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UTILIZATION OF NEW NUTRITIONAL RESOURCES IN RUMINANT FEEDING
(3) EFFECT OF USING DRIED DISTILLERS GRAINS WITH SOLUBLES (DDGS)AS PROTEIN SOURCE IN RATIONS FOR LACTATING FRIESIAN COWS

Etman, K. O. E.; A. M. Zied; T. I. El-Monayer; S. B. Mehany and Galila, A.M.A. Darwish
Animal Production Research Institute,Regional center for food and feed Agric. Res. Center,Ministry of Agric., Cairo, Egypt.

ABSTRACT

This trial aimed to study the effect of using dried distillers grains with soluble (DDGS) at different levels as partial substitute for protein sources in rations of lactating Friesian cattle. Twenty five Friesian cows were chosen and used in feeding trial (which lasted 210 days) during year of 2011. Animals were divided into five similar groups, which received concentrate feed mixture containing DDGS at rate of 0, 11, 16, 21 and 27% to cover 0, 20, 30, 40 and 50% of the dietary protein content, respectively. In addition, berseem hay and wheat straw were offered. The percentages of feed offered from the concentrate feed mixture, berseem hay and wheat straw were 70, 20 and 10%, respectively, according to NRC (2001). Milk yields of experimental animals were determined and analyzed. Also, samples of rumen liquor and blood were collected and analysed. Feed and economical efficiencies were estimated.

Additionally, five digestibility trials were carried out using three Friesian cows in each treatment to determine the digestion coefficients and nutritive values of different experimental rations using insoluble ash technique (AIA) as a natural marker.

The results obtained were as follows:

1- The DM consumption increased with increasing dietary DDGS levels. In addition, digestibility was significantly ($p<0.05$) higher for all nutrients except EE. However, increasing DDGS levels in experimental rations from 11 to 16% or from 21 to 27% did not have significant effect on nutrient digestibility and nutritive values expressed as TDN (%) or DCP (%).
2- Actual milk and 4% fat corrected milk yields increased with increasing DDGS levels in the rations of lactating Friesian cows, while increasing DDGS levels from 11 to 16% or from 16 to 21% did not have significant increase in milk yield, but increasing DDGS levels from 21 to 27% tended to significant ($P<0.05$) higher in both actual milk and 4% FCM yields with rate of 5.86% and 4.75%, respectively.
3- Fat and protein percentages of milk and their yields were affected by adding DDGS in ration . However, % total solids (TS%) and solid not fat (SNF%) were not affected, while their yields showed significantly, ($P<0.05$) increase with increasing DDGS levels in rations.
4- Animals fed ration E (containing 27% DDGS) were the best group in feed utilization efficiency expressed as kg DM per kg milk (1.015 kg) or 4%FCM (1.043kg).
5- Feed cost per kg of both milk and 4% FCM decreased with increasing DDGS levels in ration of lactating Friesian cows. Animals fed the cheapest ration (Ration E, containing 27% DDGS) gave the highest net revenue and the best economic efficiency. The improvements in net revenue and economic efficiency were 48.59% and 32.22%, respectively.
6- Increasing DDGS levels up to 27% in the ration of lactating Friesian cows significantly ($P<0.05$) increased total nitrogen (TN), ammonia nitrogen (NH_3-N),

protein – nitrogen (PN) and VFA's concentrations in rumen liquor. Also, GOT and GPT concentrations in blood serum were significantly ($P<0.05$) higher, while difference in total protein, albumin, globulin, creatinine and urea – N concentrations were not significant.

It could be concluded that, using dried distiller grains with soluble (DDGS) in the ration of lactating Friesian cows at the rate of 27% increased digestibility coefficients and nutritive values of different nutrients and resulted in higher milk yield (11.56 kg /h) or 4% FCM yield (11.25kg/h). It also improved of feed utilization efficiency, decreased feed cost (1.58 LE), increased economic efficiency (3.16) and net revenue (39.51 LE). Moreover, concentrations of rumen liquor and blood serum parameters were within normal range.

