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IN VITRO EVALUATION OF ENSILING AND /OR EXOGENOUS FIBROLYTIC ENZYME SUPPLEMENTATION OF DATE PRESS CAKE

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ABSTRACT

This study was conducted to evaluate the effect of ensiling and /or exogenous fibrolytic enzyme supplementation date press cake using *in vitro* batch culture technique. Untreated date press cake (DPC) and ensiled DPC with exogenous fibrolytic enzymes (ZAD1 and ZAD2) and with or without adding urea compared to corn grains were in vitro evaluated using batch culture technique. DM, NDF and ADF degradation and total gas production as well as fermentation parameters of the incubated samples were determined after 24 h of fermentation. Total VFAs, proportions are not affected (P > 0.05) by any of the treatments. However, value of ammonia concentration was higher (P < 0.05) with ZAD2+U group and urea group than date press cake (DPC). The pH value was highest (P>0.05) with the ensiling treatments. There were no significant differences in the values of DMD and OMD between the different treatments. But, the values of NDFD and ADFD were increased (P<0.05) in the corn group. Total gas production had no difference (P>0.05) between the corn grain and the DPC without any treatments. While, values of metabolizable protein (MP) and efficiency of microbial biomass production (EMP) were increased (p<0.05) with DPC compared to corn grains . There was no significant difference in the rumen activity when using date press cake (DPC) or corn grains. Moreover, the ensiling process did not cause a clear improvement in rumen fermentation.

Keywords: Date press cake; *In-vitro* Ruminal Fermentation; Gas production.

INTRODUCTION

Corn is one of the most important grain crops in the world. About 52 % of the corn production is used for animal feed, while, 37 % is consumed in the production ethanol plants, and 11 % go to the food industries.Because of the shortage and the high price of yellow corn grains, one of the alternatives to solve this problem is using non-conventional ingredients as a partial replacement of corn grains in ruminant rations.

On the other side, wasted date and date by-products are promising as a non-traditional carbohydrate sources in animal nutrition. When dates undergo extraction for syrup or alcohol production, the extraction yields a by-product (press cake) which is made of exhausted date flesh and residual sugars, with or without pits. Press cake is a high moisture product that does not store easily and may become a disposal problem (**Barreveld, 1993)**.

Fresh press cake contains about 70 % water. It may contain or not pits, so its crude fiber content varies from 9 to 22 % DM. Like the fruit, its protein content is rather low (5-8 % DM). Sugar content depends on the extraction rate and can be as low as 15 % DM. Research on date press cake is very limited (**Barreveld, 1993)**. Due to their high carbohydrate content and relatively low fiber, press cake

has a high energy value, as high as that cereal grains such as barley (**Boudechiche et al 2010)**.

The objective of this *in vitro* study was to compare the effect of corn, date press cake alone (DPC) and date press cake treated with some treatments on rumen degradation and fermentation activity.

MATERIAL AND METHODS

The study Materials

Date Press Cake (DPC): It is the exhausted date fresh with some residual sugar with or without the pits incorporated, depending on the type of extraction.

Exogenous fibrolytic enzyme.

ZAD® (ENZ) is a commercial product "liquid multi enzyme feed additive produced from *Ruminococcus flavefaciens*". Authorized by the Academy of Scientific Research and Technology in Egypt (Patent No.: 24551, Cairo, Egypt). **ZAD1** is Probiotic-anaerobic bacterial and exogenous enzymes (*Ruminococcus Bacteria* with clove essential oil). **ZAD2 is** probiotic-anaerobic bacterial and exogenous enzymes. (*Ruminococcus Bacteria* without clove essential oil).

