbonate	4.15	4.05	3.95	3.85	3.75
	Sodium chloride	0.40	0.37	0.35	0.33	0.30
	Vit. and Min. premix[2]	0.30	0.30	0.30	0.30	0.30
	Dicalcium phosphate	1.50	1.53	1.54	1.55	1.57
	Vegetable oil[3]	0.10	0.31	1.03	1.78	2.49
	DL–Methionine	0.11	0.11	0.11	0.11	0.11
	Total	100.0	100.0	100.0	100.0	100.0
Calculated analysis:						
Protein and amino acids	**Crude protein**	18.00	18.00	18.00	18.00	18.00
	Lysine	0.92	0.95	0.97	0.99	1.02
	Methionine	0.40	0.40	0.40	0.40	0.40
	Methionine+Cystine	0.70	0.70	0.70	0.69	0.69
	Arginine	1.133	1.133	1.137	1.140	1.143
	Threonine	0.675	0.689	0.703	0.717	0.730
	Valine	0.834	0.849	0.863	0.878	0.892
Crude fiber and fiber fractions	**Crude fiber**	3.52	4.25	5.08	5.92	6.75
	Neutral detergent fiber	10.47	11.72	13.39	15.05	16.72
	Acid detergent fiber	4.601	5.502	6.525	7.548	8.570
	Acid detergent lignin	0.481	0.609	0.776	0.943	1.111
	Hemicelluloses	4.475	4.882	5.627	6.370	7.116
	Celluloses	3.641	4.430	5.301	6.172	7.042
	Lignin	0.796	0.878	0.985	1.092	1.199
Fat	**Ether extract**	2.80	2.85	3.38	3.94	4.46
	Linoleic acid	1.581	1.612	1.893	2.190	2.466
Minerals	**Calcium**	2.00	2.00	2.00	2.00	2.00
	Available phosphorus	0.40	0.40	0.40	0.40	0.40
	Potassium	0.776	0.781	0.796	0.811	0.825
	Sodium	0.174	0.171	0.172	0.173	0.170
	Chloride	0.281	0.265	0.256	0.247	0.232
Betaine		0.021	0.033	0.052	0.070	0.089
ME, kcal./Kg		2801.8	2800.1	2799.8	2801.1	2800.5
Cost (£.E./ton)[4]		5107.6	5029.2	4959.2	4891.3	4820.8
Relative cost[5]		100.00	98.47	97.09	95.77	94.38

[1] Crude protein [2] Each 3.0 Kg of the Vit. and Min. premix manufactured by Egypt Pharma Company and contains: Vit. A 10000000 IU; Vit. D_3 2500000 IU; Vit. E 10000 mg; Vit. K_3 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.

[3] Mixture from 75% soybean oil and 25% sunflower oil.

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

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

Table 4: Composition and analysis of the experimental diets during the period from twenty-four to twenty-seven weeks of age.

Item,%		Level of sugar beet pulp%				
		0.00	**5.00**	**10.00**	**15.00**	**20.00**
Feed Ingredients	**Yellow corn, ground**	49.00	43.00	37.20	31.43	25.63
	Sugar beet pulp, ground	0.00	5.00	10.00	15.00	20.00
	Soybean meal (44%CP[1])	33.53	33.74	33.90	34.04	34.21
	Calcium carbonate	9.19	9.19	9.08	9.00	8.90
	Sodium chloride	0.40	0.38	0.35	0.33	0.31
	Vit. and Min. premix[2]	0.30	0.30	0.30	0.30	0.30
	Dicalcium phosphate	1.84	1.85	1.87	1.89	1.90
	Vegetable oil[3]	5.60	6.40	7.16	7.86	8.60
	DL–Methionine	0.14	0.14	0.14	0.15	0.15
	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	1.03	1.05	1.08	1.10	1.12
	Methionine	0.43	0.43	0.43	0.44	0.44
	Methionine+Cystine	0.74	0.74	0.74	0.74	0.74
	Arginine	1.239	1.243	1.246	1.248	1.252
	Threonine	0.722	0.736	0.749	0.763	0.776
	Valine	0.882	0.896	0.910	0.924	0.939
Crude fiber and fiber fractions	**Crude fiber**	3.43	4.26	5.09	5.93	6.76
	Neutral detergent fiber	9.16	10.81	12.48	14.14	15.80
	Acid detergent fiber	4.524	5.545	6.566	7.587	8.609
	Acid detergent lignin	0.379	0.545	0.713	0.880	1.047
	Hemicelluloses	3.456	4.191	4.935	5.680	6.424
	Celluloses	3.662	4.532	5.402	6.271	7.141
	Lignin	0.624	0.729	0.836	0.942	1.049
Fat	**Ether extract**	7.73	8.33	8.90	9.41	9.96
	Linoleic acid	4.373	4.695	4.998	5.268	5.559
Minerals	**Calcium**	4.00	4.04	4.04	4.05	4.04
	Available phosphorus	0.46	0.46	0.46	0.46	0.46
	Potassium	0.819	0.834	0.848	0.862	0.877
	Sodium	0.17	0.17	0.17	0.17	0.17
	Chloride	0.28	0.27	0.25	0.24	0.23
Betaine		0.011	0.029	0.048	0.067	0.086
ME, kcal./Kg		2898.4	2898.8	2901.2	2899.2	2900.0
Cost (£.E./ton)[4]		5527.4	5460.0	5393.2	5326.2	5257.4
Relative cost[5]		100.00	98.78	97.57	96.36	95.12

[1] Crude protein [2] Each 3.0 Kg of the Vit. and Min. premix manufactured by Egypt Pharma Company and contains: Vit. A 10000000 IU; Vit. D_3 2500000 IU; Vit. E 10000 mg; Vit. K_3 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.