INTRODUCTION

Successful dairy production operation require excellent nutrition, management and housing as well as veterinary care. Dairy animals need to consume roughages, and concentrate feeds to cover their requirement from energy and protein and other elements. In Egypt, there is a lack in protein feed ingredient for animal feeding. So, many studies were carried out to improve the quality of protein feed ingredient (EL-Sayed et al, 2002), or to use new sources of protein (Shwerab et al, 2010; Ieupp et al., 2009; May et al., 2009; Mohi El-Din et al.; 2008 and Etman et al, 2011) in ruminant rations.
Dried distiller grain with soluble (DDGS) is a co-product of the ethanol industry. It is an excellent energy and protein source for beef cattle (Etman et al., 2010 and 2011; Ham et al., 1994; Larson et al., 1993; Loza et al., 2004) and dairy cattle (Kelzer et al., 2009; Anderson et al., 2006; Kalscheur, 2005 and Powers et al., 1995).

This study is one of a series of investigations which was carried out to explore the possibility of using DDGS at levels ranging from 11% to 27% in rations of dairy animals. This work aimed to study the effect of feeding dried distiller grains with soluble (DDGS) as protein sources in ration of Friesian cows on milk yield and its composition, some rumen liquor and blood parameters , feed conversion and economic efficiency, feed intake and nutrients digestibility.

MATERIALS AND METHODS

Twenty five Friesian cows averaging 424 kg live body weight and in their 2^{nd} or 3^{rd} lactating seasons were chosen and used in feeding trial during the year of 2011 at Dina El-Maadawy private farm located in the desert road, Egypt. The experiment aimed to use dried distiller grains with soluble (DDGS) as a partial protein sources in concentrate feed mixture at levels ranging from 11% to 27% in the rations of lactating Friesian cows. Animals were distributed randomly on five groups (5 in each) according to their weights and lactating season. All animals were assigned to receive experimental rations containing concentrate feed mixture, berseem hay and wheat straw at the rate of 70, 20 and 10%, respectively according to NRC (2001).

The concentrate feed mixture of five respective rations contained dried distiller grains with soluble (DDGS) at rates of 0, 11, 16, 21 and 27% to cover 0, 20, 20, 30, 40 and 50% of the dietary protein content, respectively. Concentrate feed mixtures were offered to animals twice daily at 8.00 a.m. and 4.00 p.m. followed by berseem hay, while wheat straw and water were available during the whole day. Feeding allowances were adjusted every two weeks according to change in LBW and milk production. The feeding trial lasted 210 days, during which, feed intake and milk production were recorded at two weeks intervals.

At the middle of the feeding trial, five digestibility trials were carried out using three Friesian cows in each treatment to determine digestion coefficients and nutritive values of different experimental rations using acid insoluble ash technique (AIA) as a natural marker according to Van Keulen and Young (1977).

Daily morning and evening milk yields were recorded and 4% fat corrected milk yields were adjusted according to Gaines (1923).

Composite milk samples from consecutive morning and evening milking were taken biweekly to be analyzed for fat, protein, total solid by milko – Scan, model 133B. Representative samples of concentrate feed mixture, berseem hay, wheat straw and feaces were chemically analyzed according to A.O.A.C. (2000).

During the digestibility trials, rumen liquor samples were taken from the animals 3 hr after feeding using stomach tube. Samples of rumen liquor were filtered through four layers of cheese cloth and immediately tested for pH using digital pH meter.

In addition, total nitrogen (TN), protein nitrogen (PN) and ammonia–nitrogen (NH_3-N) were determined according to A.O.A.C. (2000), while total volatile fatty acids (VFA'S) concentrations were determined according to Eadie et al. (1967). On the other hand, blood samples were taken from the jugular vein of the animals during digestibility trials. Blood samples were collected and plasma samples were stored at – 20C° for determination of total protein, albumin, transaminase activities and creatinine and urea- N using Commercial kits of Bio-Merieus, Lab, France.

Data were statistically analyzed using general linear model program (GLM) of the Statistical Analysis System (SAS, 1996). The significant differences among means were tested using Duncan Multiple range test (Duncan, 1955).

RESULTS AND DISCUSSIONS

Effect of using DDGS at different levels on chemical composition of concentrate feed mixtures:

The data presented in tables (1 and 2) showed the percentages of feed ingredients and concentrate feed mixture used in the different experimental rations and their chemical composition.

The inclusion of DDGS at different levels in the concentrate feed mixture increased percentages of CP, EE, CF and OM contents, while NFE and ash contents tended to decrease with increasing DDGS levels. These results were agreement with those obtained by Etman et al. (2010), Etman et al. (2011) and Shwerab et al (2010).

