THE USE OF DISCARDED DATE PALM FOR BIOETHANOL PRODUCTION AND FEEDING LACTATING BUFFALOES

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SUMMARY

To evaluate the chemical composition, nutritive value and economic efficiency of ethanol production from discarded dates palm (DDP). Tested DDP was collected from New Valley region farms after harvesting, sundried and crashed. The 1stpart of crashed unfermented discarded date palm (UFDDP) was used as it is to evaluate its nutritive value; while the 2nd part was used to produce ethanol and the by-product of ethanol production, fermented discarded date palm (FDDP), was evaluated. Three digestibility trials were carried out using nine rams. Clover hay (CH) was used as a basal ration to investigate digestion coefficients and nutritive values of DDP. Ethanol was produced from four different parts of DDP by-product using yeast (*Saccharomyces cerevisi*ae).

Results showed that UFDDP had the highest DM, OM, EE, NFE and GE contents than those of FDDP, while CP, CF and ash contents had opposite trend. Unfermented discarded date palm (UFDDP) had the highest digestion coefficients ($P<0.05$) of OM, EE and NFE, while; FDDP with wheat bran had the highest digestion coefficients of CP and CF. The highest TDN, GE and DE were found for UFDDP, while FDDP recorded the lowest values.

Under experimental fermentation processing conditions, one ton of DDP with wheat bran, DDP flesh, DDP only, Date pits produced on average 224, 283.9, 261, 96.87 liters ethanol/ton, with a total price 4955, 6280, 5773 and 2143 L.E., respectively.

Fifteen lactating buffaloes with average weight of (550-650 kg) and at their (2nd and 3rd) lactating season, were randomly divided into five groups to evaluate the effect of incorporating DDP instead of corn grains in concentrated feed mixture on milk production performance. Five tested rations were offered in three successive experimental periods in complete switch back design. All experimental rations were formulated to contain 26.5% maize silage, 21.0% Egyptian clover, 10.0% rice straw in combination with 42.5% concentrate feed mixture (CFM) contained either 35% yellow corn grains (R1) or DDP was used instead of yellow corn grains by 50% (R2) or 100% (R3) or FDDP was used instead of yellow corn grains by 50% (R4) or 100% (R5). Results indicated that animals fed R1, R2 or R3 showed the best feed efficiency as DM, TDN and DCP, compared with those fed R4 or R5. Meantime, economic efficiency recorded insignificant differences with substituting corn grain by DDP in the 2nd and 3rd rations. On contrast replacement corn grains by FDDP led to decrease the economic efficiency by about 25.98 and 30.39% for the 4th and 5th rations, respectively. Moreover, substituting corn grains by 50 or 100% DDP during formulation of CFM led to reduce the price of one ton concentrate by about 8.0 and 16%, respectively.

Results of this study indicated that discarded dates can be incorporated into the rations of ruminant animals replacing all or a part of maize grains imported reverberating both beneficial the national economy to provide an outlet for date sector. Along with it can be used successfully for ethanol production and using the residues after fermentation for feeding animals.

Keywords: *Discarded dates palm, fermented discarded dates palm, digestibility, milk production, buffaloes.*

INTRODUCTION

There is an increase for using grains, especially maize, for biofuel production as energy source for human leading to increase the price of energy source in animal rations, therefore new sources of energy for animals must be found.

Egypt is the first important country in date palm world production which is represented about 17% of the total world production (FAO, 2012). Whereas, there is about 12.26 million palm trees (different varieties), producing about 1.37 million tons date crop annually (Ministry of Agriculture and Land Reclamation , 2012).Meantime, the quantity of discarded dates is estimated to be about 20% of dates produced (Belal*et al.*, 1999), which could be used to feed animals with high energy supplements (Mikki*et al.*, 1986). Date waste is a good source of energy, thus it may be possible to use date waste as an energy source in ruminant rations.

Dates are rich in sugar and the total sugar content depends on the variety and it varies between 60 and 76 % from DM and it is constituted mostly of glucose and fructose. Dates have a low protein concentration (1.5-4 % DM), which depends on the variety (Boudechiche*et al.,* 2008).

The major sugar in dates, glucose and fructose, are present in approximate levels of 44%-79% on dry basis (FAO, 2006), thus making date extracts quite suitable as a feedstock for ethanol production and the residues could be used for ruminants feed. Date fruits can provide 2.67 Mcal/kg of digestible energy. While, barley grains provides 3.06 Mcal/kg of digestible energy (Alhomidy*et al*., 2011). Also, dates can supply 87% of the digestible energy provided by the same unite mass of traditional feed grain (Al-Khateeb and Ali-Dinar, 2001). By-Product of ethanol production from discarded dates may be become more available to livestock feeders.