[3] Mixture from 75% soybean oil and 25% sunflower oil.

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

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

Birds were weighed on individual basis to the nearest gram at the beginning of 9 and at the end of 19 weeks of age throughout the experimental period. Also, at the same ages, feed intake [FI] was recorded and body weight gain [BWG], FC,g feed/g gain, caloric conversion ratio [CCR], crude protein conversion [CPC] and growth rate [GR] were calculated. Performance index [PI] was calculated according to the equation described via **North (1981)** as follow: PI= [$LBW_{,Kg}$ /FC] x100. Accumulative mortality rate was also recorded during the experiment period. Hens that died throughout the experimental period were weighed consequently; the data were used to adjust FI and calculations of FC.

Age at sexual maturity (day) was recorded for each hen as, the number of days from hatching, to day of laying first egg. Egg weight at sexual maturity (g) was estimated for each treatment at date of laying first egg. Average EW (g), total egg number per hen/period, average laying rate%/period and average FI (g) were estimated for each treatment during the period from day of laying first egg until 23 weeks of age.

Egg number and EW were recorded daily, EP was calculated as hen housed egg production, FI was recorded weekly, FC as g feed/g egg, CPC and CCR were calculated during the period from 24 until 27 weeks of age. At the end of 27 weeks of age (the last two days), total number of 80 eggs [16 eggs/treatment] were randomly collected to determine egg shape index% **(Carter**, **1968)** and weighed (individually) to the nearest 0.1g then broken on a flat surface where the height of the albumen was measured to the nearest 0.1 mm (half way between the yolk and the edge of the inner thick albumen) via electronic albumen height gauge. The yolk was separated from the albumen and weighed. Yolk visual color score was measured by matching the yolk with one of the 15 bands of the "1961, Roche Improved Yolk Color Fan". The shells were dried at room temperature for 3 days and weighed; egg shell thickness together with shell membranes was measured using a micrometer at three points on the egg [air cell; equator; and sharp end]. The percentage of albumen, yolk and shell were calculated. Haugh unit score was calculated by using egg and albumen height which was determined by using a micrometer **(Haugh, 1937)**, also, yolk index% **(Well, 1968)** was calculated.

Economical efficiency was considered from the input-output analysis via data from feeding expenses, eggs selling incomes, finally achieving the absolute revenue. These values were calculated as the net revenue/unit of total costs based upon local market prices (at the experimental time) of the ingredients used for formulating the experimental diet.

Statistical analysis of results was performed with the General Linear Models method of the SPSS software **(SPSS, 2007]**, according to the following general model:

$$\mathbf{Y_{ij} = \mu + L_i + e_{ij}}$$

Where: $\mathbf{Y_{ij}}$**:** observed value. **μ:** overall mean.

$\mathbf{L_i}$**:** level of SBP effect (**i**: control (R), 5% SBP, 10% SBP, 15% SBP and 20% SBP)

$\mathbf{e_{ij}}$: random error.

Treatment means demonstrating significant differences (P≤0.01 and P≤0.05) were tested by Duncan's multiple range test **(Duncan, 1955)**.

RESULTS AND DISCUSSION:

Results in the present study (Table 1) showed that SBP had contained lower protein 8.4%, moisture 6.2%, ash 2.1% and fat 0.56%, as compared with 8.9% protein, 11.2% moisture, 7.1% ash and 0.9% fat **(Feedipedia, 2018)**. Betaine content in SBP (in the present study, Table 1) was very high 3.98 g/Kg than YC, being 0.205 g/Kg (**Bojana *et al.*, 2015)**. In this respect, **Ragab (2013)** found that, betaine supplementation has helpful in heat stressed broiler (Ross strain) reared during the summer period. Therefore, further researches are needed to estimate effects of SBP as a source of betaine supplementation on response of poultry during times of osmotic stress.

Concerning growing period (9 to 19 weeks): Results in Table 5 indicated that inclusion of SBP in the diets of Gimmizah laying hens at different levels caused a significantly (P≤0.001) differences in LBW values at the beginning of 9 and the end of 19 weeks of age, in addition to records of BWG, FI, FC, CPC, CCR and PI during the period from 9 to 19 weeks of age. Hens fed diet containing 5% SBP had significantly higher LBW at the beginning of 9 weeks and PI during the period from 9 to 19 weeks of age (differences between 0, 5, 10 and 15% SBP were not significant). Birds fed the control diet had higher LBW at 19 weeks and LBWG during the period from 9 to 19 weeks of age, without significant differences compared to those fed 5 and 10% SBP (Table 5). Hens fed diet containing 10% SBP consumed significantly higher FI during the period from 9 to 19 weeks of age, this possibly an indication of the ability of adult hen to utilize the test material up till 15%, where the differences were not significant. The lower values of LBW at the beginning of 9 and 19 weeks, LBWG, FI and PI during the period from 9 to 19 weeks of age had recorded for the hens fed diet containing 20% SBP (Table 5). This may be an indication that the dietary fiber affected poultry performance, however, the impacts depended on the source, level of fiber and the period considered or age of the pullet.

