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EFFECT OF REPLACEMENT OF BARLEY GRAINS AND SOYBEAN MEAL BY DISTILLER'S DRIED GRAINS WITH SOLUBLES WITH OR WITHOUT SUPPLEMENTED SEAWEED IN GROWING RABBIT RATIONS ON: 3- Glucose absorption and glucose, thyroxin and triiodothyronine concentration in blood plasma of growing rabbits.

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Twenty seven weaning New Zealand White (NZW)rabbits of seven weeks old of about 813 g live body weight was randomly distributed into nine groups (three rabbits in each). The experimental groups were fed randomly on one of the nine formulated experimental rations used. The 1st ration (R1) was used as a control, which contained: 10 % yellow corn+10 % barley+ 13.7 % soybean meal (SBM) + 20 % wheat bran + 40 % clover hay + 3 % molasses+1.0 % calcium diphosphate +1.2 % limestone + 0.5 % sodium chloride+0.4% minerals-vitamins mixture+0.2 % methionine. The substituting (equal parts) from barley and SBM by 10 % and 20 % distiller's dried grains with soluble (DDGS) for ration 2 (R2) and ration 3 (R3), respectively. The supplemented seaweed (SW) for these rations was at tow levels subtracted from the wheat bran. The first level was 0.5 % seaweed for rations R4, R5 and R6. The second level was 1.0 % seaweed for rations R7, R8 and R9. All rations were nearly isonitrogenous and isocaloric. Blood plasma samples were collected from all rabbits after overnight fasting at 7, 9, 11 and 13 weeks to determine glucose, thyroxin (T_4) and triiodothyronine (T_3). A representative part (5 cm) from the small intestine was dissected immediately after slaughtering the three rabbits in each group to determine glucose absorption rates.

The results of the present study revealed that there was no significant effect with feeding on DDGS with or without SW on glucose absorption. The *mean values for glucose absorption were ranged from 0.39 to 0.44 (mg/hr), with feeding on the experimental rations.*

Rabbit's group fed on 10 % DDGS with 1.0 % SW recorded the highest significant value of blood glucose (132 mg / 100 ml) followed by R4 (fed on 0.0 % DDGS with 0.5 % SW, where the lowest value (109.42 mg / 100 ml) was detected for R2 (fed on 10 % DDGS without SW).

There was no significant effect on T4 concentrations with feeding on the experimental rations. The mean values were ranged from 13.70 to 17.92 ng/ml. The highest values were observed with feeding on R8 followed by R9, while the lowest value was observed with feeding on R1. The same trend was observed in T3 concentrations. The mean values were ranged from 3.5 to 4.46 ng/ml. In generally, the T4: T3 ratio was about 4: 1 with feeding the experimental rations.

Keywords: Glucose, thyroxin, triiodothyronine, growing rabbits.

Non-ruminants absorb high level glucose from their feed. However, glucose is crucial for maintenance and productive function in animals (Reynolds, 2005).

Across a broad range of intakes and physiological states, including growth, lactation and dry periods, there is a very tight relationship between glucose supply and energy (DE or ME) intake (Reynolds *et. al*., 2001). This likely reflects a relationship between glucose requirement and ME supply, and effects of glucose demand on liver glucose production. In growing animals, glucose requirement will be determined by growth rate, which is set by ME intake. The increased ME supplied as absorbed glucose or VFA was either oxidized or used to support greater tissue energy balance (Rigout *et al*., 2003).

Liver is the predominant site of glucose synthesis in the animals, although 10 to 15 % of total glucose synthesis occurred in the kidneys (Bergman *et al*., 1974). The relative contribution of the kidneys increased to 25 % when animals were fasted, reflecting an increase in the use of glucose precursors from the breakdown of body tissues. Precursors for glucose synthesis include propionate, glucogenic amino acids, lactate, glycerol, butyrate and valerate (Leng, 1970). On a quantitative basis, for up to 76 % of liver glucose synthesis (Reynolds *et al*., 1998). Propionate represents an important metabolic link between ME intake and liver glucose production. Propionate supply is dictated by dietary intake, and is itself an important regulator of voluntary intake. Nearly all of the propionate absorbed into the portal vein is removed by the liver and virtually all the propionate taken up by the liver is used for glucose synthesis.