Research in animal nutrition has shown that feeding sugar is better than feeding starch as the sugar is directly converted into glucose without much nutrient loss (Chamberlain *et al.,* 1993). The concept of feeding sugar by-products was developed on this physiological principle.

The available information in the literature about the inclusion of discarded date in lactating buffalo's rations is very scarce. Most of the studies focused on carcass characteristic and meat quality of goats or sheep (Mahgoub*et al.*, 2005).

Therefore, the main objectives of the present work are to:

1- Investigate the chemical composition and nutritive value of the discarded dates palm before and after ethanol production.

2- Study the economic impact of using discarded dates in lactating buffalo rations on milk production and composition.

MATERIALS AND METHODS

The current work was carried out at the Entire Central Laboratory For Date Palm Research, MehalletMousa Animal Research Station, Animal Production Research Institute, Ministry of Agriculture and Department of Animal Production, Faculty of Agric., Cairo University.

Discarded dates palm (DDP) including different kinds (dried and semi-dried) and different varieties were collected from the local farms at New Valley region after harvesting and sundried until the moisture content reduced to about 12% and then, the dried discarded date was crushed after mixing it with wheat bran at the rate of 250 kg per ton of dates (20%) to facilitate the crushing process.

The crushed discarded dates palm was divided into two parts. The 1stpart was used as it's to evaluate chemical composition and nutritive values, while the 2ndpart of crashed unfermented discarded date palm UFDDP was used to study the economic efficiency of using it for producing ethanol and evaluate its by-product fermented discarded date palm (FDDP) for feeding ruminants.

Ethanol production:

Overall process of ethanol production in the present study was carried out according to the method described by Mehaia and Cheryan (1991) as follows:

Four tested types of discarded date palm by products were used, the 1st one represented the crashed discarded date palm with wheat bran DDPW used in these study contained 20% wheat bran, while the 2nd was DDP flesh (DDPF), and the 3rd was discarded date palm only (DDP), while crushed date palm pits (DPP) used as the 4th by products of DDP. Three samples were taken from each kind, each sample one kg. Tap distilled water was added at ratio of 2 parts water to one part dates (by weight) with batch culture yeast *Saccaromycescerevisiae*, the inoculum was contained 103-104 cells. The mixture was incubated at temperature 28±°C via continuous stirring for one week. Samples were filtrated after incubation period using cheese cloth. The residual from DDPW after filtration called fermented discarded date palm

(FDDP) was used for the nutritive value evaluation, while extract solutions from all discarded dates palm types were used for determination ethanol using GC 10, Ver. 126. After ethanol estimation, the twelve extract solutions were boiled for half hour to evaporate all ethanol produced. The reminded of all extract solutions were inoculated again with the same batch culture and incubated as described previously to ensure that all soluble sugars were fermented. Ethanol was determined again after the second incubation. Total ethanol produced =1^{st}+ 2^{nd}estimation.

Digestibility trials:

Nine rams were used in indirect digestible trials as mentioned by (**Abou-Raya, 1967**) for 22 days, 15 days preliminary period and 7 days as collected period. Animals were divided into three groups (3 in each) to fed either clover hay (CH) as basal ration, CH plus unfermented discarded date palm (UFDDP) or CH plus FDDP. Ninety percent of ad libtum intake, in preliminary period, was offered for each ram (in 2 meals at 8.00 a.m. and 5.00 p.m.) during the days of collection period. Water was available at all times. Daily fresh feces from each ram was weighed during the collection period and representative samples of each collection was taken and dried in forced air oven at 65ºC for 48 hours. Dried samples for each ram at the end of collection period were thoroughly mixed, ground and kept for chemical analysis.

Chemical analysis of UFDDP, FDDP, CH and feces were carried out to determine DM, CP, CF, EE and ash according to the method of A.O.A.C. (1990). While NFE values were calculated by differences.

Gross energy of UFDDP and FDDP samples were determined with an adiabatic bomb calorimeter (Parr instrument Co., Inc., Moline, IL)

Total digestible nutrients (TDN) was calculated according to the classic formula of McDonald *et al*., (1995), while digestible energy (DE Mcal/kg DM) was calculated according to NRC (1988) the data obtained were subjected to statically analysis according to Snedecor and Cochran, (1982), Differences among treatments means were tested by multiple rang tested of Duncan, (1955).

