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Impact of Replacment of Cotton Seed Meal by Graded Levels of Dried Distillers Grains with Solubles (DDGS) on Lactating Zaraibi Goats Performance

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ABSTRACT

Twenty lactating Zaraibi goats in 2nd - 3rd season of lactation and average live body weight of 37.5±0.41 kg were used to determine the effects of inclusion (partially or totally) three levels of distiller dried grains with soluble (DDGS) instead of un-decorticated cotton seed meal (CSM) and small part of yellow corn on their productive performance. The experimental period lasted for 98 days, started after 3 months of suckling and weaning of kids. Goats were randomly assigned into four groups (5 goats each). Animals were fed according to NRC (1981) recommendations, since 50% of the total protein requirements were covered from whole corn silage (WCS) and the other 50% were assigned at rations to receive the following formulated concentrate feed mixtures : R1 concentrate feed mixture (0.0% DDGS, CFM1) control ration, R2 (8% DDGS, CFM2) , R3(16% DDGS , CFM3) and R4 (24% DDGS, CFM4) to formulate approximately four isonitrogenious and isocaloric rations. Results showed that nutrient digestibility coefficients and nutritive values in terms of TDN, DCP % , DE and ME (MJ/ kg DM) were significantly ($P<0.05$) improved gradually by adding DDGS levels to the tested rations. Inclusion DDGS at higher level in R3 and R4 rations lowered ($P<0.05$) ruminal pH values at all the sampling times. Ruminal ammonia-N concentrations were significantly higher ($P<0.05$) with DDGS rations than the control one. Increasing level of DDGS improved average daily milk yield (ADMY) and its composition. The highest ADMY was recorded with R4 followed by R3 rations, while R1 recorded the lowest value . Milk fat and protein% were the highest for groups fed R3 and R4. Milk total solids% improved with increasing DDGS levels. The economic efficiency (EE) values cleared that DDGS rations (R3 and R4) reflected superiority over the control ration by approximately 10.9 and 23.5% for 16 and 24% DDGS levels, respectively . The obtained EE values in the control and R2 rations were nearly similar (1.19 *vs* 1.21). From the nutritional and economical point of view the use of R4 (24% DDGS) to replace up to 100% of CSM in lactating goats rations could be recommended to improve goats performance and economic efficiency.

Keywords : Zaraibi goats, DDGS, Cotton seed meal, Digestion coefficient , Milk yield, Economic evaluation .

INTRODUCTION

Nowadays, the prices of all animal feedstuffs in Egypt are highly increased especially for cotton seed meal and corn to be 2-3 folds during the last five years. The cost of feeding cattle is rising steadily because of increased forage and grain costs (N.A.S.S. , 2008) and the problem of high feed prices is getting more acute. Cotton seed meal (CSM) is the traditional plant protein source used in formulating ruminants concentrate feed mixtures (CFM) in Egypt. But yearly quantity of CSM is considered the backbone of CFM produced .Unfortunately, the CSM production is not sufficient to give CFM to cover the requirements of livestock (Agriculture Economics and Statistics Institute, 2000). Such situation is causing animal nutritionists to search for lower cost alternative feed ingredients to minimize the cost of feeding in animal production . It may be economical to partially replace forage and/or grains with by-products. The by-products from the ethanol industry are gaining popularity as feedstuffs in the cattle industry of their availability, nutritive value and cost (Leupp, 2008) . The DDGS is imported to the Egyptian market as a new feed ingredient for animal feeding. This material is still a strange ingredient for ruminant animal keepers; so it is not accepted well from them irrespective of its nutritional and economic values.

As either a protein source or an energy source, DDGS can be included in the animal diet depending on several factors such as the type of diet being fed, animal nutrient requirements and other economic considerations.

Chemical composition of DDGS may be various though, it depends mostly on the bio-fuel production process and the quality of the grain (Omer *et al*., 2015). A primary ethanol industry co-product; DDGS, is an excellent source of energy and protein for beef cattle (Klopfenstein *et al*.2008) dairy cattle and sheep (Gabr *et al*., 2010a and Soliman *et al*.,2013) , rabbits (Gabr *et al*.,2010b) and fish (Gabr *et al*., 2013) . However, more information is still required on feeding DDGS to lactating farm animals in Egypt, especially goats .The main objectives of this study were to determine the effects of DDGS inclusion in lactating Zaraibi goats replacing (partially or totally) cotton seed meal (CSM, 22% of CFM) as a protein source and corn as an energy source on their productive performance, digestibility, some rumen parameters, some blood constituents and economic efficiency.

MATERIALS AND METHODS

The experimental work of this study was carried out at El–Serw Experimental Research Station, Animal Production Research Institute, Agriculture Research Center and Animal Production Department, faculty of agriculture, Mansoura university during summer 2015.