In conditions of under nutrition, the contribution of propionate and other precursors derived from the diet decreases, while the relative contributions of lactate, glycerol and amino acids from body tissues increase, albeit at a reduced rate of glucose synthesis (Lomax and Baird, 1983). The use of lactate from body tissues represents "Con Cycling" of glucose carbon between the liver and peripheral tissues, such as the muscle or adipose. However, substantial amounts of lactate can be absorbed across the portal drained viscera (PDV), which to a large extent represents dietary contributions (Van der Walt *et al.*, 1983). Nearly all the amino acids can contribute their carbon to glucose synthesis, and in total they are considered the second most important glucose precursor. Of all the amino acids, alanine represents the greatest potential contributor, and is absorbed into the portal vain in the greatest amount. However, like lactate, apart of the alanine released by the PDV and removed by the liver is a product of glucose metabolism, thus represents a recycling of glucose carbon.

Thyroxine (T_4) and triiodothyronine (T_3) hormones of the thyroid gland are major regulators of metabolic rate, growth and development of animals. Several studies have been undertaken to determine the role of physiological changes in thyroid activity in meat producing species (Garrett, 1980).

It has been reported that a reduction in plasma T_3 level is accompanied by an increase in T_4 level as a result of a reduction in peripheral monoiodation of T_4 (Klandorf *et al*., 1981). Energy content of diet clearly affects the plasma concentration of T_3 (Williams and Njoya, 1998). They demonstrated that low energy diet resulted in higher T_3 and lower plasma T4 concentrations.

The thyroid gland contains the highest concentration (0.2 to 5.0 % on a dry weigh basis) of iodine in the body, between 70 and 80 % of the total body stores. Approximately 90 % of the iodine which passes through the thyroid gland is captured by that organ (Hetzel and Welby, 1997). Iodine is then combined with tyrosine in the thyroid to form diiodotyrosine. Two molecules of this compound are then combined to form thyroxine. Approximately 80 % of the thyroxine entering the circulation is broken down through de-iodinization by the liver, kidney and other tissues.

Therefore, the aim of this study was to evaluate the effect of partially or totally substituting of barley and partially of soybean meal by DDGS with or without seaweed supplementation on glucose concentration, thyroxin (T_4) and triiodothyronine (T_3) in blood plasma of growing rabbits.

MATERIALS AND METHODS

The present study was carried out at the Experimental Station of the Poultry Production Department, while, the chemical analyses were run at the Laboratory of Animal Production Department, Faculty of Agriculture, Mansoura University, Mansoura, Egypt.

Experimental animals:

Twenty seven weaned New Zealand White (NZW) rabbits of seven weeks old of about 813 g live body weight were randomly distributed into nine groups (three rabbits in each). All rabbits of each group at 7, 9, 11 and 13 weeks of age were tended to determine glucose, T-3 and T-4 hormones concentration in blood.

Treatments and design:

The experimental groups were fed randomly on one of the nine formulated experimental rations used. The experimental rations were designed to gradually substitute barley grains and soybean meal (equal parts) by distiller dried grains with soluble (DDGS) at the rate of 10 and 20 % of the total mixed rations. Ration 1 (R1) contained 10 % barley and 13.7 % SBM (control), and substituting the barley and SBM by 10 % and 20 % DDGS for ration 2 (R2) and ration 3 (R3), respectively. The supplemented seaweed (SW) for these rations was at two levels of the wheat bran. The first level was by 0.5 % SW for rations R4, R5 and R6. The second level was 1.0 % SW for rations R7, R8 and R9. All rations were in pelleted form and nearly isonitrogenous and isocaloric.

Some blood constituents.

Blood samples were collected from the ear vein of all rabbits at 7, 9, 11 and 13 weeks old. The blood was centrifuged at 4000 rpm for 20 minutes for plasma separation to determine T_3 and T_4 hormones (Sterling and Lazarus, 1977), while glucose was determined in whole blood by Gluco-tek (Skyler *et al.*, 1981).

Absorption of glucose (in vitro) from intestine:

A representative part (5 cm) from the small intestine was dissected immediately after slaughtering of all rabbits. The dissected tissues were immersed in glucose 5 % solution in Petri dishes for one hour. After that the solutions were collected in clean tubes and then used to determine glucose absorption rates. Absorption rates were calculated by subtracting the detected amounts in the collected samples from that in the immersed solutions. The methods of glucose determination were the same as those used for blood samples by using available commercial kits.