Table 5: Effect of inclusion of sugar beet pulp in the diets on the performance of Gimmizah hens, during the period from nine to nineteen weeks of age.

Items		**Level of sugar beet pulp%**					**SEM[1]**	**P-value**
		0.00	**5.00**	**10.00**	**15.00**	**20.00**		
LBW[2], g	**9 W[3]**	358.5^{a}	358.9^{a}	336.5^{a}	332.8^{a}	284.7^{b}	14.42	**0.002**
	19 W	1105.0^{a}	1093.7^{a}	1056.4^{ab}	1004.8^{b}	937.6^{c}	22.1	**<0.001**
BWG[4], g		746.5^{a}	734.7^{a}	719.9^{ab}	672.1^{bc}	651.0^{c}	20.24	**0.005**
FI[5], g		3979.7^{ab}	3902.2^{b}	4110.6^{a}	4107.2^{a}	3890.1^{b}	47.47	**0.001**
FC[6]		5.529^{b}	5.471^{b}	5.814^{ab}	6.290^{a}	6.203^{a}	0.183	**0.004**
CPC[7]		0.777^{b}	0.768^{b}	0.836^{ab}	0.903^{a}	0.878^{a}	0.03	**0.001**
CCR[8]		1.495^{b}	1.487^{b}	1.595^{ab}	1.719^{a}	1.701^{a}	0.05	**0.002**
PI[9]		21.080^{a}	21.126^{a}	18.728^{ab}	16.777^{b}	16.038^{b}	0.89	**<0.001**
GR[10]		1.030	1.026	1.041	1.012	1.069	0.03	**0.729**

[a–c] Means in a row with different superscripts differ significantly ($P\leq0.05$). [1] Pooled SEM
[2] Live body weight [3]Weeks [4] Body weight gain [5]Feed intake [6]Feed conversion [7]Crude protein conversion [8]Caloric conversion ratio [9]Performance index [10]Growth rate

In this respect, **Sklan (2001)** suggest that, the gastro intestinal tract (GIT) of chicks is immature at hatch and does not arrive at physiological maturity until 15 to 21 days. Therefore, the digestibility of nutrients should improve through age

(Gracia *et al.,* 2009). The inclusion SBP in the diet decreased BWG and hindered FC from 1 to 17 week. Most of the negative impacts observed by fiber inclusion on the performance of pullet were observed after 5 week of age **(Guzman *et al.,* 2015).** While**, Sarikhan *et al.* (2010)** found that FI did not affected by including insoluble fiber in broiler chick diets at the end of starter [21 days], grower [42 days] and overall of experimental period [0-42 days]. Also, at 21 days of age, differences in LBWG were not observed among dietary treatments. However, FC improved ($P \leq 0.01$) by level of insoluble fiber in diets at the end of starter, grower and overall experimental period **(Sarikhan *et al.,* 2010).**

Hens fed diet containing 5% SBP had better FC, CPC and CCR during the period from 9 to 19 weeks of age but, the differences between 0, 5 and 10% SBP were not significant (Table 5). On the other hand, the worst corresponding values were recorded with the hens fed diet containing 15% and 20% SBP during the same period (Table 5). Results in Table 5 indicated that feeding different levels of SBP insignificantly affected GR during the periods from 9 to 19 weeks of age. In this respect, **Hakansson *et al.* (1978)** reported that chickens usually adapt to fiber rich diets via increasing the size of the digestive tract and consequently enhance relative FI and growth. This was possibly one of the factors involved behind the enhanced production results obtained for chickens fed on 2.3% SBP inclusion levels **(Pettersson and Razdan, 1993)**. They also found that, birds fed on diet with the lowest insertion level of SBP had the highest FI and CP digestibility.

Concerning pre-lay period (20 to 23 weeks): Tabulated results in Table (6) indicated that, inclusion of SBP in the diets of Gimmizah laying hens at different levels caused a significantly ($P \leq 0.001$) differences in age at sexual maturity (day), average egg number per hen and average egg production% during the period from the day of laying its first egg until 23 weeks of age. Hens fed diet containing 10% SBP reached to sexual maturity earlier than the other treatments (the early in age at sexual maturity is coincided with a significant increase ($P<0.001$) of average egg number per hen and laying rate% during the period from day of laying first egg until 23 weeks of age). However, as shown in Table (6), hens fed diet containing 20%

SBP reached to sexual maturity delayer than the other treatments. On the other hand, the delay in age at sexual maturity is coincided with a significant decrease (P<0.001) of average egg number per hen and laying rate% (insignificant higher egg weight) during the period from the day of laying its first egg until 23 weeks of age.

Table 6: Effect of inclusion of sugar beet pulp in the diets on age at sexual maturity egg weight at sexual maturity, average egg weight, total egg number per hen, average egg production% and daily feed intake of Gimmizah hens, during the period from twenty to twenty three weeks of age.