The main objectives of this study were to determine the effects of replacement three levels of distiller dried grains with soluble (DDGS) as a source of protein instead of of undecorticated cotton seed cake in CFM (CSM, 22% of CFM) and a part of corn as an energy source in Zaraibi dairy goats rations on their productive performance. Fortunately, the determined DM% as well as CP % of DDGS and CSM were found to be nearly similar (88.8 vs 90.0 and 27.7 vs 26.0 %, for DM and CP, respectively) which gave an opportunity to replace them quantitatively (weight by weight) for each other in tested rations, regardless of their type of protein .

1. Animals and feeding system :

Twenty lactating Zaraibi goats with average live body weight of 37.5±0.41 kg were used. The experimental period lasted for 98 days, started after 3 months of suckling and weaning of kids. Animals were divided randomly into four groups. Each group was housed in a separate well-ventilated pen according to their live body weight and their previous lactation season yield. Groups were randomly

assigned for one of four experimental rations. Animals in each group were fed in group feeding. Besides twelve Zaraibi bucks with an average live body weight of 61.12±0.31 kg were divided into four groups, 3 bucks each and were fed on the same tested rations for running the digestability trails**.** All total mixed rations were formulated to cover the nutritional requirements for producing about 1 kg milk daily according to NRC (1981) recommendations, since 50% of total protein requirements was covered from four whole corn silage (WCS) and the other 50% were covered from tested concentrate feed mixtures. The DDGS obtained from Al-Qaed feed company, Dakahlia Governorate , while whole corn silage and un-decorticated cotton seed meal were obtained from the experimental of research station. The total mixed rations contained 53% WCS as well as 47 % CFM .The DDGS replaced quantitatively (partially or totally) instead of undecorticated cotton seed meal (CSM) and a part of yellow corn for formulating four isonitrogenious (12.5% CP) and isocalories (18.30 MJ /kg DM) total mixed rations (TMR). The CFM contained DDGS at 0.0 % (control) (CFM1) , 8 % (CFM2), 16 % (CFM3) or 24 % (CFM4). The composition of the tested ingredients , CFM and total mixed rations are presented in Table (1).

Daily amount of total mixed feeds was offered for animals in two equal meals at 8 a.m. and 4 p.m. in mash form . Animals consumed feed offerd without feed refusals. Clean drinking water was available all the time. The animals were in 2nd - 3rd season **of** lactation. Daily amount of total mixed feeds were changed biweekly according to daily milk produced by goats.

Table 1. Feed ingredients (%) of tested concentrate feed mixtures.

Item	CFM 1	CFM 2	CFM 3	CFM 4
Dried distillers grains with soluble	00.0	8.00	16.0	24.0
Cotton seed meal	22.0	15.0	8.00	-
Yellow corn	30.0	29.0	28.0	28.0
Wheat bran	40.0	40.0	40.0	40.0
Molasses	5.00	5.00	5.00	5.00
Limestone	2.00	2.00	2.00	2.00
Salt	1.00	1.00	1.00	1.00
Total	100.0	100.0	100.0	100.0

2. Chemical analysis of tested ingredients and feces :

Composited samples were taken from tested ingredients and feces of bucks and dried at 70°C for running the proximate analysis according to A.O.A.C (1995) procedures. Nutrients digestibility coefficients were estimated by acid insoluble ash (AIA) as a marker according to Van Keulen and Young (1977).

3.Ruminal parameters:

Ruminal fluid samples were taken from bucks using stomach tube before feeding and at 3, and 6 hrs post- feeding at the end of the digestion trial. The ruminal fluid was strained through 4 layers of cheese cloth . The pH values were measured immediately by using a pH meter (ORION RESEARCH, model 201/digital pH meter). The concentration of ammonia-N was measured according to the method of Conway (1957). The volatile fatty acids were determined by the steam distillation methods described by Warner (1964).

4. Milk samples:

The animals were handily milked twice daily at 8.00 a.m and 5.00 p.m during the experimental period. Daily milk yield was recorded weekly for each goat for all tested rations. Reprehensive milk samples of about 0.5% of the total milk produced were taken once every two weeks from the goats in the morning and evening milking at the same proportion of the milk produced. The samples were analyzed for total solids (TS), fat, protein, solids non-fat (SNF) and Ash according to the analytical procedures of Ling (1963) and using Milko-Scan (133B Foss Electric).

5. Blood parameters:

Blood samples (about 10 ml) were taken in heparinized tubes from a jugular vein of three females goats at 3 hrs post-feeding once monthly during the experimental period. Blood serum was separated by centrifugation at 5000 r.p.m for 15 minutes then frozen at -20◦c until analysis by using commercial kits, serum total globulin (GL) was calculated by the differences (TP)-(AL).

6. Economic evaluation:

Economic gain was calculated as the difference between cost of feeds and the price of one kilogram milk. Economic efficiency was calculated as the cost of milk produced divided on the cost of total feed consumed .

7. Statistical analysis:

Data were statistically analyzed by the least squares methods described by Likelihood program of SAS (2003). Duncan's Multiple Range Test (Duncan,1955) was also used for the comparison among the experimental groups.