Table (1): Ingredients of concentrate feed mixture containing different levels of DDGS in experimental rations.

Items	* CFM of experimental rations				
	A	B	C	D	E
Ingredients (%):					
Yellow corn	47	44	44	40	40
Glutoteed (16%)	30	27	22	26	20
** DDGS	-	11	16	21	27
Soybean meal (44%)	10	5	5	-	-
Rice bran	5	5	5	5	5
Wheat bran	5	5	5	5	5
Limestone	2	2	2	2	2
Salt	1	1	1	1	1
Total (%)	**100**	**100**	**100**	**100**	**100**

*** CFM: concentrate feed mixture.**
**** DDGS: Dried Distiller grains with soluble.**

Table (2): Chemical composition of concentrate feed mixture containing different levels of DDGS, berseem hay and what straw

Items	DM (%)	Composition of DM (%)					OM (%)
		CP	EE	CF	NFE	ash	
Berseem hay	91.75	15.60	2.94	25.42	46.64	9.40	90.60
Wheat straw	91.30	3.20	1.50	42.10	43.06	10.14	89.86
* DDGS	91.20	26.70	7.52	8.74	52.64	4.40	95.60
** CFM including 0% DDGS	88.45	14.21	4.90	5.52	71.38	3.99	96.01
CFM including 11% DDGS	88.48	14.27	5.33	5.78	70.69	3.93	96.07
CFM including 16% DDGS	88.46	14.78	5.35	5.79	70.23	3.85	96.15
CFM including 21% DDGS	88.50	14.82	5.78	6.13	69.45	3.82	96.18
CFM including 27% DDGS	88.50	14.96	5.81	6.14	69.29	3.80	96.20

*** DDGS: Dried Distiller grains with soluble.**
****CFM: Concentrate feed mixture.**

Effect of using different levels of DDGS on feed intake, digestibility and nutritive values:

Results obtained in Table (3) revealed that the DM consumption (kg/cow/day) increased with increasing DDGS levels, being 10.23, 10.71, 10.84, 11.62 and 11.73 kg with animals fed rations A, B, C, D, and E, respectively. Average DM consumption calculated as kg/ 100 kg LBW showed similar trend, being 2.56, 2.55, 2.61, 2.58 and 2.70kg / 100 kg with animals fed rations A, B, C, D and E, respectively. In addition, digestibility coefficients increased ($p<0.05$) for all nutrients, except EE digestibility, as shown in Table (3). The results revealed that increasing DDGS levels up to 27% in the concentrate mixture of experimental rations significantly ($P<0.05$) increased DM, OM, CP, CF and NFE digestibilities. On the other hand, increasing DDGS levels in experimental rations from 11 to 16% or from 21 to 27% did not have any significant effect on nutrients digestibility.

Data presented in Table (3) showed also the nutritive values expressed as TDN (%), DCP (%) and DE (Mcal / kg DM) for different experimental rations. The values of TDN% recorded were 66.11, 68.28, 69.86, 72.10 and 72.80% for rations A, B, C, D and E, respectively, while the respective DCP (%) were 9.66, 9.82, 10.55, 10.92 and 11.15%. The results revealed that increasing DDGS levels from 11 to 16% or form 21 to 27% had no significant effect on nutritive values as TDN% or DCP%. Similar trend was observed with DE (Mcal /kg DM) which were found to be 2.89, 2.99, 3.10, 3.23 and 3.32 Mcal /kgDM with rations A, B, C, D and E, respectively.

Table (3): Average daily feed intake, calculated composition, digestibility coefficients and nutritive values of different experimental rations.