Lactation trial:

Experimental Animals:

Fifteen lactating buffaloes weighed 550-650 kg and at 2^{nd} to 3^{rd}lactating season were used after 8 weeks of calving. The buffaloes were free from any disease with normal health appearance. A complete switch-back experimental design were used with five treatments and three successive experimental period consisted of 28 days, the first 14 days of each period were considered a transition period followed by 14 days test period, as described by (Lucas, 1956).

The experimental buffaloes were put into three randomly blocks. Each block contained 5 buffaloes every one buffalo from each block was assigned randomly to each experimental ration.

Feeding system and management

The buffaloes were housed under open sheds and individually fed according to requirement of (APRI, 1997) for lactating buffaloes. Feeding allowances were adjusted weekly according to changes in body weight and milk production. All experimental rations were formulated to contain 26.5% maize silage, 21.0% Egyptian clover, 10.0% rice straw in combination with 42.5% concentrate feed mixture (CFM) contained ether 35% yellow corn grains (R1) or DDP was used instead of yellow corn grains by 50% (R2) or 100% (R3) or FDDP was used instead of yellow corn grains by 50% (R4) or 100% (R5).

Concentrate feed mixture was offered twice daily at 8 a.m. and 4 p.m.; while, corn silage was offered daily at 9 a.m. moreover, fresh Egyptian clover was offered daily at 4 p.m. and rice straw was offered at 8 p.m. Fresh water was offered three times daily; at 7 a.m., 3 p.m. and 8.p.m.

Milk yield and milk composition

Individually morning and evening milk yields were recorded daily then, milk was adjusted as 7 % fat corrected milk (FCM) using the formula given by Raafat and Saleh (1962) as follows:-

$$7\%FCM = 0.265 \times \text{milk yield} + 10.5 \times \text{fat yield}.$$

Composite milk samples from consecutive morning and evening samples were taken once every week during the collection period. It was mixed in proportion to yield and analyzed for fat, protein, solids not fat (SNF), total solids (TS) and (ash) by a Milko Scan, Model 133 B.

Digestibility trials

Five digestion trails were carried out during 3rd period of the lactating trials using all experimental buffaloes (3 animals in each group), to determine the nutrients digestibility and nutritive values of the experimental rations. Fecal rectum samples were collected for six successive days from each animal. Samples of experimental feedstuffs and feces were composted and representative samples were analyzed according A.O.A.C (1990).

Acid insoluble ash (AIA) was used as natural marker (Van Keulen and Young, 1977) and determined in feedstuffs and feces by the method of Schneider and Flatt (1975). Total digestible nutrients (TDN) and digestible crude protein (DCP) were calculated according to the classic formula of (McDonald *et al.*, 1995). While the digestible energy (DE Mcal/kg DM), was calculated according to (NRC, 1988).

Feeding utilization efficiency

Feeding utilization efficiency was determined as amount of DM, TDN, DE and DCP required for producing 1 kg 7% FCM.

Economic efficiency

Economic efficiency was calculated as the ratio between the price of 7% FCM produced and the cost of feeds consumed based on the following prices: Egyptian pound (L.E.) per ton, during years 2011 and 2012; fresh buffaloes milk (4500 L.E/ton, commercial concentrate feed mixture (2200 L.E./ton), fresh Egyptian clover (150 L.E/ton), maize silage (300 L.E/ton), wheat bran (1200 L.E/ton), maize grain (1750 L.E/ton), rice straw (150 L.E/ton), fermented discarded dates (500 L.E./ton), unfermented discarded dates (760 L.E/ton). However, the prices of one ton of experimental concentrate feed mixtures were CFM2 (2027 L.E/ton), CFM3 (1853 L.E/ton), CFM4 (1983 L.E/ton) and CFM5 (1762 L.E/ton).

$$\text{Economic efficiency} = \frac{\text{Money input (price of milk produced)}}{\text{Money output (price of feeds consumed)}}$$

Statistical analysis

The data obtained were subjected to statistical analysis according to Lucas, (1956) and Snedecor and Cochran, (1982)

Treatment means=$\acute{Y}$ + Q/2np

In which $\acute{Y}$ is the grand mean performance in the experiment, the mean of the original data

Q = sum of D's for the buffaloes receiving the treatment in the first and third periods minus the sum of the D's for the cows receiving the treatment in the second period

$D=Y_1 - 2Y_2 + Y_3$

In which Y_1, Y_2 and Y_3 represent the performance in periods 1, 2 and 3 respectively.

n= number of buffaloes per treatment sequences,

p= number of treatments.