RESULTS AND DISCUSSION

1.Chemical composition of tested ingredients and tested rations:

The chemical composition of tested ingredients and calculated experimental rations are shown in Table (2). It was clear that DDGS contained, 27.7 % CP, 8% CF, 8.8% EE, 50.0% NFE and 5.5% Ash. These values are more close to those recorded by Rosentrater ,(2007) , Gabr *et al*. (2010a) , Hardman, (2013) and Abd El-Rahman *et al.* (2014). The chemical composition of CSM used herein was more close to that given by the latter author with some few exceptions. The chemical composition of WCS was within the normal range published in Egypt (Mahmoud *et al.,*1992; El-Ayouty *et al*.,2000 and El-Zelaky,2001).

All tested rations and tested concentrate feed mixtures had practically similar nutrients content ,with some few exceptions. The overall average of four mixed rations was 61.38, 93.23, 12.28, 2.70, 17.6, 60.58 and 6.77 for DM, OM, CP, EE, CF, NFE and Ash, respectively (Table 2).

As for GE (MJ/kg DM) concentration, the highest value was recorded with DDGS (20.22 MJ/kg DM) followed by CSM (18.72 MJ/kg DM), while those of WCS, CFM1, CFM2, CFM3 of tested rations were practically similar. Likewise, GE concentration of CFM3, CFM4 as well as the four tested rations was nearly the same.

Table 2. Chemical analysis (%), on DM basis, calculated gross energy(GE) of tested feed ingredients CFM´s and calculated chemical composition of tested rations.

ITEM	DM	OM	CP	CF	EE	NFE	ASH	GE* (MJ/kg DM)
Cotton seed meal (CSM)	90.0	95.0	26.0	23.5	2.0	43.5	5.0	18.72
Dried distillers grains (DDGS)	88.8	94.5	27.7	8.0	8.8	50.0	5.5	20.22
Whole corn silage (WCS)	36.5	93.0	11.5	24.7	2.4	54.4	7.0	17.94
CFM1	89.8	93.0	13.2	10.2	2.6	67.0	7.0	17.55
CFM2	90.1	93.3	12.8	10.0	2.8	67.7	6.7	17.93
CFM3	90.0	93.7	13.00	9.7	3.1	67.9	6.3	18.07
CFM4	90.0	94.0	13.8	9.5	3.5	67.2	6.0	18.25
Calculated chemical composition of tested rations (%) on DM basis.								
Item	DM	OM	CP	CF	EE	NFE	Ash	GE* (MJ/kg DM)
Ration1	61.3	93.0	12.3	18.0	2.5	60.3	7.00	18.50
Ration2	61.8	93.1	12.1	17.4	2.6	61.1	6.86	18.42
Ration3	61.6	93.3	12.2	17.7	2.8	60.7	6.68	18.01
Ration4	60.8	93.5	12.5	17.8	2.9	60.2	6.55	18.08

The gross energy (GE) values of tested ingredients, formulated concentrate feed mixtures and rations were calculated after MAFF (1975) as follows:

***GE(MJ/kg DM)= 0.0226 CP + 0.0407 EE + 0.0192 CF + 0.0177 NFE where CP, EE, CF and NFE gm/kg DM.**

2.Digestibility coefficients and nutritive value:

Results in Table (3) showed that most of nutrient digestibility coefficients were significantly (P<0.05) increased by addition of DDGS, especially with R3 and R4 (16 and 24% DDGS), compared with R2 and R1 (8, 0% DDGS). Comparable results have been reported by Etman *et al*. (2014) ; Omer *et al.* (2015) and Ghoneem and Mahmoud (2016). However, Soliman *et al*. (2013) recorded that when the Frisian cows fed on ration contained 20% DDGS all nutrient digestibility were significantly increased, but when DDGS was reached up to 30%, most of nutrients digestion coefficients were significantly (P<0.05) decreased, compared to control ration.

Data in Table (3) showed that similar trend as that observed with nutrients digestibility coefficients was recorded for the nutritive values expressed as TDN% , DE and ME (MJ/Kg DM) as well as DCP values. The TDN % of tested rations contained DDGS were significantly higher than that of control ration. As for DCP% , R3 and R4 rations showed higher values (P<0.05) than those of R2 and R1 without significant difference between the latter ones. There were no pronounced differences in DE and ME values among all experimental rations containing DDGS, while they were significantly (P<0.05) higher than the control. The higher nutritive values observed with DDGS rations could be attributed to better digestibility of most nutrients recorded by those groups. Similar results have been reported by Etman *et al*. (2012) and Omer *et al*. (2015) .

Table 3. Digestibility coefficients and nutritive values of tested rations fed to Zaraibi bucks.