Items	Experimental rations					Significant Level
	A	B	C	D	E	
Av. DM consumption (kg/cow/day):						
Concentrate feed mixture	5.96	6.26	6.34	6.79	6.86	
Berseem hay	2.52	2.62	2.65	2.85	2.87	
Wheat straw	1.75	1.83	1.85	1.98	2.00	
Total DM intake	10.23	10.71	10.84	11.62	11.73	
Av. DM consumption (kg/100kg/ L.B.W):						
Concentrate feed mixture	1.49	1.49	1.53	1.51	1.58	
Berseem hay	0.63	0.62	0.64	0.63	0.66	
Wheat straw	0.44	0.44	0.44	0.44	0.46	
Total DM intake	2.56	2.55	2.61	2.58	2.70	
Calculated composition of experimental rations:						
DM	89.40	89.42	89.40	89.43	89.43	
OM	94.32	94.36	94.41	94.44	94.45	
CP	13.40	13.43	13.79	13.81	13.91	
EE	4.17	4.47	4.49	4.79	4.82	
CF	13.15	13.34	13.34	13.58	13.59	
NFE	63.61	63.12	62.79	62.26	62.13	
Digestibility Coefficients of experimental rations :						
DM	75.14^{b}	76.82^{b}	79.15^{ab}	81.13^{a}	82.64^{a}	(P < 0.05)
OM	80.73^{c}	81.15^{bc}	82.84^{b}	83.17^{a}	85.16^{a}	(P < 0.05)
CP	72.11^{b}	73.14^{b}	76.52^{ab}	79.04^{a}	80.17^{a}	(P < 0.05)
EE	69.40	70.16	70.42	70.62	70.45	NS
CF	64.32b	66.82b	69.29ab	70.16a	72.18a	(P < 0.05)
NFE	65.22b	67.30b	68.42ab	70.73a	71.15a	(P < 0.05)
Nutritive Value:						
TDN (%)	66.11^{b}	68.28^{b}	69.86^{ab}	72.10^{a}	72.80^{a}	(P < 0.05)
DCP (%)	9.66^{b}	9.82^{b}	10.55^{ab}	10.92^{a}	11.15^{a}	(P < 0.05)
* DE (Mcal / kg DM)	2.89^{b}	2.99^{b}	3.10^{ab}	3.23^{a}	3.32^{a}	(P < 0.05)

*** Calculated as measured by McDonald et al., (1978).**

Generally, increasing DDGS levels in concentrate feed mixture showed significantly (P<0.05) higher digestibility coefficients for all nutrients except for EE digestibility and higher nutritive values of the rations when expressed as TDN, DCP or DE. Data were agreement with those obtained by Walter et al., (2012), Felix et al., (2012), Luebbe et al., (2012) and Leupp et al., (2009).

Effect of using DDGS at different levels on milk yield and its composition:

Average milk yield expressed as actual milk yield or fat corrected milk (FCM) yield are presented in Table (4). Data revealed that both actual milk and fat corrected milk yields increased with increasing DDGS levels in the rations, being 9.14, 9.61, 10.25, 10.92 and 11.56 kg versus 9.48, 9.75, 10.13, 10.74 and 11.25kg with animals fed rations A, B, C, D and E, respectively. The results showed that increasing DDGS levels from 16 to 21% had no significant increase in both milk yield and 4% FCM yield. However, increasing DDGS levels from 21 to 27% significantly (P<0.05) increased both actual and 4% FCM yields 5.86 % and 4.75%, respectively. On the other hand, there were significant (P<0.05) differences in fat and protein percentages (Table-4), being lower fat % and higher for the protein % with increasing DDGS levels. Accordingly, fat and protein yields increased with increasing DDGS levels.

Table (4): Average daily milk, corrected fat milk yield and its milk composition.

Items	Experimental rations					Significant Level
	A	B	C	D	E	
Av. Milk production (kg/cow/day):						
Av. Actual milk yield	9.14^{c}	9.61^{c}	10.25^{bc}	10.92^{b}	11.56^{a}	(P < 0.05)
Av. 4% FCM yield	9.48^{c}	9.75^{c}	10.13^{b}	10.74^{b}	11.25^{a}	(P < 0.05)
Av. Milk composition and its yields :						
Fat (%)	4.25^{a}	4.10^{a}	3.92^{b}	3.89^{b}	3.82^{b}	(P < 0.05)
Fat yield (gm/cow/day)	388^{b}	394^{b}	402^{a}	425^{a}	442^{a}	(P < 0.05)
Protein (%)	3.20^{b}	3.24^{b}	3.38^{ab}	3.42^{a}	3.64^{a}	(P < 0.05)
Protein yield (gm/cow/day)	292^{b}	311^{b}	346^{ab}	373^{a}	421^{a}	(P < 0.05)
TS (%)	13.82	13.64	13.50	13.48	13.38	NS
TS yield (gm/cow/day)	1263^{c}	1311^{c}	1384^{bc}	1472^{a}	1547^{a}	(P < 0.05)
SNF (%)	9.57	9.54	9.58	9.59	9.56	NS
SNF yield (gm/cow/day)	875^{c}	917^{c}	982^{bc}	1047^{a}	1105a	(P < 0.05)

a, b and c: Means in the same row with different superscripts are significant (P< 0.05) differed.
NS = not significant