Using General linear models procedure adapted by SPSS (2088) for user's Guide, with one way ANOVA

$Y_{ik}=\mu+F_i+e_{ik}$

Where:

Y_{ik} = any observed value μ = the overall mean

F_i = effect of feed type (1-9) e_{ik} = random error

Differences among treatment means were tested by multiple range test of Duncan, (1955).

RESULTS AND DISCUSSION

Chemical composition and gross energy of experimental feeds are presented in Table (1). Results showed that UFDDP had the highest DM, OM, EE, NFE and GE contents compared with FDDP. While CP, CF and ash contents of UFDDP had opposite trend. These results might be due to drainage of the soluble fractions of water soluble carbohydrates and other soluble nutrients during incubation with yeast (*Saccharomyces cerevisiae*) for producing ethanol. These results are in agreement with findings of Ahmed*et al.*, (1999), Awadalla*et al.* (2002) and Al-Dobaib*et al.* (2009).

Nutritive values as TDN and DCP, digestible energy and gross energy (Table 2) in UFDDP recorded the highest values (p<0.05) in TDN, GE and DE. While, FDDP recorded the lowest. Meantime, FDDP had significant (p<0.05) higher DCP value compared with UFDDP. The lowest nutritive value of FDDP mainly due to the great losses of all soluble nutrients especially sugars caused by soaking and fermentation processing during ethanol production from FDDP, the previous results indicated that dates offers a relatively high energy source which is comparable to the concentrate feed.

The nutritive value of UFDDP as TDN in the present study was nearly similar with those obtained by Rashed and Alwash (1976) and Al-Dobaib*et al.,* (2009) who found that the TDN on DM basis of UFDDP ranged between 81.0 and 83.00.

Ethanol production from discarded date palm by-products:

Date contains high levels of carbohydrate mostly as monosaccharaides (glucose and fructose 1:1) (Belal*et al.,* 1999). Thus making date extracts quite suitable as a feedstock for fermentation, and converting the sugars into ethanol by *Sacchromycescerevisiae*yeast as described byMehaia and Cheryan, (1991).

However, chemical composition of tested DDP by-products was determined to investigate the effect of sugar contents as NFE on the quantity of ethanol produced per ton date by-products.

Chemical composition of date in Table (1) showed that DDPF contained the highest NFE (76.60) followed by DDPW with wheat bran (75.14) while DDP recorded 66.57and date palm pits showed the lowest value (39.98). Such results were mainly associated with or without presence of pits or wheat bran in the tested date palm. Data of ethanol production (Table 3) indicated that, the average value of ethanol produced appeared to be more affected by NFE content of tested DDP by-products. It was noticeable that DDPF contained the highest NFE% achieved the highest quantity of ethanol (283.9 L/ton) followed by DDP with pits (261 L/ton), while the date pits recorded the lowest value of ethanol (96.87 L/ton). Meantime, DDP with wheat bran showed (224.0 L/ton). These results agree with findings of (Nizar*et al.,* 2007).

Chemical composition of the experimental ingredients and rations:

Chemical composition of the experimental ingredients and tested rations consumed by lactating buffaloes during experimental period are presented in Table (1). Results indicated that all of the experimental rations had nearly similar values of OM, CP%, EE% and ash. While, CF was the lowest in R1 compared with the other experimental rations. Meantime, NFE decreased from 54.07% (R1) to 48.95% (R5).

Nutrients digestibility and nutritive value of the experimental rations:

Average digestion coefficients of experimental rations fed to lactating buffaloes are presented in Table (4). Data indicated that there were no significant (P<0.05) differences in OM digestibility among animals fed R2 and R3 compared with those fed R1 being 68.44, 67.83 and 68.80%, respectively. While, R4 and R5 recorded the lowest values of OMD (64.76 and 64.23%) with significant (P<0.05) differences compared with R1, R2 and R3. Meantime, R1 and R2 recorded the lowest CF digestibility values 59.55 and 58.9%, compared with R3, R4 and R5 were (63.31, 68.27 and 64.78%), respectively. While, CP digestibility didn't show significant (P<0.05) differences among R1, R3 and R5 were (63.90, 64.90 and 64.83%), respectively. while, R2 recorded the highest value 66.48% and R4 the lowest 64.04%. While, EE digestibility of R4 and R5 recorded the lowest values; 81.58 and 78.83%, respectively. The lower digestibility coefficients of CF in R1, R2 and R3 may be due the higher NFE which may inhibit the activity of cellulolytic and hemi-cellulolytic, microorganisms, leading to a decrease in the availability and utilization of CF in the rumen and could have adverse effects on the digestibility coefficients on such nutrients.