Item	Experimental rations			
	Control R1	R2	R3	R4
Av. dry matter intake (g/h/d):				
WCS (g/h/d):	550	560	565	570
CFM (g/h/d):	480	500	500	475
Total DM intake(g/h/d):	1030	1060	1065	1045
DM intake g/Kg $W^{0.75}$	47.79	48.57	48.4	46.73
Digestion coefficients,%				
DM	$68.30^{c} \pm 0.15$	$68.90^{bc} \pm 0.20$	$69.50^{b} \pm 0.15$	$70.00^{a} \pm 0.23$
OM	$70.46^{b} \pm 0.52$	$71.66^{a} \pm 0.17$	$72.23^{a} \pm 0.38$	$72.80^{a} \pm 0.15$
CP	$71.50^{b} \pm 0.51$	$72.33^{b} \pm 0.55$	$74.00^{a} \pm 0.57$	$74.50^{a} \pm 0.11$
CF	$62.10^{c} \pm 0.32$	$63.20^{b} \pm 0.43$	$64.73^{a} \pm 0.23$	$64.83^{a} \pm 0.10$
EE	$75.43^{c} \pm 0.34$	$76.67^{c} \pm 0.60$	$78.50^{b} \pm 0.51$	$81.16^{a} \pm 0.66$
NFE	$63.60^{c} \pm 0.15$	$63.96^{c} \pm 0.26$	$65.30^{b} \pm 0.47$	$67^{a}.00 \pm 0.11$
Nutritive values%				
TDN	$62.51^{d} \pm 0.08$	$63.22^{c} \pm 0.12$	$64.97^{b} \pm 0.26$	$66.52^{a} \pm 0.10$
DCP	$8.79^{c} \pm 0.06$	$8.76^{c} \pm 0.07$	$9.03^{b} \pm 0.07$	$9.34^{a} \pm 0.02$
DE(Mj/Kg DM)*	$12.82^{b} \pm 0.16$	$13.44^{a} \pm 0.05$	$13.64^{a} \pm 0.12$	$13.51^{a} \pm 0.04$
ME (Mj/Kg DM)*	$10.51^{b} \pm 0.13$	$11.02^{a} \pm 0.04$	$11.18^{a} \pm 0.10$	$11.08^{a} \pm 0.03$

a, b, c, and d means within each row having the same superscript letter(s) are not significantly different at P ≤ 0.05

***DE and ME calculated according to MAFF(1975) using the following equation being:**

1- DE(Mj/Kg DM) digestible organic matter (g/Kg) x 0.19. 2-ME=DE(Mj/Kg DM) x0.82

3.Rumen liquor parameters:

Results in Table (4) showed that the highest values of ruminal pH for all dietary treatments were recorded before feeding at all sampling time, while the minimum were recorded at 3 hrs post-feeding. The decrease in pH values at 3 hrs post-feeding mainly due to increase in VFA's concentration in the rumen at that time. Then pH values tended to increase again at 6 hrs post-feeding with all tested rations which were in harmony with the highest NH3-N concentration at that time as well. The animals which fed on rations R3 & R4 showed the highest ruminal pH values at all sampling times, compared with control ration. These results are in agreement with those reported by Etman *et al.*(2012) and Soliman *et al.*(2013). The obtained pH values were appropriate to the normal function of cellulotic bacteria,

also it was out of the starting of acidosis (pH ≤5.8) . The present estimates for pH values were correspond with the range (6.2 to 7.2) reported by Van Soest (1994) which adjudged as best for fiber digestion.

Ruminal NH3-N concentration tended to be lower before feeding (0 time) and higher at 3 and 6 hrs post-feeding. NH3-N concentration significantly (P<0.05) increased with increasing DDGS levels in the tested rations , compared with control the ration. The present findings are agreed with Gabr *et al.* (2010a) who reported that the highest values of NH3-N concentration were recorded by adding different DDGS levels (10, 15 and 20%) in tested rations at 3 hrs post-feeding with growing lambs.

The TVFA's concentration significantly (P<0.05) influenced by DDGS inclusion, since the highest values were recorded with the highest DDGS level with R4 ration at 3 hrs post-feeding. Simillar results have been reported by Gabr *et al.* (2010a). In this field, Soliman *et al.* (2013) reported that the TVFA's significantly (P<0.05) increased with 20% DDGS ration, compared with other tested rations and they mentioned that TVFA's concentration in rumen liquor could be influenced by several factors such as the amount of easily fermentable carbohydrates, ration composition, ruminal pH beside the digestibility of organic matter and ammonia concentration. In addition, Borhami *et al*.(1992) recorded a positive and significant correlation between microbial protein yield (g/day) and VFA production. Also a positive correlation between ruminal ammonia-N and TVFA's concentration have been reported by Boraei (2004).