However, there were no significant difference in TS% and SFN%, but TS and SNF yields appeared to be significantly (P<0.05) higher with animals fed ration E (contain 27% DDGS). These results, it demonstrated that the fat and protein percentages of milk and its yields were affected by the level of DDGS in ration of lactating Friesian cows.However, TS% and SNF% were not affected by ratio DDGS levels, but their yields showed significant (P<0.05) increase with increasing DDGS levels in rations. The results were agreement with those obtained by Kelzer et al. (2009), Chibisa et al. (2012), Zhang et al. (2010), Anderson et al., (2006), kleinschmit et al., (2007), Holt, et al., (2010) and Janicek et al., (2008).

Effect of using DDGS with different levels on feed utilization efficiency:

Data obtained in Table (5) showed that daily feed intake as DM, TDN and DCP increased with increasing dietary DDGS levels. The increased DM intake with animals fed the experimental rations might be due to increase the palatability with increasing dietary DDGS levels.

Table (5): Average daily feed unit intake, milk yield and feed utilization efficiency of animals fed different experimental rations.

Items	Experimental rations					Significant Level
	A	B	C	D	E	
No. of animals	5	5	5	5	5	
Av. live body weight (kg)	400	420	415	450	435	
Experimental period (day)	210	210	210	210	210	
Av. daily milk yield (kg/h)	9.14[c]	9.61[c]	10.25[bc]	10.92[b]	11.56[a]	(P < 0.05)
Av.daily 4% FCM yield (kg/h)	9.48[c]	9.75[c]	10.13[bc]	10.74[b]	11.25[a]	(P < 0.05)
Av. daily feed unit intake / head:						
DM (kg)	10.23	10.71	10.84	11.62	11.73	
TDN (kg)	6.763	7.313	7.573	8.378	8.539	
DCP (kg)	0.988	1.052	1.144	1.269	1.308	
Feed utilization efficiency, as:						
Kg DM / kg milk yield	1.119[a]	1.114[a]	1.058[b]	1.064[b]	1.015c	(P < 0.05)
Kg TDN / kg milk yield	0.740[b]	0.761[a]	0.739[b]	0.767[a]	0.739b	(P < 0.05)
Kg DCP/ kg milk yield	0.108[b]	0.109[b]	0.112[ab]	0.116[a]	0.113a	(P < 0.05)
Kg DM / kg 4% FCM yield	1.079[b]	1.098[a]	1.070[b]	1.082[a]	1.043[c]	(P < 0.05)
Kg TDN / kg 4% FCM yield	0.713[c]	0.750[b]	0.748[b]	0.780[a]	0.759[b]	(P < 0.05)
Kg DCP / kg 4% FCM yield	0.104[b]	0.108[b]	0.113[ab]	0.118[a]	0.116[a]	(P < 0.05)

a, b and c: Means in the same row with different superscripts are significant (P < 0.05) differed
NS = not significant

Feed utilization efficiency calculated as amounts of feed unites consumed per Kg milk produced from both actual milk and 4% FCM .

The results revealed that animals fed ration E (containing 27% DDGS) tended to significantly (P<0.05) had better feed utilization efficiency expressed as kg DM/kg milk or 4% FCM yields. Differences in feed utilization efficiency as kg TDN per kg actual milk or 4% FCM yields were significant with increasing DDGS levels from 21% to 27%. However, feed utilization efficiency expressed as kg DCP/kg of both actual milk or 4% FCM yields did not significantly increase with increasing DDGS level from 11 to 16% or from 21 to 27% .

Differences in feed utilization efficiency among different experimental groups might have been due to differences in milk yield and feed intakes. However, feed utilization efficiency was best for animals fed ration E (containing 27% DDGS). The results were in accordance with those reported by Kelzer et al., (2009), Zhang et al., (2010), Anderson et al., (2006), Mullins et al., (2010), Kleinschmit et al., (2007), and Janicek et al., (2008).