The nutritive values of the experimental rations in terms of TDN, DE, and DCP on DM basis are illustrated in Table (4). It could be noticed that rations contained either yellow corn or UFDDP (R1, R2 and R3) had the highest values of TDN and there were no significant (P<0.05) differences in TDN and DE among these rations. While, R4 and R5 which contained FDDP recorded the lowest significantly (p<0.05) values of TDN and DE. Meantime, all experimental rations showed nearly similar DCP. This result agree with the findings of El-Gasim*et al.,* 1995, that dietary inclusion of date pits significantly improved the feed utilization of sheep.

Many reasons may have been considered responsible for the superiority of nutrients digestibility and nutritive values of R1, R2 and R3 which contained either yellow corn or UFDDP, such as differences in the chemical composition of the experimental ingredients especially fermented and unfermented DDP.

Moreover, inclusion of UFDDP in R2 and R3 may be caused other beneficial effects (formulated balanced rations adequate amounts of nutrients, minerals and vitamins).

Meantime, the lowest nutritive value of R4 and R5 which contained FDDP mainly due to the great losses of all soluble nutrients especially sugars caused by soaking and fermentation processing during ethanol production from FDDP.

Generally, the present nutritive values are mainly associated with the chemical composition and proportion of the experimental feedstuffs, in particular of UFDDP and FDDP.

Feed intake and feed efficiency:

Data in Table (5) showed that the average daily intake of experimental feeds on DM basis by experimental lactating buffaloes were nearly similar for the different groups. The absence of significant differences of feed intake may be due to that rations were offered to experimental buffaloes in restricted amounts according to their requirements and calculated nutritive values of experimental feedstuffs. Results obtained are in agreement with the findings of Allam*et al.,* 1997, that no significant differences (P<0.05) were detected in daily DM intake per 100 BW among lactating Friesian cow fed different rations contained different ratio of yellow corn and date seeds. The same trend were reported by Mahgoub, 2001, that no significant differences (P<0.05) were detected in the daily DM intake among lactating buffaloes fed different rations of concentrate mixtures and date seeds. The highest significant (P<0.05) averages daily intake of TDN and DE were observed with buffaloes fed R1, R2 and R3. While, the lowest values were recorded with buffaloes fed R4 or R5. These results may be attributed to the higher TDN and DE of yellow corn and UFDDP containing rations as the results of improving digestibility of most nutrients of these rations as shown in Table (4).

In respect of DCP intake, buffalo fed either R1, R2, R3 and R4 consumed nearly similar and significant (P<0.05) lower amounts of DCP than those fed R5.

Feed efficiency expressed as kg of DMI, TDN and DCP kg required for producing one kg 7% FCM is presented in Table (5). It could be observed that lactating buffaloes fed R1, R2 or R3 recorded the best feed efficiency as DM, TDN or DCP compared with those fed R4 or R5. This result might be due to the higher milk production for these groups.

Milk production and composition:

Data of average 7% FCM for buffaloes fed different rations in Table (6) indicated that there was insignificant (P<0.05) decrease in 7% FCM for buffaloes fed R2 compared with those fed R1 but the other rations significantly (P<0.05) decreased the amount of FCM by 10, 31 and 39% for R3, R4 and R5, respectively compared with R1. There were insignificant (P<0.05) differences between the two levels of replacement for each type of DDP in FCM. These results are in agreement with the findings of Al-Dobaib*et al.,* 2009, that feeding iso-nitrogenous rations including a reasonable dose of discarded dates had no negative effects on milk yield and composition of Aradi goats.The same trend was observed byAllam*et al.,* 1997 andMahgoub, 2001.

The lowest milk production for buffaloes fed R4 or R5 might be attributed to the lowest content of TDN% and DE in these rations as shown in Table (4). Meanwhile, the requirement of the expected production of tested buffaloes fed R4 and R5 did not cover by giving the experimental rations containing different percentage of FDDP. Data of chemical composition of milk are presented in Table (6) indicated that the average fat percentage ranged from 5.64 to 7.45 %. Significant differences (P<0.05) in fat percentage were existed between R1 and other groups. There were no significant (P<0.05) differences between groups fed R2 and R3 also, between R3 and R4 in fat percentage.