Table 4. Ruminal parameters of bucks fed tested rations

Item	hrs	R1	R2	R3	R4
pH	0	$6.44^{c} \pm 0.02$	$6.55^{bc} \pm 0.03$	$6.67^{b} \pm 0.01$	$6.84^{a} \pm 0.08$
	3	$6.37^{c} \pm 0.03$	$6.40^{c} \pm 0.01$	$6.48^{b} \pm 0.01$	$6.57^{a} \pm 0.01$
	6	$6.49^{b} \pm 0.01$	$6.49^{b} \pm 0.02$	$6.53^{b} \pm 0.02$	$6.66^{a} \pm 0.03$
NH3-N mg/100ml	0	$17.13^{b} \pm 0.38$	$18.33^{ab} \pm 0.32$	$19.05^{a} \pm 0.45$	$18.19^{ab} \pm 0.64$
	3	$23.62^{c} \pm 0.68$	$25.27^{bc} \pm 0.51$	$26.57^{ab} \pm 0.35$	$27.33^{a} \pm 0.74$
	6	$19.24^{b} \pm 0.43$	$20.64^{ab} \pm 0.57$	$20.90^{a} \pm 0.53$	$21.97^{a} \pm 0.27$
TVFA's meq/100ml	0	$8.04^{c} \pm 0.08$	$8.33^{b} \pm 0.06$	$8.47^{ab} \pm 0.15$	$8.64^{a} \pm 0.01$
	3	$10.67^{d} \pm 0.06$	$11.46^{c} \pm 0.08$	$11.75^{b} \pm 0.10$	$12.14^{a} \pm 0.07$
	6	$9.32^{c} \pm 0.18$	$9.97^{b} \pm 0.12$	$10.20^{ab} \pm 0.13$	$10.52^{a} \pm 0.17$

a, b, c and d means within each row having the same superscript letter(s) are not significantly different at P ≤ 0.05

4. Milk yield and its chemical composition:

The present results (Table 5) indicated that average daily milk yield (ADMY) was significantly (P<0.05) improved by increasing DDGS levels up to 24% . The highest values of ADMY (822 and 880 g/h/d) were recorded with R3 and R4, respectively. While the lowest values (727 and 752 g/h/d) were with control and R2 ration. The addition of DDGS at 8 , 16 and 24% in R2, R3 and R4 resulted in increasing ADMY by about 3.4 , 13 and 20% ,respectively compared with control ration. Similar trend for improving milk yield as a result of inclusion DDGS in lactating dairy cows rations have been reported by several authors (Chen, 2004 ; Kleinschmit *et al.* 2006 ; Janicek *et al* .2008 ; Benchaar *et al*. 2013)**.**

Such improvement in ADMY of goats fed DDGS rations could be associated with higher average daily dry matter and TDN intake (Table 7) since these parameters are usually metabolically correlated .

The highest non-significant and significant values for milk fat % and yield (g/day) , respectively were recorded by R3 and R4 rations, compared with R2 and control ration. The present results were in line with Westreicher-Kristen *et al*.(2014) and Soliman *et al*.(2013) they reported that milk fat % was improved with adding different levels of DDGS in dairy cows rations . They explained such effect by the nature of fat in DDGS, especially corn DDGS which is quite unsaturated with typically more than 60 % linoleic acid.

Milk protein % and yield of R4 was significantly (P<0.05) the highest, compared to other tested rations. Likewise, protein yield of R3 and R4 rations significantly (P<0.05) increased, compared to R2 and control ration. Similar trend have been reported by Cyriac (2005) who found a significant (P<0.005) increase in the concentration of milk protein percentage with adding DDGS in ration from 0% up to 21%.

Concerning milk solids non-fat (SNF), inclusion rations with DDGS had no significant effect on SNF%, while the effect was significant (P<0.05) in SNF yield. The highest value (P<0.05) of SNF was recorded with R3 and R4, compared to other tested rations. Likewise, similar trend as that observed of fat and SNF % and yield have been observed of lactose. Similar results showed by Anderson *et al.*(2006) they reported that the effect of DDGS was non significant on the milk lactose %. However, Benchaar *et al.* (2013) reported that lactose yields increased linearly when cows fed increasing proportions of DDGS. Also, Westreicher-Kristen *et al*.(2014) showed that milk lactose % was increased by increasing DDGS in cow rations .

Regarding the yield of total solid (TS) , significant differences were observed among different tested rations. The higher values of the overall average of TS yield were recorded with the highest level of DDGS ration compared to control ration, while non-significant differences were observed on overall average of TS%. Comparable trend have been reported by Kurokawa *et al* .(2013) they reported that milk TS yield was significantly increased as a result of feeding DDGS with dairy cows .

Milk ash % and yield were slightly increased by adding DDGS in goats rations but the differences were not significant. The highest and lowest values for milk ash % were recorded in group 4 and control group, respectively as shown in Table (5). Such variation in milk chemical composition as affected by DDGS inclusion could be associated with other factors other than dietary level of DDGS when formulating lactating goats rations eg. Type of forage (Cyriac, 2005) , ratio of forage to concentrate (Schingoethe,2007) , high oil content of distiller's grains (Xu *et al*.,2010) and formulating diets on an amino acid basis (Nichols *et al*.,1998).