Effect of using DDGS at different levels on the economic efficiency:

Data presented in Table (6) showed that averages daily feed cost / kg milk yield were 2.09, 1.80, 1.70, 1.67 and 1.58 LE for animals fed rations A, B, C, D and E, respectively. Corresponding values of daily feed cost / 4% FCM yield were 2.01, 1.78, 1.72, 1.69 and 1.63 LE. The present data showed that feed cost per kg of both milk and 4% FCM yields decreased with increasing dietary DDGS levels. The cheapest ration (ration E, containing

27% DDGS) gave the highest net revenue (39.51 LE/head) compared with the other rations. Results showed that animals which gave the highest net revenue were fed the cheapest ration (contained the highest level of DDGS). The same trend was observed with the economic efficiency, being 2.39, 2.77, 2.93, 3.00 and 3.16 for animals fed rations A, B, C, D and E, respectively, as shown in Table (6). In this respect, improvements in the economic efficiency were recorded for animals fed rations B, C, D and E, being 15.90, 22.59, 25.52, and 32.22%, respectively. Improvements in net revenue were 15.57, 27.04, 36.89 and 48.59% for the same animal groups, respectively.

Table (6): Av. daily feed intake as fed Milk yield, feed cost and economical efficiency with different experimental rations.

Items	Experimental rations				
	A	B	C	D	E
Av. daily feed intake, as fed (kg/h):					
Concentrate feed mixture	6.74	7.00	7.09	7.60	7.67
Berseem hay	2.75	2.85	2.89	3.10	3.13
Wheat straw	1.92	2.00	2.03	2.17	2.19
Av. Daily milk yield (kg/h):					
Actual milk yield	9.14	9.61	10.25	10.92	11.56
4% FCM yield	9.49	9.75	10.13	10.74	11.25
*** Feed cost and economical efficiency:**					
Cost of feed intake (LE/h)	19.11	17.32	17.47	18.20	18.29
Cost of milk yield (LE/h)	45.70	48.05	51.25	54.60	57.80
Av. daily feed cost / kg milk yield	2.09	1.80	1.70	1.67	1.58
Av. daily feed cost /4% FCM yield	2.01	1.78	1.72	1.69	1.63
Av. Net revenue (LE/h)	26.59	30.73	33.78	36.40	39.51
Economical efficiency	2.39	2.77	2.93	3.00	3.16
Improvement in net revenue %	-	15.57	27.04	36.89	48.59
Improvement in economical efficiency %	-	15.90	22.59	25.52	32.22

- **Based on the assumption that the price of one ton of berseem hay, wheat straw and concentrate feed mixture containing DDGS with rate of 0, 11, 16, 21 and 27% was 1500, 400, 2110, 2022, 2012, 1934 and 1922 LE, respectively, while the price of one kg milk was 5 LE.**

Generally, using DDGS at the rate of 27% in lactating Friesian cow rations tended to increase milk yield and decrease feed cost. The results were agreement with the finding of Etman et al., (2010), Etman et al., (2011) and Shwerab et al.., (2010).

Effect of using DDGS at different levels on rumen liquor parameters:

Average ruminal liquor parameters of animals fed different experimental rations are shown in Table (7). The data revealed that the pH value ranged between 6.14 to 6.45, showing no significant differences among different experimental groups. No significant differences in non-protein nitrogen (NPN) concentrations were also observed among experimental groups. On the other hand, total nitrogen (TN), ammonia-N and protein-N significantly ($P<0.05$) increased with increasing DDGS levels up to 27%.

Generally, the increased TN, ammonia-N and protein-N concentration might be due to increase protein intake as reported by Faichney and White (1977). At the same time, total VFA's concentration ranged between 10.21 to 12.80 meq/100ml, showing significantly (P<0.05) higher value for animals fed rations D and E. Animals fed rations, containing DDGS tended to have somewhat higher VFA's concentration. This might be due to increase protein and energy intakes as well as increased apparent digestibility of organic matter (Arelovich et al., 2000). The present results were agreement with those reported by Felix et al., (2012), Walter et al., (2012), Leupp et al., (2009), Kelzer et al., (2009), Chibisa et al., (2012), Zhang et al., (2010) and Mullins et al., (2010).

Table (7): Average rumen liquor parameters of animals fed different experimental rations after 4 hr feeding.