The highest milk protein value was observed with buffaloes fed R1 followed by those fed R2; while buffaloes fed R5 recorded the lowest values, and the intermediate values of protein were recorded with buffaloes fed either R3 or R4. These results are in agreement with thoseobtained by Allam*et al.,* 1997, and Mahgoub, 2001. Results indicated that there was no significant (P<0.05) difference among groups for milk lactose. These results are in agreement with those of Allam*et al.,* 1997, and Mahgoub,2001.Concerning total solids (TS) content in milk results indicated that there was a significant (P<0.05) decrease when buffaloes fed R2, R3, R4 or R5 compared with those fed R1. There were no significant (P<0.05) differences in TS content among buffaloes fed R2, R3 or R4. The highest TS for R1 group might be due to the higher fat and protein content of milk produced in this group.The present milk composition in present study are within normal range of milk composition in buffaloes milk which was obtained by El-Aidy ,2003, and Bendary*et al.,* 2006.

Economic efficiency:

Economic efficiency of feeding lactating buffaloes on the experimental rations in Table (7) indicated that economic efficiency as the ratio between prices of 7% FCM produced plus the additional input for ethanol production for R4 and R5/cost of feed intake was insignificant among R1, R2 or R3. And among R1, R3 and R5 On contrast, feeding buffaloes R4 showed significant decrease (P<0.05) of economic efficiency compared with the control ration R1.

It could be concluded that substituting corn grains by 50 or 100% UFDDP during the formulation of FCM led to reducing the price of one ton from concentrate by about 8 and 16%, respectively. Meantime, FDDP need more research to evident which portion with which additive can replace corn and to be used as a source of energy for animal feed.

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Table (1). Chemical composition of ingredients and experimental rations (on DM basis).

Item	Chemical composition, %					
	OM	CP	EE	CF	NFE	Ash
Ingredients,						
UFDDP	96.03	8.69	3.10	10.00	75.14	3.97
FDDP	92.12	14.66	2.10	33.75	41.61	7.88
DDPF	97.50	6.31	4.92	9.66	76.61	2.50
DDP	94.32	8.91	5.42	15.01	64.98	5.68
DPP	90.50	7.17	6.21	37.14	39.98	9.50
CH	89.30	14.10	2.50	28.90	43.80	10.70
Egyptian clover	87.91	15.55	3.45	26.10	42.81	12.09
Corn grains	98.69	8.58	4.03	1.79	84.29	1.31
Maize silage	93.89	8.54	2.99	25.45	56.91	6.11
Rice straw	83.86	2.56	1.80	32.44	47.06	16.14
Experimental rations,						
R1	90.55	12.83	3.04	20.61	54.07	9.45
R2	90.36	12.83	3.49	21.61	52.88	9.64
R3	90.16	12.39	3.36	21.83	53.58	9.84
R4	90.15	12.72	3.37	22.53	51.53	9.85
R5	89.73	13.06	3.24	24.48	48.95	10.27

UFDDP: Unfermented discarded date palm+ wheat bran; FDDP: Fermented discarded date palm+ wheat bran; DDPF: Discarded date palm flesh; DDP: Discarded date palm only; DPP: Date palm pits; CH: clover hay; R1: ration contained 35% corn grains in concentrated feed mixture; R2: ration contained 17.5% corn grains plus 17.5% UFDDP in concentrated feed mixture; R3: ration contained 35% UFDDP in concentrated feed mixture; R4: ration contained 17.5% corn grains plus 17.5% FDDP in concentrated feed mixture; R5: ration contained 35% FDDP in concentrated feed mixture.

Table (2). Nutritive values of the experimental discarded date by products.

Item	UFDDP	FDDP	SEM	Sig.	CH
TDN %	77.57	62.03	3.66	*	56.38
GE Mcal/kg DM	3.97	3.57	3.52	*	-
*DE Mcal/kg DM	3.42	2.73	0.16	*	2.48
DCP %	6.44	11.39	1.31	*	10.81

UFDDP: Discarded Date Palm. FDDP: Fermented Discarded Date Palm. CH: Clover Hay
**DE (Kcal/ kg DM) =0.04409×TDN (NRC, 2001).*

Table (3). Average values of ethanol production from the different kinds of discarded date by products.

Items	Experimental DDP by-products			
	DDPF	DDP	DDPW	DPP
Average total liters of ethanol produced/ton	283.9	261	224.0	96.87
Price of one ton from different DDP products	820	650	760	450
Price ton/number of liters	2.9	2.5	3.39	4.65

Table (4). Nutrients digestibility coefficients and nutritive values of the experimental rations.