Statistical analysis:

The statistical analysis was carried out using the General Linear Model Program (GLM) of SAS (2000). The obtained data for absorption of glucose (in vitro), glucose, Thyroxine (T4) and Triiodothyronine (T3) constituents in blood of different groups of rabbits were subjected to factorial analysis of variance according to the following model:

$$Y_{ijk} = \mu + T_i + L_j + TL_{ij} + e_{ijk}$$

Where; Y_{ijk} = Observation of the tested factor, µ = Overall mean, T_i = The effect of treatment (DDGS), i = 0, 10 and 20 %, L_j = The effect of levels (seaweed), j = 0, 0.5 and 1 %, TL_{ij} = The interaction between treatment and level effect and e_{ijk} = Random error.

Differences among means were subjected to Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Effects of supplemented SW or feeding DDGS and their interaction on glucose absorption:

The results in Table 1 show that then differences in absorption rate of glucose may indicated different levels of DDGS or seaweed in diets of rabbits had no deleterious effects on glucose absorption in the small intestine, which indicated that DDGS or seaweed had no contents interacted with glucose during absorption. The possibility of controlling hunger, satiety and feed intake by altering the type of carbohydrate in feed has intrigued a number of investigators (Glimp *et al.*, 1989).

Table 1. Main effects of supplemented SW or feeding DDGS on glucose (mg/hr) absorption at 13 weeks of age.

Items	SW(%)					DDGS (%)				
	0 .0	**0.5**	**1.0**	**± SEM**	***P***	**0.0**	**10.0**	**20.0**	**± SEM**	***P***
Glucose (mg/hr)	0.40	0.42	0.44	0.011	0.170	0.41	0.42	0.43	0.011	0.561

SEM = Standard error of means. *P* = Probability.

Glucose of the body major energy source was lower in restricted feeding rabbits and the recovery phase due to their lower amount of feed intake compared with the *ad libitum* rabbits. As a consequence of the restricted feed intake plasma immunoreactive insulin was decreased. Insulin is a key player in the control of intermediary metabolism influencing both carbohydrates and lipid metabolism (Rommers *et al*., 2004). Lostao *et al*. (1991) reported that intestinal glucose absorption in vivo comprises two components: an active component, which saturates between 30 and 50 mM glucose and a passive component, which increases in a broadly linear manner up to concentrations well in excess of 100 mM. At higher concentration, the passive component is 3 – 5 times greater than the active component and is therefore likely to be the major pathway by which intestinal glucose absorption occurs during the assimilation of a meal.

The results in Table (2) showed that no significant interaction effects of feeding rabbits on different levels of DDGS with or without SW on glucose absorption. The mean values of glucose absorption ranged from 0.39 to 0.44 mg/hr.

Table 2. Interaction effects between feeding DDGS and with or without seaweed (SW) on Glucose (mg/hr) absorption of rabbits at 13 weeks of age.

Items	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**± SEM**	***P***
DDGS (%)	**0.0**	**10.0**	**20.0**	**0.0**	**10.0**	**20.0**	**0.0**	**10.0**	**20.0**		
SW (%)		**0.0**			**0.5**			**1.0**			
Glucose (mg/hr)	0.40	0.39	0.42	0.41	0.41	0.43	0.43	0.44	0.43	0.019	0.893

SEM = Standard error of means. *P* = probability.

Effects of supplemented SW or feeding DDGS and their interaction on glucose concentration in whole blood:

Results presented in Table (3) show that the mean values of glucose concentration increased ($P<0.05$) with supplemented 0.5 or 1.0 % SW, being 125.69 and 128.61 mg/100 ml, respectively as compared to 0.0 % SW (120.14 mg/100 ml). However, feeding on 10% DDGS significantly decreased glucose concentration to 121.64 mg/100 ml compared with the control (128.06 mg/100ml), while insignificantly decreased to 124.75 mg/100 ml occurred with feeding on 20 % DDGS.

Table 4 and Figure 1, show the interaction effects of feeding rabbits DDGS with or without supplemented SW on glucose concentration in blood (mg/100 ml) from 7 to 13 weeks of age. Feeding on R8 caused the highest significant ($P<0.05$) blood glucose concentration (132 mg/100 ml) followed by R4. However the lowest blood glucose concentration was recorded for R2 (109.42 mg /100 ml).