Experimental treatments

Date press cake (DPC) was ensiled with Zad1, Zad2 (2 ml / kg dry matter) and with or without urea (1.5% / kg dry matter) (3 jars per each treatment) and stored for 45 days, the experimental treatments were corn grains, DPC without treatment and five supplemented treatments (DPC supplemented with Zad1, DPC supplemented with Zad2, DPC supplemented with Zad1+ 1.5% urea, DPC supplemented with Zad2+ 1.5% urea and DPC supplemented with urea) and five ensiled treatments (DPC ensiled with Zad1, DPC ensiled with Zad2, DPC ensiled with Zad1+ 1.5% urea, DPC ensiled with Zad2+ 1.5% urea and DPC ensiled with urea).

In vitro gas production technique

Two days before beginning of the experiment, 400 ± 4 mg of sample for each treatment was weighed into 125 mL glass bottles. These bottles have a total volume of 125±2 mL. A buffer solution was prepared before addition of rumen fluid as described by **(Szumacher-Strabel et al 2002)** and flushed continuously with CO_2 at 39°C during sample inoculation. Rumen fluid was obtained from slaughter house and it was collected from sheep. The collected rumen fluid was mixed into a bottle (1L) with an O_2-free headspace and immediately transported to laboratory at 39°C. Upon arrival at the laboratory, the rumen fluid was filtered through four layers of cheesecloth to eliminate large feed particles. The buffer solution was added to rumen fluid at ratio 4:1. Forty mL of this inoculum was added to each bottle, then the headspace of each bottle was flushed with CO2, and closed. The initial pH of the inoculums was from 6.8-6.9. Triplicates of each sample were used for each treatment.

Degradability

Dry matter degradability (% dDM) was calculated as the (difference between the sample DM content and that in the residual after 24 h incubation / sample DM content * 100). NDF and ADF of the residuals after fermentation were analyzed with the same methods used for feed ingredient analysis. Degradability of NDF, ADF, cellulose and hemi were calculated as (difference between the content in the sample before and after incubation / content in the sample before incubation *100).

Total gas production

After 24 h of samples incubation, the total gas production was estimated by the displacement of syringe piston, which was connected to the serum flasks. The gas produced due to fermentation of substrate was calculated by subtracting gas produced in blank vessels (without substrate) from total gas produced in the vessels containing buffered rumen fluid and substrate.

Calculation

Metabolizable energy (ME, Mcal/kg DM) , *In vitro* organic matter digestibility (OMD, %) were estimated according to (**Menke and Steingass, 1988)**, (SCFA) Short Chain Fatty Acid concentrations were calculated according to **Getachew et al 2002)**, Microbial Biomass Production (MCP) and Efficiency Of Microbial Biomass Production (EMP) were calculated according to **(Blümmel et al 1997)** as:

- ME (mJ/kg DM) = 2.20 + 0.136 GP + 0.057 CP (%),
- OMD = 14.88 + 0.889 GP+ 4.5 CP (%) + 0.0651 ash (%),

- SCFA (mmol/200 mg DM) = -0.00425 + 0.0222 * GP
- MCP (mg/g DM) = mg dDM- GP*2.2
- EMP = (mg dDM- GP*2.2))/ mg DMD

Where GP is net GP in mL from 200 mg of dry sample after 24 h of incubation, 2.2 mg/ mL is a stoichiometric factor that expresses mg of C, H, and O required for the SCFA gas associated with production of 1 mL of gas.

After 24 hr of incubation, the filtrated rumen liquor for each sample was subjected for further investigation. The pH of rumen fluid was measured using pH meterpen and quantitative analysis of ammonia concentration was carried out by Nesler method modified by **(Szumacher-Strabel et al 2002),** total volatile fatty acids (TVFA's) was determined according to **(John et al, 1957).**

Gas production calculation

After 24 hours gas production was calculated as followed:

- GPDM= total gas production (ml) / substrate DM (g)
- GPdDM= total gas production (ml) / substrate dDM (g)
- GPOM= total gas production (ml) / substrate OM (g)
- GPNDF = total gas production (ml) / substrate NDF (g)
- GPADF= total gas production (ml) / substrate ADF (g)
- GPdNDF= total gas production (ml) / substrate dNDF (g)
- GPdADF= total gas production (ml) / substrate dADF (g)