Table 5. Average daily milk yield (g/h/d) , milk chemical composition (%) and milk nutrients yield (g/h/d) by Zaraibi goats fed experimental rations.

G	ADMY	item	FAT	PROTEIN	LACTOSE	TS	SNF	ASH
1	$727.9^{c} \pm 12.53$	y	$26.25^{b} \pm 0.47$	$22.84^{c} \pm 0.73$	$33.71^{b} \pm 0.97$	$88.15^{c} \pm 2.18$	$61.91^{b} \pm 1.79$	5.354 ± 0.104
		%	3.68 ± 0.062	$3.19^{b} \pm 0.023$	4.71 ± 0.017	12.33 ± 0.046	8.65 ± 0.028	0.750 ± 0.009
2	$752.9^{c} \pm 18.16$	y	$27.51^{b} \pm 0.76$	$23.76^{cb} \pm 0.83$	$34.81^{b} \pm 1.48$	$91.62^{cb} \pm 3.25$	$64.11^{b} \pm 2.56$	5.542 ± 0.258
		%	3.72 ± 0.080	$3.20^{b} \pm 0.018$	4.69 ± 0.021	12.36 ± 0.076	8.635 ± 0.017	0.745 ± 0.008
3	$822.9^{b} \pm 20.88$	y	$30.74^{a} \pm 0.93$	$25.83^{ab} \pm 1.09$	$38.12^{ab} \pm 1.68$	$100.75^{ab} \pm 3.95$	$70.01^{ab} \pm 3.08$	6.052 ± 0.316
		%	3.78 ± 0.076	$3.17^{b} \pm 0.009$	4.67 ± 0.017	12.36 ± 0.068	8.578 ± 0.02	0.740 ± 0.009
4	$880.90^{a} \pm 21.68$	y	$32.58^{a} \pm 0.985$	$27.88^{a} \pm 1.166$	$39.83^{a} \pm 1.95$	$106.50^{a} \pm 4.29$	$73.92^{a} \pm 3.4$	6.212 ± 0.307
		%	3.83 ± 0.090	$3.26^{a} \pm 0.019$	4.65 ± 0.046	12.48 ± 0.094	8.64 ± 0.046	0.725 ± 0.005

a, b and c means within each row having the same superscript letter(s) are not significantly different at P ≤ 0.05

5.Blood constituents:

The results of blood parameters for tested groups as affected by inclusion of DDGS in tested rations are presented in Table (6). It was clear that most of the tested blood constituents were not significantly affected by dietary treatments , except that of total protein , glucose concentration and A/G ratio. There was a tendency for increasing total protein and glucose concentrations as the level of DDGS increased in tested rations. Generally, the values of blood total protein (P<0.05) and its fractions concentrations in groups fed R2, R3, R4 containing DDGS were higher than the control and this could be due to increase of CP digestibility coefficients, DCP% as well as reuminal ammonia nitrogen concentration of pervious groups. Such results are in agreement with Zanouny (2011) who found that the improvement in CP digestibility coefficients could be the reason for the increase in serum total protein and its fractions with sheep. The significance increase in glucose concentration in the present study may be due to providing suitable amounts of gluconeogenics sources such as rumen degradable protein and propionic acid as noticed by Leng (1990). Also Murillo *et al*. (2016) reported significant increasing in plasma glucose of groups fed different levels of DDGS in beef cattle.

However, there was small difference but significant (P<0.05) in A/G ratio among tested groups. In addition, blood cholesterol and triglycerides values were tended to slightly increased by increasing DDGS level in tested rations. being the highest with group fed on R3 and R4 and the lowest with R1 and R2. Similar trend for cholesterol concentration have been reported by Omer *et al*.(2015) . In contrast, the values of creatinine and blood urea concentration were slightly decreased by increasing DDGS levels. Comparable results have been reported by Etman *et al.* (2012) who reported non-significant decrease in creatinin and blood urea concentration with increasing the DDGS level in rations. The current values of blood urea were within the normal range for goats (Swenson, 1977) and gives no indication of problems with using DDGS in the feeding programs.

As for liver enzyme activities, it could be noticed that ALT and AST concentrations were tended to gradually increased as the level of DDGS increased. Similar results reported by Gabr *et al*. (2010a) , Ghoneem and Mahmoud (2016) and Etman *et al.*(2012). In general, liver function might be affected by other factors such as age, body weight or administrative circumstance related to good or bad feeding (Etman *et al.,* 2011).

The obtained values of some blood profiles of tested groups in present study were within the normal range for healthy goats given by Plumb (1999) being 2.4:4.4 g/dl , 64.6:136.4 mg/dl , 0.9:1.8 mg/dl , 66:230 and 15.3:52.3 U/L for albumin , cholesterol , creatinine , AST and ALT concentrations , respectively. However Etman *et al.* (2011) recorded that most of blood parameters were not affected by adding DDGS in experimental rations with fattening buffalo calves.

Table 6. Effect of inclusion DDGS in tested rations on blood constituents of Zaraibi goats.