The presented values for glucose concentration were within the range as found by Nichols (2003), Igwebuike *et al*.(2008) and EL-Bana *et al*. (2005).

Table 3. Main effects of supplemented SW or feeding DDGS on glucose concentration in blood (mg / 100 ml) from 7 to 13 weeks of age.

Items	SW(%)					DDGS(%)				
	0.0	0.5	1.0	± SEM	*P*	0.0	10.0	20.0	± SEM	*P*
WK (7)	116.89 [b]	127.11 [a]	126.56 [a]	3.015	0.047	125.11	123.33	122.11	3.015	0.781
WK (9)	117.22	124.78	130.22	4.118	0.109	130.67	118.56	123.00	4.118	0.138
WK (11)	122.67	128.78	127.44	2.817	0.297	130.22	121.89	126.78	2.817	0.139
WK (13)	123.78	122.11	130.22	2.839	0.131	126.22	122.78	127.11	2.839	0.534
Means	**120.14 [b]**	**125.69 [a]**	**128.61 [a]**	**1.630**	**0.006**	**128.06 [a]**	**121.64 [b]**	**124.75 [ab]**	**1.630**	**0.040**

a, b, c : Means within the same raw with different superscripts are significantly different ($P < 0.05$).
SEM = Standard error of means. *P* = Probability. Wk: Week

Cordova, (1994) reported a direct relation between glucose and zinc levels in blood, so marked increase in glucose level in blood of rabbits consumed seaweed could be related to the increase of zinc uptake.

Table 4. Interaction effects between feeding growing rabbits DDGS and with or without seaweed (SW) on glucose concentration in blood (mg / 100 ml) from 7 to 13 weeks of age.

Items	R1	R2	R3	R4	R5	R6	R7	R8	R9	±SEM	*P*
DDGS(%)	**0.0**	**10.0**	**20.0**	**0.0**	**10.0**	**20.0**	**0.0**	**10.0**	**20.0**		
SW(%)		**0.0**			**0.5**			**1.0**			
WK (7)	121.33	109.67	119.67	132.33	128.00	121.00	121.67	132.33	125.67	5.222	0.186
WK (9)	132.00	98.67	121.00	130.33	125.67	118.33	129.67	131.33	129.67	7.132	0.123
WK (11)	134.33	107.67	126.00	135.33	125.67	125.33	121.00	132.33	129.00	4.880	0.014
WK (13)	121.67	121.67	128.00	128.33	114.67	123.33	128.67	132.00	130.00	4.918	0.434
Means	**127.33**	**109.42**	**123.67**	**131.58**	**123.50**	**122.00**	**125.25**	**132.00**	**128.58**	**2.823**	**0.003**

SEM = Standard error of means. *P* = Probability, Wk: Week

In growing animals, glucose requirement will be determined by growth rate, which is set by ME intake. The increase ME supplied as absorbed glucose was either oxidized or used to support greater tissue energy balance (Rigout *et al*., 2003). Precursors for glucose synthesis include propionate, glycogenic amino acids, lactate, glycerol, butyrate and valerate (Leng, 1970). Propionate represents an important metabolic link between ME intake and liver glucose production. Propionate supply is dictated by dietary intake and

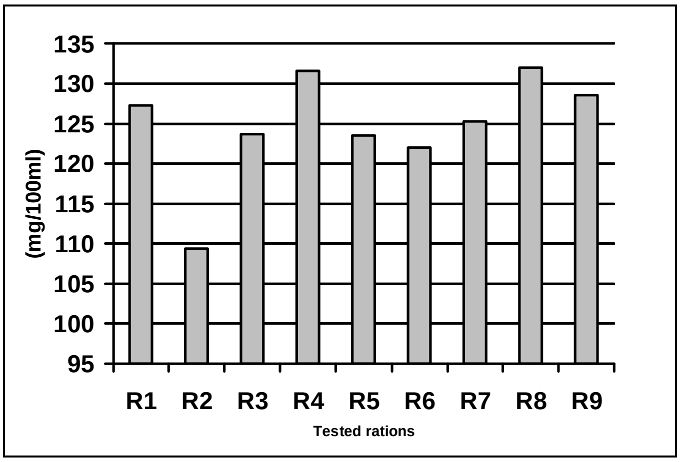

Figure 1. The effects of feeding DDGS with or without (SW) on glucose concentration (mg/100 ml) in blood of growing rabbits.

is itself an important regulator of voluntary intake. Nearly all of the propionate absorbed into the portal vein is removed by the liver and virtually all the propionate taken up by the liver is used for glucose synthesis (Reynolds *et al*., 1998).