Items	Age at sexual maturity (day)	Egg weight at sexual maturity (g)	Average egg weight (g)	Average egg number per hen	Average egg production%	Daily feed intake (g)
Level of sugar beet pulp%						
0.00	142.25^{bc}	28.50	33.13	4.26^{a}	14.20^{a}	78.16
5.00	150.33^{ab}	33.00	34.42	1.76^{b}	5.88^{b}	84.96
10.00	137.25^{c}	28.00	33.31	4.41^{a}	14.69^{a}	94.17
15.00	140.00^{c}	28.67	32.31	2.10^{b}	7.01^{b}	87.56
20.00	151.75^{a}	32.00	37.66	1.33^{b}	4.44^{b}	87.55
SEM[1]	2.55	1.82	1.90	0.45	1.78	3.60
P-value	0.007	0.182	0.373	0.003	0.003	0.090

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

Live BW at onset of egg production and during the production year influences the competence of egg production. Several researchers (**Harms *et al.,* 1982 and Summers and Leeson, 1983)**; have revealed that smaller birds produce significantly less eggs than do heavier birds. Also, **Robinson and Robinson, (1991)** found that low LBW hens found to commence lay later and produced fewer eggs than high or medium weight hens (in the same flock) as a result of delayed onset of production. Moreover, **Gous and Cherry (2004)** reported that the light hens reached sexual maturity after the heavy hens. Hens with lighter LBW produce lighter eggs, intake less feed per day, and more efficiently to convert feed to egg mass in comparison with heavier hens **(Ruiz *et al.,* 1983 and Summers and Leeson, 1983)**. However, **Nofal and Hassan (2004)** found that, Mamourah and Gimmizah large hens showed significantly lower production than that of the medium and small hens.

In the present study, it is probable that the negative result of the high level of SBP on the performance through the grower and pre lay period was cumulative to its decreasing impact at the starter period. However, feeding of high CF diets is used as a policy to control growth in various types of poultry for example, chicken pullets or turkey breeder candidates to prevent excessive growth. Increasing the CF level of the feed during the growing period is well known to increase the ability of the pullets to intake more feed at the beginning of the laying cycle (**Bouali *et al.,* 2013**).

Some researchers **(Mateos *et al.,* 2002** and **Montagne *et al.,* 2003)** have reported that an adequate type and amount of CF might enhance GIT adaptation of poultry to present productive systems and decrease digestive disorder without antibiotic use in feed**.**

Concerning laying period (24 to 27 weeks of age): Results in Table 7 indicated that inclusion of SBP in the diets of Gimmizah laying hens at different levels caused a significantly differences in EW, FI, CPC and CCR. Hens fed diet containing 20% SBP had significantly ($P \leq 0.01$) highest value of EW and higher FI (this may be due to hens fed diet containing 20% SBP reached to sexual maturity delayer than the other treatments), and the lower values were recorded with the hens fed diet containing 0.0% SBP (Table 7). Gimmizah laying hens fed diet containing 0.0% SBP had better values of CPC and CCR ($P \leq 0.05$), but, the differences between 0, 5, 10 and 15% SBP were not significant (Table 7). On the other hand, the worst corresponding values were recorded with the hens fed diet containing 20% SBP (Table 7).

Table 7: Effect of inclusion of sugar beet pulp in the diets of Gimmizah laying hens on productive performance during the period from 24 to 27 weeks of age.

Item	Level of sugar beet pulp%					SEM[1]	P-value
	0.00	5.00	10.00	15.00	20.00		
EW,g[2]	36.21^{c}	38.27^{b}	37.48^{b}	37.37^{b}	39.65^{a}	0.37	<0.001
EN[3]	12.33	12.47	13.73	12.21	12.51	0.98	0.669
EP[4], %	44.05	44.54	49.04	43.62	44.69	3.27	0.669
FI[5],g	70.30^{b}	70.66^{b}	78.81^{a}	73.23^{b}	81.57^{a}	1.78	<0.001
FC[6]	4.50	4.18	4.44	4.73	4.86	0.27	0.438
CPC[7]	0.839^{b}	0.878^{b}	0.844^{b}	0.898^{b}	1.10^{a}	0.07	0.031
CCR[8]	12.81^{b}	13.41^{b}	12.89^{b}	13.71^{b}	16.81^{a}	1.04	0.031

[a–c] Means in a row with different superscripts differ significantly ($P \leq 0.05$). [1]Pooled SEM
[2]Average egg weight, [3]Egg number/hen, [4]Egg production, [5]Daily feed intake, [6]Feed conversion,
[7]Crude protein conversion,[8]Caloric conversion ratio.

Results in Table 7 indicated that feeding different levels of SBP insignificantly affected EN, EP and FC (this perhaps an indication of the ability of adult hen to utilize the test material up till 20%, but the differences were not significant). Our findings are partially congruent with that of **Emam (2018)** who reported that SBP could be used at a rate of 5% in the starter diets of Gimmizah during the period from 2 to 8 weeks of age with no any adverse effects on the chicks performance, while, use of SBP at 20% in the diet resulted in poor performance.

Similar results were reported by **El-Ghamry *et al.* (2003)** who studied the effects of inclusion of SBP in Bovans brown (commercial egg type layer) and found that increasing SBP inclusion from 0.0 to 15% in the diet had no effect on EP during period from 52 to 64 weeks of age. However, they found that feed efficiency and FC significantly decreased by increasing SBP inclusion from 10 to 15% in the diet as compared with the control group, this possibly due to increase in the level of SBP as a result of its higher content of CF **(El-Ghamry *et al.,* 2003)**. The response observed in present study disagree with those reported by **Almirall *et al.* (1997)** who found that increasing SBP inclusion from 0.0 to 15% in the diet of Hi-sex laying hens had no effect on cumulative feed consumption during period from 22 to 55 weeks of age, but, inclusion of SBP in the diets caused a significantly differences for EP and EW. While, **Roberts *et al.* (2007)** reported that no significant effect of increasing dietary fiber was observed on EP, EW and feed consumption or FC during period from 23 to 58 weeks of age in Hi-line W-36 hens. Moreover, **Alagawany and Attia (2015)** observed that no significant effect of increasing dietary SBP was observed on feed consumption, FC, EN and EW.