Item	Tested Rations			
	R1	R2	R3	R4
Serum protein (g/dl):				
Total Protein g/dl	$8.10^{c} \pm 0.08$	$8.26^{b} \pm 0.01$	$8.33^{ab} \pm 0.01$	$8.47^{a} \pm 0.02$
Albumin g/dl	4.0 ± 0.1	4.03 ± 0.19	4.03 ± 0.09	4.07 ± 0.15
Globulin g/dl	4.1 ± 0.1	4.23 ± 0.13	4.3 ± 0.06	4.40 ± 0.06
A/G Ratio	$0.98^{a} \pm 0.01$	$0.95^{ab} \pm 0.01$	$0.94^{ab} \pm 0.01$	$0.92^{b} \pm 0.02$
Liver function (U/L):				
ALT U/L	19 ± 1.16	19.33 ± 2.72	21.67 ± 0.66	22.3 ± 1.33
AST U/L	79 ± 3.06	80.0 ± 2.52	81.33 ± 2.18	82.67 ± 2.33
Cholesterol mg/dl	80.0 ± 1.53	81.33 ± 1.45	82.33 ± 0.88	82.67 ± 0.67
Triglycerides mg/dl	11.0 ± 0.58	11.33 ± 0.67	12.0 ± 0.57	13.33 ± 0.88
Glucose mg/dl	$57.50^{d} \pm 0.15$	$58.30^{c} \pm 0.21$	$59.30^{b} \pm 0.10$	$61.20^{a} \pm 0.06$
Kidney function (mg/dl):				
Creatinine mg/dl	1.13 ± 0.13	1.03 ± 0.07	0.97 ± 0.07	0.97 ± 0.03
Blood Urea mg/dl	29.67 ± 1.2	29.00 ± 2.51	28.0 ± 2.52	27.33 ± 0.88

a, b, c and d means within each row having the same superscript letter(s) are not significantly different at P ≤ 0.05

6. Animal performance and economical evaluation :

Results in Table (7) showed that groups fed DDGS rations recorded higher total DM, TDN and DCP intake values expressed as (g/h/d) or (g/KgW0.75) than those recorded with control group. Such improvements in previous traits could be associated with the beneficial effects of adding DDGS in tested rations caused by higher nutrients digestibility as well as nutritive value of

tested rations. The best feed conversion (the lowest) as DM, TDN and DCP intake/kg milk was recorded with groups fed DDGS rations, while the highest in the control group. Such effect could be attributed with higher ADMY of tested groups fed treated rations. Similar trend have been reported by Etman *et al.* (2012) and Omer *et al.* (2015).

The lowest return values were recorded by goats fed control and R2 rations (0.32 vs 0.36 L.E) respectively , while the better return was obtained with R3 and R4 rations (0.56 vs 0. 78 L.E), respectively.

The economic efficiency (EE) values of DDGS rations (R3 and R4) reflected superiority over the control ration by approximately 10.9 and 23.5% for 16 and 24% DDGS levels, respectively. The obtained EE values in control and R2 rations were nearly similar (1.19 vs 1.21). The present findings were in general agreement with Tangendjaja *et al*. (2013) who found that feed costs were depressed gradually with increasing DDGS in ration of dairy cows .Also similar trend have been reported by Etman *et al*.(2012) with dairy cows.

Table 7. Effect of feeding tested rations on Zaraibi goats performance.

Item		Experimental rations			
		Control R1	R2	R3	R4
Feeding period, weeks		14	14	14	14
Average Body weight, Kg		37	37	38	38
Av. dry matter intake (g/h/d):					
WCS (g/h/d):	As fed	1975	1980	2030	2070
	DM basis	720	722	740	755
CFM (g/h/d):	As fed	700	722	730	700
	DM basis	625	650	655	630
Total DM, TDN and DCP intake (g/h/d) :					
Total DM intake as fed (g/h/d):		2675	2702	2760	2770
Total DM intake (g/h/d):		1345	1372	1395	1385
DM intake g/ $KgW^{0.75}$		89.66	91.46	91.17	90.52
Total TDN intake g/h/d		839.4	867.4	906.06	924.7
TDN intake g/Kg $W^{0.75}$		55.96	57.82	59.2	60.42
Total DCP intake (g/h/d)		118.22	119.91	125.82	129.63
DCP intake g/Kg $W^{0.75}$		7.88	8.01	8.23	8.45
Feed conversion efficiency :					
Av. daily milk yield (g)		$727.9^{c} \pm 12.5$	$752.9^{c} \pm 18.2$	$822.9^{b} \pm 20.9$	$880^{a} \pm 21.7$
Kg DMI / kg milk		1.85	1.82	1.69	1.57
Kg TDN intake / kg milk		1.15	1.15	1.10	1.05
DCP intake g/kg milk		162	160	153	147
Economical efficiency :					
Feed cost / kg milk (L.E)		2.32	2.27	2.06	1.86
The economic efficiency*		1.19	1.21	1.32	1.47
Price of consumed feed (L.E)		1.68	1.71	1.7	1.64
Price of milk produced (L.E)		2.00	2.07	2.26	2.42
*Return (L.E)		0.32	0.36	0.56	0.78

a, b, and c means within each row having the same superscript letter(s) are not significantly different at $P \leq 0.05$