Effects of supplemented SW or feeding DDGS and their interaction on concentration of thyroid hormones:

On the other hand, the obtained results showed that supplemented SW increased the concentrations of T_4 and T_3 in blood. As shown in Table 5, value of T_4 concentration increased ($P<0.05$) with both levels of supplemented SW. The mean values were (14.29, 16.13 and 17.28 ng/ml) with supplemented 0.0 %, 0.5 % and 1.0 % SW, respectively.

Concentration of T_3 had the same trend of T_4 concentration. The mean values were 3.77, 4.17 and 4.34 ng/ml with supplemented 0.0 %, 0.5 % and 1.0 % SW, respectively. However, there was no significant effect of DDGS levels on T_4. The mean values were higher with feeding on 10 or 20 % DDGS (16.20 and 16.23 ng/ml, respectively) than the control (15.27 ng/ml). While, T_3 concentrations were higher ($P<0.05$) with feeding DDGS than the control. The mean values were 3.85, 4.21 and 4.22 ng/ml with feeding on 0.0, 10 and 20 % DDGS, respectively.

Table 5. Main effects of supplemented SW or feeding DDGS on T4 and T3 concentration (ng / ml) in blood plasma from 7 to 13 weeks of age.

Items	SW(%)					DDGS(%)				
	0.0	**0.5**	**1.0**	**± SEM**	***P***	**0.0**	**10.0**	**20.0**	**± SEM**	***P***
T4 concentration (ng / ml):										
WK (7)	11.29	11.27	11.27	0.439	1.000	11.22	11.34	11.27	0.439	0.981
WK (9)	15.26 ^{b}	16.83 ^{b}	18.96^{a}	0.564	0.001	16.25	17.30	17.51	0.564	0.266
WK (11)	13.78 ^{b}	17.02 ^{a}	18.23^{a}	0.701	0.001	15.41	16.92	16.69	0.701	0.286
WK (13)	16.83 ^{b}	19.40 ^{a}	20.64^{a}	0.592	0.001	18.18	19.23	19.46	0.592	0.290
Means	**14.29 ^{b}**	**16.13 ^{a}**	**17.28^{a}**	**0.387**	**0.0001**	**15.27**	**16.20**	**16.23**	**0.387**	**0.163**
T3 concentration (ng / ml):										
WK (7)	3.37	3.37	3.43	0.130	0.932	3.45	3.37	3.36	0.130	0.882
WK (9)	3.92 ^{b}	4.42 ^{a}	4.50 ^{a}	0.116	0.005	4.01 ^{b}	4.43 ^{a}	4.40 ^{a}	0.116	0.034
WK (11)	3.51 ^{b}	4.13 ^{ab}	4.59 ^{a}	0.254	0.024	3.57	4.25	4.41	0.254	0.071
WK (13)	4.25 ^{b}	4.75 ^{a}	4.83 ^{a}	0.100	0.001	4.37 ^{b}	4.76 ^{a}	4.71 ^{a}	0.100	0.027
Means	**3.77 ^{b}**	**4.17 ^{a}**	**4.34 ^{a}**	**0.070**	**<.0001**	**3.85 ^{b}**	**4.21 ^{a}**	**4.22 ^{a}**	**0.070**	**0.002**
T4 / T3 concentration (ng / ml):										
WK (7)	3.36	3.36	3.32	0.163	0.979	3.27	3.38	3.40	0.163	0.839
WK (9)	3.94	3.83	4.22	0.185	0.325	4.08	3.91	4.00	0.185	0.794
WK (11)	3.99	4.35	3.99	0.249	0.502	4.41	4.02	3.89	0.249	0.325
WK (13)	3.97	4.08	4.29	0.141	0.284	4.15	4.04	4.14	0.141	0.823
Means	**3.80**	**3.89**	**3.98**	**0.089**	**0.371**	**3.97**	**3.85**	**3.85**	**0.089**	**0.536**

a, b, c : Means within the same raw with different superscripts are significantly different (P <0.05).
SEM = Standard error of means , *P* = Probability, Wk: Week

The Na+ / I – symporter (NIS) is a key plasma membrane protein that catalyses the active accumulation of Iodine (I –) in the thyroid gland *i.g*. the first and critical rate-limiting step in the biosyntheses of the thyroid hormones (Werner and Ingbar, 1991).