Results in Table 8 indicated that feeding different levels of SBP insignificantly affected egg quality during the period from 24 to 27 weeks of age. Numerical improvements in EW,g; yolk index% and haugh unit were frequently observed when SBP was inclusion in the diets of Gimmizah laying hens at level of 5 to 20% during the period from 24 to 27 weeks of age as compared with control, but, these did not achieve a level of statistical significance (Table 8). However, numerically, as shown in Table 8, inclusion of SBP in the diets at level of from 5 to 20% partially decrease yolk color (this may be due to a lower pigment content of the diets) as compared with those fed 0.0%, but, these did not achieve a level of statistical significance. It can be concluded that, we need to supplementation of suitable pigmentation sources in the future studies to Gimmizah laying hens diets especially when it's fed on SBP for protection of yolk color.

Table 8: Effect of inclusion of sugar beet pulp in the diets of Gimmizah laying hens on egg quality during the period from 24 to 27 weeks of age.

Item	Level of sugar beet pulp%					SEM[1]	P-value
	0.00	5.00	10.00	15.00	20.00		
Egg weight, g	38.10	39.50	40.00	39.90	39.90	1.05	0.684
Yolk color	7.40	7.00	6.60	7.00	6.60	0.54	0.587
Shell thickness, mm	0.395	0.345	0.381	0.351	0.313	0.02	0.060
Albumen%	62.27	64.48	63.31	64.86	62.18	1.97	0.401
Yolk%	29.14	28.54	27.83	28.70	29.81	1.03	0.731
Shell%	7.70	7.32	8.86	7.01	8.02	0.82	0.212
Yolk index%	43.98	47.09	45.21	44.87	46.49	1.62	0.665
Shape index%	77.31	78.08	78.19	78.44	77.10	1.47	0.957
Haugh unit	57.04	58.67	60.59	59.09	59.67	1.13	0.238

[1]Pooled SEM

The response observed in present study partially agree with those reported by **El-Ghamry *et al.* (2003)** who reported that feeding different levels of SBP (5 to 15%) insignificantly affected egg quality parameters during the period from 52 to 64 weeks of age except, yolk color and shell thickness. Increasing SBP inclusion from 10 to 15% in the diet resulted in a decrease in yolk color **(El-Ghamry *et al.*, 2003)**. Feeding 4% SBP caused the highest values of albumen, yolk, shell, and Haugh unit score, but decreased the eggshell thickness (**Nobakht and Hamedi, 2014)**.

Mortality rate was not related to treatments studied during the periods from 9 to 19, 20 to 23 and 24 to 27 week of age (data not show). Therefore, the optional levels of dietary CF in poultry diets could be depend on the age of the birds in addition to on the physicochemical properties of the fiber source used.

Economical efficiency (EEf): Data in Table 9 showed that EEf value was improved in birds fed diet containing 5 and 10% SBP as compared with those fed the 0.0% SBP during the period from 24 to 27 weeks of age. Birds fed diet containing 5% SBP had the best values of economical and relative efficiency (0.443 and 106.34%, respectively), followed by those fed 10% SBP (0.442 and 106.13%, respectively) as compared with those fed the control diet (0.0% SBP). While, those fed diet containing 20% SBP had the lowest values of economical and relative efficiency (0.302 and 72.57%, respectively).

Table 9: Effect of inclusion of sugar beet pulp in the diets of Gimmizah laying hens on economical efficiency during the period from 24 to 27 weeks of age.

Item	Level of sugar beet pulp%				
	0.00	5.00	10.00	15.00	20.00
a	12.33	12.47	13.73	12.21	12.51
b	1.250	1.250	1.250	1.250	1.250
c = a × b	15.41	15.59	17.16	15.26	15.64
d	70.30	70.66	78.81	73.23	81.57
e	1.968	1.978	2.207	2.050	2.284
f	5.527	5.460	5.393	5.326	5.257
g = e × f	10.88	10.80	11.90	10.92	12.01
h = c - g	4.532	4.785	5.261	4.341	3.630
E.E.f. = h / g	0.417	0.443	0.442	0.398	0.302
Relative (E.E.f.)	100.00	106.34	106.13	95.43	72.57

a ……. egg number/hen.
b …… price/ egg (L.E.), according to the local market price at the experimental time.
c ……. total price of eggs /hen (L.E.).
d……..daily feed intake (g).
e…….... total feed intake/hen, kg = (FI (g/hen/day) /1000) X 30 days (Experiment period, days).
f……..price/ Kg feed (L.E.), based on average price of diets during the experimental time.
g……..total feed cost/hen (L.E.)
h……..net revenue / hen (L.E.)
E.E.f. …..economical efficiency(net revenue per unit feed cost).
Relative (E.E.f.)……assuming that economical efficiency of the control groups equals 100.