***Ccalculated based on the prevailing price of ingredients and milk being 2.75, 2.6, 3, 2.5, 2, 1.5 , 1.5, 2, 0.3 L.E/Kg of milk, DDGS, Cotton seed meal, Yellow corn, Wheat bran, Molasses, Limestone, Salt, and WCS , respectively(2015)**

CONCLUSION

From the nutritional and economical point of view the use of DDGS at the higher level (16 and 24%) to replace CSM in lactating goats rations could be recommended to improve goats performance and economic efficiency without negative impact on milk yield, its composition and animal health in general .

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تأثير احلال كسب بذرة القطن بمستويات متدرجة من مستخلص تقطير حبوب الذرة الجافه مع الذائبات علي الاداء الانتاجي للماعز الزرايبي الحلاب

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تم إجراء هذه الدراسة بهدف بحث تأثير احلال ثلاثة مستويات من النواتج الثانوية لتقطير حبوب الذرة الجافة مع الذائبات (DDGS) بدلا من بروتين كسب بذور القطن الغير مقشور وتأثير ذلك علي الأداء الإنتاجي للماعز الزرايبي الحلابة. تم استخدام عشرون عنزة زرايبي حلاب في الموسم الثاني والثالث بمتوسط وزن 37,5 كجم ، بدأت بعد الفطام واستمرت لمدة 98 يوم وتم توزيع الماعز الحلاب عشوائيا الى اربعة مجاميع (5 عنزات بكل مجموعة) وتم تغذية الحيوانات طبقا لتوصيات NRC (1981) حيث تم تغطية 50% من البروتين الكلى من خلال سيلاج الاذرة الكامل أما باقي الـ 50% تم تغطيتها من خلال مخلوط العلف المركز في العلائق المختلفة مع الـ (DDGS) حيث تكونت العليقة الاولى من مخلوط العلف المركز فقط بينما الثانية والثالثة والرابعة تكونت من مخلوط العلف المركز مع مستوى استبدال 8 و16 و 24% (DDGS) علي التوالي . وأظهرت النتائج ما يلي: - لم تحدث أي تأثيرات سلبيه علي قياسات الكرش (pH , Ammonia , VFA's) والتي كانت تميل للزيادة في المجموعات التي غذيت علي العلائق المحتوية علي (DDGS) مقارنة بالعليقة الكنترول . - تحسنت معاملات الهضم للعناصر الغذائية المختلفة وكذلك القيمة الغذائية في صورة مركبات كلية مهضومة (TDN%) وبروتين خام مهضوم (DCP%) مع اضافة (DDGS) في العلائق المختبرة. - لم تظهر أي تأثيرات سلبيه علي قياسات الدم بصفه عامه مع حدوث تحسن في مستوي الجلوكوز في الدم (5%) بزيادة مستويات (DDGS) في العلائق .- تحسين متوسط انتاج اللبن اليومي ومكوناته المختلفة مع زيادة مستويات (DDGS) في العلائق الثانية والثالثة والرابعة حيث سجلت المعاملة الثالثة و الرابعة أعلي متوسط انتاج لبن يومي (822.9 و 880.9 جم /رأس /يوم) علي التوالي يليها المجموعة الثانية (752.9) بينما سجلت مجموعة الكنترول (727.9) أقل قيم لمتوسط انتاج اللبن اليومي .- سجلت اعلى القيم للنسبة المئوية لدهن وبروتين اللبن مع العليقة الثالثة والرابعة مقارنة بباقي المعاملات، كما تحسنت النسبة المئوية للمواد الصلبة الكلية مع زيادة مستويات (DDGS) في العلائق المختبرة .- سجلت المجموعات التي غذيت علي العلائق التي تحتوي علي (DDGS) افضل كفاءة في معامل التحويل الغذائي (المأكول من DMI , DCP, TDN / كجم لبن) ، مقارنة بالمجموعة الكنترول .- اظهرت نتائج الكفاءة الاقتصادية ان العليقة الثالثة والرابعة سجلت زيادة بنسبة 10.9 % و 23.5 % مقارنة بباقي المعاملات، بينما كانت الكفاءة الاقتصادية لكل من الكنترول والعليقة الثانية متشابهة تقريبا. من وجهة النظر الاقتصادية والغذائية يمكن التوصية باستخدام أعلى معدل إحلال باستخدام العليقة الرابعة التي تحتوي علي 24% DDGS محل كسب بذرة القطن الغير مقشور بنسبة احلال 100% فى علائق الماعز الحلاب لتحسين الاداء الإنتاجي والعائد الاقتصادي .