Chemical analysis of feed ingredients

yellow corn, untreated and ensiled DPC were analyzed for DM and ash, (CF) Crude fiber, Crude protein (CP) (Nitrogen x 6.25) and ether extract (EE) contents according to **(AOAC, 2005).** Neutral detergent fiber (NDF), acid detergent fiber (ADF) and (ADL) acid detergent lignin contents were analyzed sequentially **(Van Soest et al 1991)** using the Ankom^{200} Fibre Analyzer for NDF and ADF and thereafter soaking the residual with 72% sulfuric acid for 3 hours.. The NDF content was analyzed with 2 additions of heat-stable α-amylase and 1:1 g sodium sulfite per g sample in the neutral detergent solution**.** NDF and ADF are expressed inclusive of residual ash and hemicellulose and cellulose calculated from NDF, ADF and ADL values. Non-fiber carbohydrate (NFC) was calculated according to the following formula:

NFC (%)**=** 100− (%ND+%CP+ %fat +%ash) **(NRC, 2001)**.

Statistical analysis

The data of *In vitro* degradability and fermentation parameters were statistically analyzed according to statistical analysis system User's Guide, (**S.A.S., 2004).** Separation among means was carried out by using Duncan Multiple test, **(Duncan, 1955).** The following model was used:

$$Y_{ij} = \mu + S_i + \alpha_{ij}$$

Where: Y ij = the observation of the model, μ = General mean common element to all observation, Si = the effect of i the treatment, and α ij = the effect of error.

RESULTS AND DISCUSSION

Chemical composition

Comparing between corn grain and date press cake (DPC) in chemical composition shows that they are similar in most components except fiber. Note that the ratio of total crude fiber in the DPC is about 14.86%, but in the corn grain it was 2.30%, resulting in an increase in the percentage of each of the NDF, ADF and ADL content in DPC compared to the corn grain **Table (1).**

The data of **Table (1)** showed comparable values of chemical composition due to effect of ensiling DPC with Exogenous enzyme with or without adding urea and exogenous enzyme supplementation in this connection **Nsereko et al (2002)** reported that, exogenous fibrolytic enzymes may ameliorate the nutritive value of food by-products due to enhanced attachment by rumen microorganisms**.** Therefore, in this study some enzymatic products such as ZAD 1 and ZAD 2 were used as dietary supplements with DPC to improve fiber digestion in it. Therefore, it is possible to improve the nutritional value of the DPC by using some additives such as enzymes or urea or mixing them.

Rumen basic parameters

Limited data are available about the effect of DPC on ruminal fermentation activity and ruminal microorganisms, moreover to its modes of action and optimal concentrations.

Table 1. Chemical analysis between corn, Date press cake and treated Date press cake before and after ensiling.

Items	Corn	DPC	Ensiled DPC with					Supplemented DPC with				
			ZAD1	ZAD2	ZAD1+ urea	ZAD2+ urea	urea	ZAD1	ZAD2	ZAD1+ urea	ZAD2+urea	urea
MI	11.65	22.3	57.9	57.5	57.3	57.4	57.2	57.4	57.7	53.1	57.6	66.1
DM	88.35	77.7	42.1	42.5	42.7	42.6	42.8	42.6	42.3	46.9	42.4	33.9
OM	98.84	98	97.4	97.4	97.3	97.5	97.6	97.7	97.8	97.6	97.5	97.2
ASH	1.16	1.99	2.61	2.65	2.75	2.53	2.4	2.35	2.2	2.43	2.5	2.78
EE	6.23	1.5	2	1.9	1.6	1.9	1.8	2.2	1.8	1.8	2.2	1.7
CP	10.57	10.5	8.64	8.91	13	12.8	14.5	10.5	12.6	14	14.3	14.2
CF	2.3	14.9	15.9	15.1	15.7	15.8	15	14.7	14.6	15.3	14.4	14.5
NDF	25.71	48	51	49.3	50.3	49.8	48.9	46.6	46.9	47.2	47.2	48
ADF	7.26	36.7	39.7	40.8	39.6	39.2	38.3	35.9	36.1	36.2	36.2	36.9
ADL	3.31	25.6	27.7	28.1	28	27.7	26.5	25.1	24.4	24.7	25.1	23.8
Lignin	2.99	25.3	27.35	27.68	27.72	27.35	26.2	24.86	24.06	24.37	24.79	23.47
Cellulose	3.96	11.1	12	12.7	11.6	11.6	11.8	10.7	11.8	11.5	11.1	13.1
hemic	18.44	11.3	11.33	8.5	10.64	10.57	10.6	10.78	10.78	11	10.97	11.07
NFE	71.19	71.2	70.8	71.4	66.9	66.9	66.4	70.3	68.8	66.5	66.5	67
NFC	48.94	40.1	38.4	39.9	35.1	35.5	34.8	40.6	38.7	37	36.3	36.2