Items	Experimental rations					Significant Level
	A	B	C	D	E	
pH value	6.14	6.23	6.30	6.40	6.45	NS
Total VFA's (meq/100ml)	10.21[c]	11.08[b]	11.25[b]	12.14[a]	12.80[a]	(P < 0.05)
Total nitrogen (mg/100ml)	118.40[c]	120.02[b]	120.32[b]	121.15[a]	122.43[a]	(P < 0.05)
NH_3-N (mg/100ml)	20.11[b]	21.15[b]	22.84[ab]	24.16[a]	25.15[a]	(P < 0.05)
Protein-N (mg/100ml)	85.14[b]	85.82[b]	86.10[ab]	66.23[a]	86.52[a]	(P < 0.05)
NPN (mg/100ml)	33.26	34.20	34.22	34.92	35.91	NS

a, b and c: Means in the same raw with different superscripts are significant (P<0.05) differed.
NS = not significant

Effect of using DDGS at different levels on blood parameters:

Data presented in Table (8) showed that the differences in total protein, albumin and globulin among different experimental groups were not significant, however, these compounds increased with increasing DDGS levels in rations. Accordingly, albumin / globulin ratios decreased with increasing DDGS levels in rations. The increase in total protein, albumin and globulin may be the results of improving nitrogen absorption (Kornegay et al., 1977), while Kumar et al., (1980) reported that there was a positive correlation between dietary protein and serum protein concentration.

Table (8): Blood Parameters of animals fed different experimental rations after 4 hr feeding

Items	Experimental rations					Significant Level
	A	B	C	D	E	
Serum Protein (gm/dl):						
Total protein	5.50	5.62	5.82	5.94	6.12	NS
Albumin (A)	3.75	3.80	3.87	3.90	3.94	NS
Globulin (G)	1.75	1.82	1.95	2.04	2.18	NS
A/G ratio	2.14	2.09	1.98	1.91	1.81	
Liver Function (u/L):						
GOT (AST)	43.12[b]	43.64[b]	45.13[ab]	46.08[a]	46.18[a]	(P < 0.05)
GPT (ALT)	16.51[c]	19.25[b]	22.28[b]	25.74[a]	26.14[a]	(P < 0.05)
Kidney function:						
Creatinin (mg/dl)	1.58	1.48	1.40	1.32	1.30	NS
Urea-N (mg/100ml)	14.74	14.68	14.22	13.73	13.50	NS

a, b and c: Means in the same raw with different superscripts are significant (P<0.05) differed.
NS = not significant

With respect to liver function, the results showed that increasing DDGS levels in the experimental rations tended to significantly ($P<0.05$) increased both GOT and GPT concentrations. However, increasing DDGS levels from 11 to 16% or from 21 to 27% had no significantly effected on liver function. With this respect, Boots et al., (1969) reported that GOT and GPT concentrations depends on several factors such as: feeding practices, genetic control, and response to stress, age, liver function and body weight.

The creatinin and urea-N concentrations in blood of animals fed experimental rations showed somewhat lower values compared with that of those fed control ration. These differences were not significant. Using DDGS in ration of lactating Friesian cows had not effected on blood total protein, albumin, GOT, GPT, creatinin and urea-N.

These results were agreement with those reported by Etman et al., (2010), Etman et al., (2011) and Shwerab et al., (2010).

Finally, it may be concluded that, dried distiller grains with soluble could be used in lactating Friesian cow rations up to 27%. The use of DDGS with these levels improved digestibility coefficients and nutritive values of experimental rations, increased milk yield (11.56kg/h) and 4% FCM yield (11.25kg/h) and improved feed utilization efficiency with no any adverse effect on animal performance. Also, DDGS decreased feed cost and increased the economic efficiency (3.16) and net revenue (39.51 LE/h).

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الإستفادة من مصادر غذائية جديدة في تغذية المجترات
(٣) تـأثير إسـتخدام النـواتج المرضـية لتقطيـر حبـوب الأذرة (DDGS) كمصـدر بروتيني في علائق الأبقار الفريزيان الحلابه

كامل عثمان إبراهيم عثمان، عبد المنعم محمد مصطفي زيد، طـارق إبراهيم المنير، سمير بشري مهني و جليله على محمد علي درويش
معهد بحوث الإنتـاج الحيـواني – المركـز الاقليمـي للأغذيـة والأعـلاف – مركـز البحـوث الزراعيـة وزارة الزراعة – جمهورية مصر العربية