Item	R1	R2	R3	R4	R5	SEM
Digestibility coefficients						
OM	68.80^{a}	68.44^{a}	67.83^{a}	64.76^{b}	64.23^{b}	0.59
CP	63.90^{b}	66.48^{a}	64.90^{b}	64.04^{c}	64.83^{b}	0.37
EE	87.12^{a}	85.90^{a}	86.28^{a}	81.58^{b}	78.83^{c}	0.93
CF	59.55^{c}	58.29^{c}	63.31^{b}	68.27^{a}	64.78^{b}	1.00
NFE	72.35^{a}	71.98^{a}	69.30^{b}	62.35^{c}	62.65^{c}	1.21
Nutritive values						
TDN%	66.15^{a}	65.46^{a}	65.52^{a}	61.84^{b}	60.74^{b}	0.63
DE (Mcal/kg) DM	2.92^{a}	2.89^{a}	2.73^{b}	2.89^{a}	2.68^{b}	0.03
DCP%	8.20^{b}	8.23^{b}	8.04^{c}	8.15^{bc}	8.47^{a}	0.06

a, b and c: means in the same raw with different superscripts differ significantly (p<0.05).
DE Mcal/kg=0.04409 x TDN

Table (5). Average daily feed intake (on DM basis) and feed efficiency of experimental rations.

Items	Experimental rations					
	R1	R2	R3	R4	R5	SEM
Dry matter intake, kg/h./d.,						
CFM1	7.06					
CFM2		7.04				
CFM3			6.99			
CFM4				7.01		
CFM5					7.0	
Egyptian clover	4.73	4.73	4.73	4.73	4.73	
Maize Silage	2.85	2.85	2.85	2.85	2.85	
Rice Straw	1.79	1.79	1.79	1.79	1.79	
Total DM intake	16.43	16.41	16.56	16.38	16.37	
Total intake as TDN/kg/day	10.87^{a}	10.77^{a}	10.85^{a}	10.13^{b}	9.94^{b}	0.10
DE/Mcal/day	48.41^{a}	47.48^{a}	47.84^{a}	44.63^{ab}	43.83^{b}	0.45
Total intake as DCP/kg/day	1.35^{b}	1.35^{b}	1.33^{b}	1.35^{b}	1.39^{a}	0.01
Feed efficiency,						
DMI/FCM	1.40^{d}	1.44^{d}	1.57^{c}	2.02^{b}	2.29^{a}	0.08
TDN/FCM	0.95^{c}	0.95^{c}	1.03^{c}	1.25^{b}	1.39^{a}	0.04
DCP/FCM	0.12^{c}	0.12^{c}	0.13^{c}	0.17^{b}	0.20^{a}	0.01

*a and b : means in the same raw with different superscripts differ significantly (P<0.05).CFM1: concentrated feed mixture contains 35% corn grains; CFM2**:** concentrated feed mixture contains 17.5% corn grains plus 17.5%*

UFDDP; CFM3: concentrated feed mixture contains 35% UFDDP; CFM4: concentrated feed mixture contains 17.5% corn grains plus 17.5% FDDP; CFM5: concentrated feed mixture contains 35% FDDP.

Table (6). Milk production and composition of lactating buffaloes fed experimental rations.

Items	Experimental rations					
	R1	R2	R3	R4	R5	SEM
Calculated 7% fat milk (FCM)	11.75^{a}	11.37^{ab}	10.53^{b}	8.10^{c}	7.14^{c}	0.49
Milk composition, %						
Fat	7.45^{a}	6.92^{b}	6.62^{bc}	6.35^{c}	5.64^{d}	0.17
Protein	4.58^{a}	4.40^{b}	4.35^{bc}	4.26^{cd}	4.17^{d}	0.05
Lactose	5.00	5.30	5.49	5.38	5.16	0.45
TS	17.67^{a}	17.04^{b}	17.13^{b}	16.95^{b}	16.13^{c}	0.17

a,b,c and d: means in the same row with different superscripts differ significantly.

Table (7). Economic efficiency of daily milk production.