DPC ,date press cake – MI, Moisture – DM , Dry matter – OM , Organic matter – EE ,Ether extract – CP, Crude protein – CF, Crude fiber – NDF ,Neutral detergent fiber – ADF ,Acid detergent fiber – ADL ,Acid detergent lignin – NFE ,Nitrogen free extract¬ – NFC ,Non-fibrous carbohydrate

Volatile fatty acids are the ultimate product of microbial fermentation in the rumen and they are the main source of metabolizable energy for ruminants **(Van Soest, 1982)**. Although, the data of **Table (2)** showed no significant differences in total VAF concentrate among the different incubated samples after 24 h, it could be notice that DPC was higher total VFA's; concentrate compared to yellow corn by about 18.64%. This may be due to the higher NFC as well as the lower CF recorded for corn compared to DPC. Also, it is interest to note that supplementing DPC with urea only led to decrease total VFA's compared to DPC untreated and un supplemented by about 26.21%.

It is agreed that ammonia plays a central role in the rumen nitrogen metabolism; it gives an indication of protein degradability. Ammonia concentration was increased significantly with the treatments that have urea and this is logical because the urea is highly degradable and led to fast replace of ammonia in the rumen liquor **(Chalupa, 1968)**.

Concerning ammonia concentration the ensiled DPC with ZAD2 and urea and the supplemented DPC with ZAD2 and urea and DPC supplemented with urea recorded significant (P=0.049) increase in ammonia concentration compared to the control DPC (without any treatment), this may be due to effect of urea addition. On the other head, all the other experimental treatment recorded slightly higher ammonia concentration compared to DPC. These results may be due to the fact that ZAD complex contains fibrolytic enzyme and thus provides the activity of microflora, which works to break the urea (**Togtokhbayar et al 2015)**.

Results of pH value in the DPC, ZAD1 and ZAD2 without ensiling were lower ($P < 0.05$) than other treatments. Also, it was observed that the pH value was highest ($P>0.05$) with the ensiling treatments. The pH value was increased with the ensiling groups because the ensiling provides the activity of micro flora **(Beauchemin and Yang, 2005)**.

It is interest to note that all values were out of the normal range, which were very low and ranged from 4.69 to 4.90. This may be due to the incubated samples contained high level of easy fermented carbohydrate NFE or NFC as well as low level of CP **Table (1),** consequently increase total VFA's formation and led to decrease pH values.

Table 2. Effect of ensiling and/or exogenous fibrolytic enzyme supplementation of date press cake on Rumen basic parameters.