يهدف هذا البحث إلى دراسة تأثير استخدام النواتج العرضية لتقطير حبوب الاذرة بالسوائل (DDGS) بمستويات مختلفة كمصادر بروتينيه في علائق الأبقار الفريزبان الحلابه. إستخدم عدد (٢٥) بقرة فريزيان حلابة في تجربة تغذية لمدة ٢١٠ يوماً وقسمت الحيوانات إلى خمسة مجموعات متماثلة (٥ حيوانات في كل مجموعة) وغذيت الحيوانات على علف مركز يحتوى على النواتج العرضية لتقطير حبوب الأذرة بنسب صفر، ١١، ١٦، ٢١، ٢٧% علماً بأن هذه النسب السابقة تغطي صفر، ٢٠، ٣٠، ٤٠، ٥٠% من بروتين العلف المركز المقدم للمجموعات الخمسة على التوالي بجانب التغذية على تبن القمح ودريس البرسيم وكانت نسب العلف المركز ودريس البرسيم وتبن القمح المقدم للحيوانات هى ٧٠% ، ٢٠% ،١٠% على التوالي.

وفي نفس الوقت تم إجراء خمسة تجارب هضم لتقدير القيمة الغذائية والهضمية للعلائق المختبرة وكانت

أهم النتائج المتحصل عليها ما يلي:

١- زاد معدل المادة الجافة المأكولة بزيادة نسبة النواتج العرضية لتقطير الأذرة في العليقة مع إرتفاع معدل هضم كل المركبات الغذائية (عند مستوى ٥%) فيما عدا هضم مستخلص الإثير، وعلى الرغم من ذلك فإن زيادة نسبة النواتج العرضية لتقطير حبوب الأذرة من ١١ إلى

١٦% أو من ٢١ إلى ٢٧% في العلف المركزلم يكن له تأثير معنوى على معامل هضم المركبات العضوية أو القيمة الغذائية.

٢- زادت كميات اللبن الطبيعي وكذلك اللبن المعدل الدهن ٤% زيادة معنوية بزيادة نسبة النواتج العرضية لتقطير حبوب الأذرة من ٢١ إلى ٢٧% وقدرت هذه الزيادة بقيم ٥.٨٦%، ٤.٧٥% على التوالي.

٣-تأثرت نسب دهن وبروتين اللبن تأثراً معنوياً بزيادة نسبة النواتج العرضية لتقطير حبوب الأذرة في العليقة، إلا أن نسب كل من الجوامد الكلية والجوامد غير الدهنية لم تتأثر معنوياً، وعلى الرغم من ذلك فقد زادت كميات كل من الدهن والبروتين والجوامد الكلية والجوامد غير الدهنية زيادة معنوية فى المجموعة الخامسة التى تغذت على ٢٧ % نواتج عرضية لتقطير حبوب الأذرة (DDGS).

٤-زادت الكفاءة الغذائية معبرا عنها بالكيلو جرام مادة جافة مأكولة لكل كيلو جرام لبن طبيعي اولبن معدل الدهن ٤% زيادة معنوية بزيادة نسبة النواتج العرضية لتقطير حبوب الأذرة فى المجموعة الخامسة التى تحتوى على ٢٧% منتجات تقطير الاذرة.

٥-انخفضت تكاليف التغذية لكل كيلو جرام لبن طبيعي أو لبن معدل الدهن ٤% بزيادة نسبة الـ DDGS الى مستوى ٢٧% وعند هذا المستوى كان التحسن في الكفاءة الاقتصادية هو الأعلي (٣٢.٢٢%) مع أعلي نسبة عائد (٤٨.٥٩%).

٦-كانت مقاييس سائل الكرش وسيرم الدم في النطاق الطبيعي عند إستخدام الـ DDGS بمستوياته المختلفة ولم تظهر أي أعراض جانبية على حيوانات التجارب.

من هذه الدراسة يمكن إستخدام نواتج تقطير حبوب الأذرة بالسوائل DDGS في علائق الأبقار الفريزيان الحلابة بمعدل يصل إلى ٢٧% وهذا يؤدى إلى زيادة في معاملات هضم المركبات العضوية والقيمة الغذائية والهضمية للعلائق التجريبية مع زيادة كميات اللبن الناتج وتحسن في الكفاءة الغذائية وانخفاض تكاليف التغذية لإنتاج كيلو جرام لبن طبيعي أو لبن معدل الدهن ٤%.

قام بتحكيم البحث

أ.د / محمد محمد الشناوى	**كلية الزراعة – جامعة المنصورة**
أ.د / حسين سعد سليمان	**كلية الزراعة – جامعة عين شمس**