Conclusion: The obtained results show that the SBP could be used at a rate of 10% in the growing, pre-lay (from 9 to 23 weeks) and layer diets of Gimmizah without any adverse effects on the pullet or hen performance. This can assist in improving the Gimmizah production; reduce feeding expenses and partly solving the problem of present deficiency of traditional feed ingredients. On the other hand, an additional dietary CF might be more helpful in adult than in young pullets. We need to supplementation of suitable pigmentation sources in the future studies to Gimmizah laying hens diets especially when it’s fed on SBP for safety of yolk color.

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 study (especially Professor Dr. Ashry, M.R.K.). This 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.

REFERENCES

A.O.A.C. (2016). Association of Official Analytical Chemists, Official Methods of Analysis. 20th Edition, Washington, D.C, USA, online.

Agar, B., Genccelep, H., Saricaoglu, F. T., and Turhan, S. (2016). Effect of sugar beet fiber concentrations on rheological properties of meat emulsions and their correlation with texture profile analysis. Food and Bioproducts Processing, 100: 118–131.

Alagawany, M., and Attia, A. (2015). Effects of feeding sugar beet pulp and Avizyme supplementation on performance, egg quality, nutrient digestion and nitrogen balance of laying Japanese quail. Avian biology research, 8(2):79–88.

Almirall, M., Cos, R., Esteve-Garcia, E., and Brufau, J. (1997). Effect of inclusion of sugar beet pulp, pelleting and season on laying hens performance. Br. Poult. Sci., 38: 530–536.

Bojana, F. V., Jovana, B. S., Jelena, K. A., and Marija, B. I. (2015). The betaine content in common cereal-based and gluten-free food from local origin, Food and Feed Res., 42 (2):129-137.

Bouali, O., Perez-Bonilla, A., Garcia, J., Guzman, P., Saldana, B., and Mateos, G. G. (2013). Effect of source and level of fiber of the pullet diets and energy content of the laying diets on performance of brown egglaying hens from 17 to 48 weeks of age. Poult. Sci. 92 (E-Suppl. 1):P 192, (Abstr.)

Carter, T. C. (1968). The hen egg. A mathematical model with three parameters. Br. Poult. Sci., 9: 165-171.

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

Egyptian Agriculture Ministry Decree (1996). The standard properties for ingredients, feed additives and feed manufactured for animal and poultry. EL Wakaee EL-Masria, No. 192 (1997) P 95 Amirria Press Cairo, Egypt.

El-Ashry, M.A., Motaghally, Z.A., and Maareck, Y.A. (2000). Effect of dried sugar beet pulp as a feedstuff for ruminants, Final Technical Report, National Research Center, Cairo, Egypt.

El-Ghamry, A. A., El-Yamany, A. T., and El-Allawy, H. M. H. (2003). Partial replacement of yellow corn by rice polishings and sugar beet pulp in laying hens diet supplemented with kemzyme. Egypt. Poult. Sci., 24: 1-14.

Emam, R.M.S. (2018). 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. Egypt. Poult. Sci., 38: 909-922.

Feedipedia (2018). Feedipedia - Animal Feed Resources Information System - INRA CIRAD AFZ and FAO © 2012-2017, https://www.feedipedia.org.

Feedstuffs ingredient analysis table (2017). Feedstuffs ingredient analysis table: 2016 edition, Prepared by Amy Batal[1] and Nick Dale[2]; [1]Sanderson Farms; [2]University of Georgia, Athens, Ga., https://www.Feedstuffs farmcentric.com.

Filipovic, N., Djuric, M., and Gyura, J. (2007). The effect of the type and quantity of sugar-beet fibers on bread characteristics. J. of Food Ingineering, 78:1047–1053.

Food and Agriculture Organization of the United Nations, FAO (2018). http://www.fao.org/faostat/en/#data/QC.

Foster, B. L., Dale, B. E., and Doran-Peterson, J. B. (2001). Enzymatic hydrolysis of ammonia-treated sugar beet pulp. Applied Biochemistry and Biotechnology, 91–93:269–282.

Garcia, G., Galvez, J. F., and de Blas, J. C. (1993). Effect of substitution of sugar beet pulp for barley in diets for finishing rabbits on growth performance and on energy and nitrogen efficiency. J. Anim. Sci., 71:1823–1830.

Gous, R.M., and Cherry, P. (2004). Effects of body weight at, and lighting regimen and growth curve to, 20 weeks on laying performance in broiler breeders. Br. Poult. Sci., 45 (4): 445-452.

Gracia, M.I., Lazaro, R., Latorre, M.A., Medel, P., Aranibar, M.J., Jimenez-Moreno, E., and Mateos, G.G. (2009). Influence of enzyme supplementation of diets and cooking-flaking of maize on digestive traits and growth performance of broilers from 1 to 21 days of age. Anim. Feed Sci. Technol. 150, 303–315.

Guzman, P., Saldana, B., Mandalawi, H. A., Perez-Bonilla, A., Lazaro, R., and Mateos, G. G. (2015). Productive performance of brown-egg laying pullets from hatching to 5 weeks of age as affected by fiber inclusion, feed form, and energy concentration of the diet. Poult. Sci., 94:249–261.

Hakansson, J., Eriksson, S., and Svensson, S. A. (1978). The influence of feed energy level on feed consumption, growth and development of different organs of chicks. Uppsala: Swedish University of Agric. Sci., Report 57:1-54.