Items		PH	NH3	TVFA's
Corn		4.69^{e}	6.63^{abc}	5.37
DPC		4.88^{ab}	4.34^{e}	6.6
Ensiled DPC with	ZAD1	4.78^{bcd}	5.93^{abc}	6.67
	ZAD2	4.81^{bcd}	6.02^{abc}	6.77
	ZAD1 + urea	4.92^{a}	6.89^{abc}	7.1
	ZAD2 + urea	4.90^{a}	7.53^{ab}	6.17
	Urea	4.88^{ab}	5.96^{abc}	6.27
Supplemented DPC with	ZAD1	4.71^{e}	4.66^{bc}	6.17
	ZAD2	4.72d^{e}	5.83^{abc}	7.1
	ZAD1 + urea	4.85^{abc}	6.69^{abc}	6.2
	ZAD2 + urea	4.87^{ab}	7.74^{a}	7.27
		4.87^{ab}	7.29^{ab}	4.87
SE		0.02	*0.56*	*0.8*
P.Value		0.0001	0.0049	0.6544

DPC, Date press cake–SE, Standard error of mean–TGP, Total gas production – NH_3, Ammonia mmol/l – TVFA's, Total volatile fatty acids.

Rumen degradability

There were no significant differences in the values of DMD between the different treatments but the highest values (P>0.05) were recorded for the treatments supplemented with ZAD2 with or without ensiling and DPC supplemented with ZAD1.

Ensiling DPC with exogenous enzyme and with or without urea or supplementation with the same treatments led to slightly improve in OM degradability except the DPC supplemented with ZAD1and ZAD2 which slightly decreased OM degradability compared to untreated DPC **Table (3),** more over the OM degradability for corn sample was higher than all of the other treatments.

Also, NDF and ADF degradability for corn sample were significantly higher than the other experimental treatments. However, they had no significant different among the other treatments **Table (3).**

These results may be due to the profile of the soluble carbohydrates in the DPC that work to increase the micro flora activity **(Hoover and Stokes, 1991)**. In the case of NDFD and ADFD have achieved the highest values with the corn grains because the ratio of total fiber in the corn grains very few compared to DPC, which gives the opportunity for micro flora to analyze this fiber better. It is also noted that the low fiber ratio in corn grains was the indirect cause of increasing the OMD compared to other treatments.

Table 3. Effect of ensiling and/or exogenous fibrolytic enzyme supplementation of date press cake on rumen degradability.

Items		DMD	OMD	NDFD	ADFD
Corn		44.67	57.05^{a}	62.49^{a}	65.85^{a}
DPC		55.53	49.09^{bcd}	33.30^{b}	37.47^{b}
Ensiled DPC with	ZAD1	52.99	50.36^{bc}	33.77^{b}	33.40^{b}
	ZAD2	58.22	50.37^{bc}	32.15^{b}	38.50^{b}
	ZAD1 + urea	57.48	53.18^{b}	33.17^{b}	33.80^{b}
	ZAD2 + urea	57.63	52.63^{b}	32.98^{b}	35.33^{b}
	urea	56.82	50.80^{bc}	33.15^{b}	37.23^{b}
Supplemented DPC with	ZAD1	58.5	45.81^{d}	33.91^{b}	36.20^{b}
	ZAD2	57.97	48.17^{cd}	31.70^{b}	40.00^{b}
	ZAD1 + urea	51.95	57.02^{a}	28.41^{b}	36.90^{b}
	ZAD2 + urea	55.42	52.49^{b}	31.60^{b}	36.90^{b}
	urea	55.43	49.97^{bc}	33.35^{b}	36.03^{b}
SE		3.1	4.54	2.98	2.3
P.Value		0.165	0.0497	0.0001	0.0001

DPC, Date press cake –SE, Standard error of mean – DMD ,Dry Matter digestibility – NDFD ,Neutral detergent fiber digestibility – ADFD ,Acid detergent fiber digestibility– OMD ,Organic Matter Digestibility.

Rumen gas production

Gas production is a good indicator of microbial ferment ability, digestibility and rumen protein pro-

duction (**Salem et al 2014**). The data of **Table (4)** showed that total gas production per g DM, dMD, NDF and ADF were significantly higher than these values of DPC without any treatment. Ensiling DPC or supplementation with or without exogenous enzyme and urea cause great improvement in gas production per g DM, which significant improvement in GP/DM for the treated DPC compared to DPC without treatment (control) except for DPC ensiled or supplemented with ZAD1 and that supplemented with urea similar trends were observed for GPNDF, ADF and OM.