Table 6 and Figures (2 and 3) show the interaction effect of feeding on DDGS with or without supplemented SW on T_4 and (T_3) concentrations (ng/ml) in blood from 7 to 13 weeks of age. There was no significant effect on T_4 concentrations with feeding on the experimental rations. The mean values were ranged from 13.70 to 17.92 ng/ml. The highest value was observed with feeding on R9 followed by R9, while the lowest value was detected with feeding on R1. The same trend was observed in T_3 concentrations. The mean values were ranged from 3.5 to 4.46 ng/ml. *In generally*, the T4: T3 ratio was about 4: 1 when feeding the experimental rations.

Table 6. Interaction effects between feeding DDGS and with or without seaweed (SW) on T4 and T3 concentration (ng / ml) in blood from 7 to 13 weeks of age.

Items	R1	R2	R3	R4	R5	R6	R7	R8	R9	± SEM	*P*
DDGS(%)	0.0	10.0	20.0	0.0	10.0	20.0	0.0	10.0	20.0		
SW(%)		0.0			0.5			1.0			
T4 concentration (ng / ml):											
WK (7)	11.17	11.52	11.17	*11.17*	11.25	11.39	11.31	11.25	11.25	0.760	0.997
WK (9)	14.37	15.09	16.33	16.94	16.91	16.65	17.44	19.91	19.54	0.978	0.573
WK (11)	14.17	13.79	13.38	16.01	17.17	17.88	16.07	19.81	18.82	1.215	0.456
WK (13)	15.08	17.25	18.16	19.07	19.73	19.40	20.40	20.71	20.83	1.026	0.666
Means	**13.70**	**14.41**	**14.76**	**15.80**	**16.27**	**16.33**	**16.30**	**17.92**	**17.61**	**0.670**	**0.917**
T3 concentration (ng / ml):											
WK (7)	3.40	3.40	3.32	3.40	3.40	3.32	3.54	3.31	3.45	0.226	0.973
WK (9)	3.62	4.04	4.10	4.08	4.59	4.61	4.33	4.68	4.49	0.202	0.893
WK (11)	3.10	3.94	3.49	3.29	4.10	5.00	4.32	4.73	4.73	0.439	0.455
WK (13)	3.88	4.48	4.40	4.50	4.86	4.90	4.72	4.93	4.83	0.174	0.739
Means	**3.50**	**3.97**	**3.83**	**3.82**	**4.24**	**4.46**	**4.23**	**4.41**	**4.38**	**0.122**	**0.296**
T4 / T3 concentration (ng / ml):											
WK (7)	3.31	3.40	3.38	3.29	3.30	3.49	3.21	3.43	3.32	0.282	0.989
WK (9)	4.06	3.77	3.99	4.17	3.69	3.63	4.02	4.26	4.38	0.321	0.677
WK (11)	4.59	3.50	3.88	4.90	4.36	3.79	3.75	4.21	4.00	0.430	0.346
WK (13)	3.91	3.87	4.13	4.23	4.05	3.97	4.32	4.21	4.33	0.243	0.894
Means	**3.92**	**3.63**	**3.85**	**4.14**	**3.86**	**3.66**	**3.86**	**4.06**	**4.03**	**0.154**	**0.201**

SEM = Standard error of means , *P* = Probability, Wk: Week

Thyroxine (T4) and triiodothyronine (T3) of the thyroid gland are major regulators of metabolic rate, growth and development of animals. Several studies have been undertaken to determine the role of physiological changes in thyroid activity in meat producing species (Garrett, 1980). The results of Alfuraiji *et al*. (1994) indicated positive correlation between thyroid hormone levels in plasma and body weight during the growing period. This reaffirmed that the thyroid hormones are important in part as regulators of growth.