Harms, R.H., Costa, P.T., and Miles, R.D. (1982). Daily feed intake and performance of laying hens grouped according to their body weight. Poult. Sci., 61:1021-1024.

Haugh, R. P. (1937). Haugh units for measuring egg quality. Poult. Magazine. 43:552.

Mateos, G. G., Lazaro, R. P., and Gracia, M. (2002). The feasibility of using nutritional modifications to replace drugs in poultry feeds. J. Appl. Poult. Res., 11:437-452.

Mateos, G. G., Jimenez-Moreno, E., Serrano, M.P., and Lazaro, R. P. (2012). Poultry response to high levels of dietary fiber sources varying in physical and chemical characteristics. J. Appl. Poult. Res., 21: 156–174.

Mirzaei-Aghsaghali, A., and Maheri-Sis, N. (2008). Nutritive value of some agro-industrial by-products for ruminants - A review. World J. Zool. 3 (2): 40-46.

Mojtahedi, M., and Danesh Mesgaranm, M. (2009). Variability in the chemical composition and in situ ruminal degradability of sugar beet pulp produced in north-east Iran. Res. J. Biol. Sci., 4 (12): 1262-1266.

Montagne, L., Pluske, J. R., and Hampson, D. J. (2003). A review of interactions between dietary fibre and the intestinal mucosa, and their consequences on digestive health in young non-ruminant animals. Anim. Feed Sci. Technol., 108:95–117.

National Research Council, NRC (1982). United States-Canadian Tables of Feed Composition: Nutritional Data for United States and Canadian Feeds, Third Revision. National Academy Press. Washington, D.C., USA.

National Research Council, NRC (1994). Nutrient Requirements of Poultry. 9th revised edition. National Academy Press. Washington, D.C., USA.

National Research Council, NRC (1998). Nutrient requirements of swine, 10th revised ed. National Academy Press. Washington, D.C., USA.

Nobakht, A., and Hamedi, O. A. A. (2014). Study the effects of different levels of sugar beet pulp and combo multi-enzyme on performance, blood parameters and egg traits of laying hens. Anim. Sci. J., 27:42–51.

Nofal, M.E., and Hassan, I.I. (2004). Duration of fertility and productive performance of mamourah laying hens as influenced by feeding system during the last periods of the first year production. Egypt. Poult. Sci. J. 24(III):719-735.

North, M. O. (1981). Commercial Chicken Production Manual, 2nd Edition. AVI Publishing Company Inc, USA.

Olmos, C. J., and Hansen, Z. M. E. (2012). Enzymatic depolymerization of sugar beet pulp: Production and characterization of pectin and pectic-oligosaccharides as a potential source for functional carbohydrates. Chemical Engineering J. 192:29–36.

Papadomichelakis, G., Fegeros, K., and Papadopoulos, G. (2004). Digestibility and nutritive value of sugar beet pulp, soybean hulls, wheat bran and citrus pulp in rabbits, Epitheorese-Zootehnikes- Epistemes, 32, 15-27.

Pettersson, D., and Razdan, A. (1993). Effects of increasing levels of sugar-beet pulp in broiler chicken diets on nutrient digestion and serum lipids. Br. J. Nutr., 70:127-137.

Ragab, M. S. (2013). Impact of betaine supplementation to triticale diets varying in their metabolizable energy content on broiler performance during summer season. Egyptian J. Nutrition and Feeds, 16: 113-129.

Roberts, S.A., Xin, H., Kerr, B.J., Russell, J.R., and Bregendahl, K. (2007). Effects of dietary fiber and reduced crude protein on nitrogen balance and egg production in laying hens. Poult. Sci., 86: 1716–1725.

Robinson, F.E., and Robinson, N.A. (1991). Reproductive performance, growth rate and body composition of broiler breeder hens differing in body weight at 21 weeks of age. Can J. Anim. Sci., 71:1233-1239.

Ruiz, N., Miles, R.D., Wilson, H.R., and Harms, R.H. (1983). Choline supplementation in the diets of aged White Leghorn hens grouped according to body weight. Poult. Sci., 62:1028-1032.

Sarikhan, M., Shahryar, H. A., Gholizadeh, B., Hosseinzadeh, M. H., Beheshti, B., and Mahmoodnejad, A. (2010). Effects of insoluble fiber on growth performance, carcass traits and ileum morphological parameters on broiler chick males. Int. J. of Agric. and Biology, 12:531–536.

Sauvant, D., Perez, J. M., and Tran, G. (2004). Tables Of Composition And Nutritional Value Of Feed Materials: Pigs, Poultry, Cattle, Sheep, Goats, Rabbits, Horses, Fish. D. Sauvant, J.M. Perez & G.Tran (Eds). Wageningen Academic Publishers, Wageningen and INRA Editions, Versailles.

Serena, A., and Bach Knudsen, K.E. (2007). Chemical and physicochemical characterisation of co-products from the vegetable food and agro industries. Anim. Feed Sci. Technol. 139, 109–124.

Sklan, D. (2001). Development of the digestive tract of poultry. World's Poult. Sci., J. 57:415–428.

SPSS (2007). User's Guide: Statistics. Version 16. SPSS Inc. Chicago, IL, USA.