Items	Experimental rations					
	R1	R2	R3	R4	R5	SEM
Milk price (L.E/day)	52.88^{a}	51.17^{a}	47.39^{b}	36.45^{c}	32.13^{d}	1.29
Feed cost (L.E/day)	25.9^{a}	24.3^{a}	23.50^{cd}	24.14^{b}	22.7^{d}	0.24
Profit,(L.E)	26.98	26.80	23.89	12.31	9.43	
Additional input** (L.E)	------	------	------	6.69	12.48	
Total profit	26.98	26.80	23.89	19	21.91	
Economic efficiency*	2.04^{ab}	2.11^{a}	2.02^{ab}	1.79^{c}	1.97^{b}	0.05

a,b,c and d: means in the same row with different superscripts differ significantly.
**Economic efficiency = money input/money output*
** *Additional input = (amount of ethanol produced (l) × 22.12) – cost of 1 letter ethanol produced.*

إستخدام البلح الفرز فى إنتاج الإيثانول وتغذية الجاموس الحلاب

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لتقييم التركيب الكيماوى والقيمة الغذائية والكفاءة الغذائية والأقتصادية لإستخدام البلح الفرز فى علائق الجاموس الحلاب قبل وبعد إنتاج الإيثانول. تم تجميع البلح الفرز من مزارع النخيل بالوادى الجديد بعد عملية الحصاد. تمت عملية التجفيف الشمسى والجرش ليقسم لجزئين الأول تم إستخدامة كما هو والجزء الأخر تم إستخدامة فى إنتاج الإيثانول. تم إجراء ثلاث تجارب هضم بإستخدام تسعة كباش بإستخدام الدريس كعليقة اساسية لتقدير معاملات الهضم والقيمة الغذائيه .أظهرت نتائج تجربة التخمير أن كل واحد طن من البلح الفرز مخلوط بنخالة القمح و لحم الثمرة والبلح الكامل بالنوى و نوى البلح يمكن أن ينتج حوالى 244 و 283.9 و 261 و 96.87 لتر إيثانول\الطن. كما أظهرت النتائج أن البلح الفرز بدون تخمير هو الأعلى فى محتواة من المادة الجافة والمادة العضوية ومستخلص الأيثير و الكربوهيدات الذائبة فى حين أن البلح المتخمر كان الأعلى فى البروتين الخام و الألياف الخام والرماد. وأظهرت تجارب الهضم أرتفاع معاملات الهضم لكل من المادة العضوية ومستخلص الأيثير و الكربوهيدرات الذائبة للبلح الفرز مقارنة بالبلح المتخمر فكان الأعلى فى معامل هضم كل من البروتين والألياف. المركبات الغذائية المهضومة و الطاقة الكلية كانت أعلى فى البلح الفرز مقارنة بالبلح المتخمر. تم إستخدام عدد 15 جاموسه حلابة بمتوسط وزن 550-650 كجم مابين الموسم الثانى والثالث للحليب قسمت عشوائيا لخمس مجاميع لدراسة تأثير إحلال البلح الفرز و البلح المتخمر محل حبوب الذرة فى التغذية حيث كانت العلائق تحتوى على26.5% سيلاج ذرة و 21.0% برسيم مصرى و 10% قش أرز مخلوط مع العلف المركز حيث غذيت المجموعة الأولى (1) على علف 35% حبوب ذرة فى حين حل البلح الفرز محل الذرة بنسبة 50% فى العلف المقدم للمجموعه الثانية و 100% للمجموعة الثالثة فى حين أن البلح المتخمر حل محل حبوب الذرة بنسبة 50% و 100% لكل من المجموعة الرابعة والخامسة على التوالى . حققت الحيوانات المغذاة على العليقة الأولى والثانية والثالثة أعلى كفاءة غذائية كمعدل إستهلاك المادة الجافة والمركبات الغذائية المهضومة والبروتين المهضوم. إحلال البلح الفرز محل حبوب الذرة بنسبة 50 و100% لم يظهر فرق معنوى فى الكفاءة الأقتصادية مقارنة بإستخدام البلح المتخمر كبديل الذرة فى المجموعتين الرابعة والخامسة والذى أدى لتقليلالكفاءة الإقتصادية بنسبة 25.98 و 30.39% على التوالى. إحلال البلح الفرز محل حبوب الذرة بنسبة 50 و 100% أدى لتقليل سعر طن العلف المركز بحوالى 8 و 16% على التوالى. البلح الفرز يمكن أن يحل بشكل جزئى أو كامل محل حبوب الذرة فى علائق الجاموس الحلاب محققا مردودا لكل من قطاعى إنتاج الحيوان والنخيل كما ان البلح الفرز يمكن إستخدامة فى إنتاج الإيثانول وإدراج المنتج الثانوى كعلف صالح لتغذية الحيوان.