The greater fluctuation in T_3 may be explained by the fact that T_3 is more potent than T_4 and the latter has to be transform to T3 in tissue before it becomes biologically active (Boonnamsiri *et al*. 1979). Armstrong and Britt, (1987) have shown that change in energy and protein levels in diets are associated with increased or decreased concentrations of T_4 and T_3 in blood

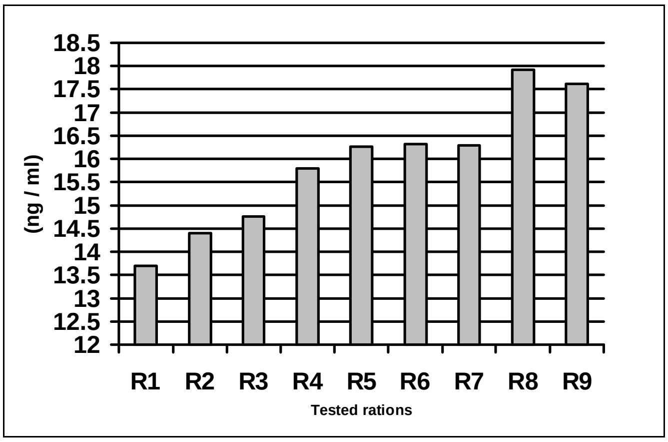

Figure 2. The effect of feeding DDGS with or without (SW) on T4 concentration (ng / ml) in blood of growing rabbits.

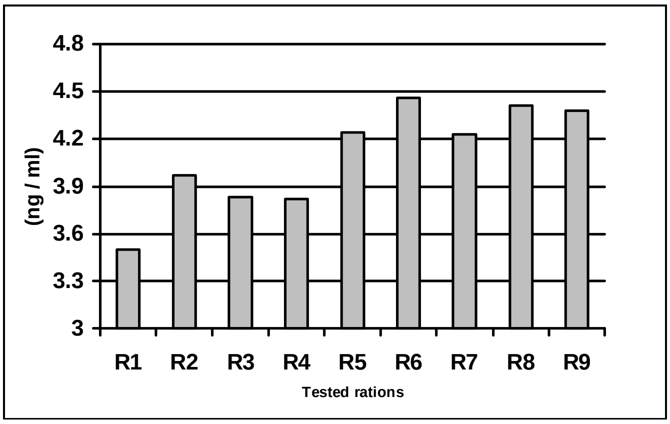

Figure 3. The effect of feeding DDGS with or without (SW) on T3 concentration (ng / ml) in blood of growing rabbits.

serums of mammals. In birds fed on high energy and protein diets (3200kcal ME/kg, 230 g/kg, respectively) mean concentrations of T3 and T4 were (2.4 and 9.3 ng/ml, respectively), Moravej *et al.* (2006).

Energy content of diet clearly affects the plasma concentrations of T3. Williams and Njoya, (1998) demonstrated that low energy diet resulted in higher T3 and lower T4 concentrations.

Conclusively, it could be concluded that feeding DDGS at levels 0.0 and 10 % supplemented with SW at levels 0.5 and 1.0 (%) were higher in glucose concentration than the other ration groups, while the lowest value was with feeding DDGS at level 10 % and unsupplemented with SW, but there were no significant effect on T_4 concentrations with feeding on these rations. The highest values were observed with feeding DDGS at levels 10.0, 20.0, 0.0, 10.0 and 20.0 % supplemented with SW at levels 0.5 or 1.0 (%), respectively, while the lowest value was with feeding control diet.

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تأثير إحلال النواتج العرضية لتقطير الحبوب الجافة بالسوائل محل حبوب الشعير وكسب فول الصويا مع إضافة أو بدون إضافة الطحالب البحرية فى علائق الأرانب النامية على:-

٣- امتصاص الجلوكوز وتركيز كل من الجلوكوز وهرمون الثيروكسين وتراى أيودو ثيرونين فى الدم.

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تم اختيار ٢٧ أرنبا نيوزيلندي ابيض عمر ٧ أسابيع بمتوسط وزن ٨١٣ جم وتم توزيعهم عشوائيا في تسع مجاميع متساوية في العدد والعمر ووزن الجسم (٣ أرنب / مجموعة). استخدمت الأرانب لتقدير تركيز الجلوكوز، هرمون الثيروكسين وتراى أيودو ثيرونين فى الدم وذلك عند عمر ٧ و ٩ و ١١ و ١٣ أسبوع. ثم اخذ جزء من الأمعاء الدقيقة (٥ سم) بعد ذبح الأرانب وذلك لتقدير معدل امتصاص الجلوكوز.