Summers, J.D., and Leeson, S. (1983). Factors influencing early egg size. Poult. Sci., 62:1155-1159.

Well, R. J. (1968). The measurement of certain egg quality: A study of the hens egg. Ed. By T.C. Carter Pub. Oliver and Boy Edinbrugh pp. 220-226 and 235-236.

الملخص العربي

تأثير احتواء العلائق علي لب بنجر السكر علي أداء وجودة البيض لدجاج الجميزة البياض

رمضان محمد سلامة إمام[١]، هالة محمد عبد الواحد[٢]
[١]قسم إنتاج الدواجن - كلية الزراعة -جامعة الفيوم – مصر
[٢]معهد بحوث الإنتاج الحيواني- مركز البحوث الزراعية- الدقي- الجيزة- مصر

صمم هذا البحث لدراسة تأثير احتواء العلائق علي لب بنجر السكر علي أداء دجاج الجميزة خلال الفترة ٩ حتي ٢٧ أسبوع من العمر. غذيت الكتاكيت من قبل علي عليقة البادئ من بداية الأسبوع الثالث حتي ثمانية أسابيع من العمر، ثم غذيت الدجاجات في الدراسة الحالية علي عليقة النامي من بداية الأسبوع التاسع حتي الأسبوع التاسع عشر من العمر، عليقة قبل وضع البيض من بداية الأسبوع العشرون وحتي الأسبوع الثالث والعشرون من العمر ثم عليقة البياض من بداية الأسبوع الرابع والعشرون وحتي الأسبوع السابع والعشرون من العمر. عند بداية الأسبوع التاسع من العمر استمرت ١٨٠ أنثي علي التغذية علي نفس المعاملات التجريبية والتي احتوت علي خمسة مستويات من لب بنجر السكر (صفر، ٥، ١٠، ١٥، ٢٠ %) حتي ٢٧ أسبوع من العمر (خمس معاملات/أربعة مكررات (٩ دجاجة/مكرر)).

عند بداية الأسبوع التاسع من العمر، كانت للدجاجات المغذاه علي عليقة تحتوي علي ٥% لب بنجر السكر الأعلي معنوياً في وزن الجسم عند بداية الأسبوع التاسع من العمر والأداء الإنتاجي (خلال الفترة من ٩ إلي ١٩ أسبوع من العمر)، كما كانت الأفضل معنوياً في قيم كفاءة تحويل كل من الغذاء، البروتين والطاقة خلال الفترة من ٩ إلي ١٩ أسبوع من العمر.كانت الدجاجات المغذاه علي عليقة تحتوي علي صفر% لب بنجر السكر الأعلي معنوياً في وزن الجسم الحي علي عمر ١٩ أسبوع وأيضا وزن الجسم المكتسب خلال الفترة من ٩ إلي ١٩ أسبوع من العمر. كانت لدجاجات المغذاه علي عليقة تحتوي علي ١٠% لب البنجر الأعلي معنوياً في كمية الغذاء المأكول خلال الفترة من ٩ إلي ١٩ أسبوع من العمر.

كانت الدجاجات المغذاه علي عليقة تحتوي علي ١٠% لب البنجر مبكرة في النضج الجنسي معنوياً عن المعاملات الاخري (التبكير في النضج الجنسي يتزامن مع زيادة معنوية في متوسط عدد البيض للدجاجة ومعدل إنتاج البيض% خلال الفترة من وضع الدجاجة لأول بيضة حتي ٢٣ أسبوع).

كانت الدجاجات المغذاه علي عليقة تحتوي علي ٢٠% لب البنجر الأعلي معنوياً في وزن البيضة وكمية الغذاء المأكول وسجلت الدجاجات المغذاه علي العليقة المحتوية علي صفر% لب بنجر السكر اقل القيم خلال الفترة من ٢٤ إلي ٢٧ أسبوع من العمر. كانت لدجاجات الجميزة المغذاه علي عليقة تحتوي علي صفر% لب بنجر السكر الأفضل معنوياً في قيم كفاءة تحويل كل من البروتين والطاقة خلال الفترة من ٢٤ إلي ٢٧ أسبوع من العمر، ولكن الاختلافات بين صفر، ٥، ١٠، ١٥% لب بنجر السكر غير معنوية. سجلت الدجاجات المغذاه علي ٢٠% لب بنجر السكر أسوء القيم لكفاءة تحويل كل من البروتين والطاقة خلال الفترة من ٢٤ إلي ٢٧ أسبوع من العمر. لم يكن للتغذية علي مستويات مختلفة من لب بنجر السكر أي تأثير علي متوسط عدد البيض للدجاجة ومعدل إنتاج البيض% وكفاءة تحويل الغذاء وجودة البيض خلال الفترة من ٢٤ إلي ٢٧ أسبوع من العمر.

الإستنتاج: من نتائج البحث يتضح أنه يمكن استخدام لب بنجر السكر بنسبة ١٠% في عليقة النامي (من ٩ إلي ١٩ أسبوع من العمر) وقبل وضع البيض (من ٢٠ إلي ٢٣ أسبوع من العمر) وعليقة البياض (من ٢٤ إلي ٢٧ أسبوع من العمر) لدجاج الجميزة، بدون أي تأثير عكسي علي أداء وجودة البيض. بينما أدى احتواء العليقة علي ٢٠% لب بنجر السكر إلي أداء إنتاجي سيئ.