تم تغذية الأرانب على تسع علائق تجريبية على النحو التالي: العليقه (الاولى) المقارنة تحتوى على: ١٠ % ذرة صفراء + ١٠ % شعير + ١٣،٧ % كسب فول الصويا + ٢٠ % نخالة قمح + ٤٠ % دريس برسيم + ٣ % مولاس + ١ % داى كالسيوم فوسفات + ١،٢ % حجر جيرى + ٠،٥ % ملح طعام + ٠،٤ % مخلوط معدنى وفيتامينات + ٠،٢ % مثيونين.

وتم إحلال النواتج العرضية لتقطير الحبوب الجافة بالسوائل محل الشعير وكسب فول الصويا بنسبة ١٠ و ٢٠ % (كل من النسبة مقسمه على كل من الشعير وكسب فول الصويا بنسب متساوية) وذلك للعلائق (الثانية والثالثة). ثم تم إضافة الطحالب البحرية لهذه العلائق بنسبة ٠،٥ % وذلك لكل من العليقة الرابعة والخامسة والسادسة. كما تم إضافة الطحالب البحرية لهذه العلائق بنسبة ١ % وذلك لكل من العليقة السابعة والثامنة والتاسعة. وكانت جميع العلائق على شكل مكعبات ومتساوية في الطاقة والبروتين تقريبا. وطبقا للإحتياجات المطلوبة لتغذية الأرانب النامية.

وكانت أهم النتائج المتحصل عليها هى كما يلى:-

- لم تظهر فروق معنوية عند التغذية على العلائق التجريبية على معدل إمتصاص الجلوكوز وكان متوسط معدل إمتصاص الجلوكوز يتراوح بين ٠،٣٩ – ٠،٤٤ مللجم / ساعة.
- زاد تركيز الجلوكوز فى الدم معنويا (٠،٠٥) عند التغذية على العليقه الرابعة و الثامنة (١٣١،٥٨ و ١٣٢،٠٠ ملليجم / ١٠٠ مل، على التوالى) مقارنة بالتغذية على العلائق التجريبية الأخرى. بينما زاد تركيز الجلوكوز معنويا (٠،٠٥) عند التغذية على العليقه الاولى والتاسعة (١٢٧،٣٣و ١٢٨،٥٨ ملليجم / ١٠٠ مل، على التوالى) مقارنة بالتغذية على العلائق الثالثة، الخامسة، السادسة و السابعة (١٢٣،٦٧و ١٢٣،٥ و ١٢٢،٠٠ و ١٢٥،٢٥ ملليجم / ١٠٠ مل، على التوالى). بينما انخفض تركيز الجلوكوز معنويا (٠،٠٥) عند التغذية على العليقه الثانية (١٠٩،٤٢ ملليجم / ١٠٠ مل.
- لم تظهر فروق معنوية على تركيز هرمون الثيروكسين فى الدم عند التغذية على العلائق التجريبية وكان متوسط القيم يتراوح بين ١٣،٧ – ١٧،٩٢ نانوجرام / ملى ونلاحظ زيادة مستوى الهرمون بالتغذية على العلائق الخامسة، السادسة، السابعة، الثامنة و التاسعة بينما انخفض بالتغذية على العليقة الاولى. وكان تركيز هرمون تراى أيودو ثيرونين فى الدم مرتبط بتركيز هرمون الثيروكسين وكان متوسط القيم يتراوح بين ٣،٥ – ٤،٤٦ نانوجرام / مل.
- وبصفة عامة كانت نسبة تركيز هرمون الثيروكسين : تركيز هرمون تراى أيودو ثيرونين تتراوح بين ٤ : ١ عند التغذية على العلائق التجريبية المختلفة.

التوصية: يستنتج من هذه الدراسة انه بالرغم من التغذية على العلائق الرابعة والثامنة ادت الى زيادة تركيز الجلوكوز فى الدم مقارنة بالتغذية على العلائق الاخرى فى حين ان التغذية على العلائق الاولى والتاسعة كانت اعلى تركيزا مقارنة بالتغذية على العلائق الثالثة والخامسة والسادسة وكانت التغذية على العليقة الثانية اقل تركيزا. ولكن لم تظهر فروق معنوية على تركيز هرمون الثيروكسين نتيجة التغذية على العلائق المختبرة.