The level of total gas production in in vitro fermentation depends on the composition of nutrient content such as (plant cell walls, starch, carbohydrates, protein), presence of inhibitor for gas production (poly ethylene glycol, condensed tannins), the quality of diet provided to ruminant and the fermentation activity of micro flora in the rumen fluid (**Kara, 2015a) and (Kara et al 2015b**). It has been shown that exogenous fibrolytic enzymes could potentially improve fiber degradation through a hydrolytic action prior to feeding or in vitro incubation **(Giraldo et al 2004) and (Elghandour et al 2013**). So the insignificant improvement in the gas values with ZAD compared to the DPC was due to the presence of enzymes. The result of the GPOM gave another boost to explain the possibility of using DPC alone or with some enzymes without the ensiling process as an alternative to corn grains in ruminants feed.

Table 4. Effect of ensiling and/or exogenous fibrolytic enzyme supplementation of date press cake on gas production.

items		GPDM	GPdMD	GPOM	GPNDF	GPNDF	GPADF	GPADF
Corn		126.13^{a}	319.46^{a}	112.74^{abc}	433.50^{a}	741.50^{ab}	1534.16^{a}	764.60^{ab}
DPC		104.97^{bcd}	189.03^{b}	104.93^{abc}	214.42^{cd}	651.04^{b}	280.37^{bc}	748.50^{ab}
Ensiled DPC with	ZAD1	103.92^{cd}	196.39^{ab}	104.23^{bc}	199.06^{d}	590.84^{b}	255.90^{c}	767.06^{ab}
	ZAD2	114.12^{abcd}	196.36^{ab}	114.81^{abc}	226.81^{bcd}	706.49^{ab}	274.10^{bc}	712.05^{b}
	ZAD1 + urea	121.30^{ab}	211.10^{ab}	121.75^{a}	235.56^{bc}	711.37^{ab}	298.82^{bc}	885.65^{ab}
	ZAD2 + urea	119.96^{abc}	208.12^{ab}	120.31^{ab}	235.51^{bc}	714.65^{ab}	299.01^{bc}	848.14^{ab}
	urea	112.20^{abcd}	197.49^{ab}	111.68^{abc}	222.90^{bcd}	674.76^{ab}	284.74^{bc}	768.06^{ab}
Supplemented DPC with	ZAD1	99.75^{d}	170.42^{b}	100.76^{c}	211.00^{cd}	621.55^{b}	274.42^{bc}	756.51^{ab}
	ZAD2	106.13^{bcd}	183.20^{b}	106.87^{abc}	222.76^{bcd}	707.69^{ab}	289.21^{bc}	724.50^{ab}
	ZAD1 + urea	120.65^{abc}	232.58^{ab}	121.42^{a}	251.18^{b}	885.19ab	327.57^{b}	891.75a
	ZAD2 + urea	114.43^{abcd}	207.02^{ab}	115.29^{abc}	238.33^{bc}	756.90^{ab}	310.53^{bc}	842.51^{ab}
	urea	106.67^{bcd}	192.76^{ab}	107.23^{abc}	217.19^{bcd}	653.14^{b}	282.32^{bc}	786.37^{ab}
SE		*3.35*	*25.54*	*3.35*	*7.01*	*43.05*	*11.07*	*33.87*
P. value		0.0001	0.0483	0.001	0.0001	0.0114	0.0001	0.0092

DPC ,Date press cake – SE ,Standard error of mean – GPDM ,Gas Production in Dry Matter – GPdMD ,Gas Production in Dry Matter Digestibility – GPOM ,Gas Production in Organic Matter – GPNDF ,Gas Production in Acid detergent fiber – GPNDFD ,Gas Production in Neutral detergent fiber digestibility – GPADF ,Gas Production in Acid detergent fiber – GPADFD ,Gas Production in Acid detergent lignin digestibility.

Efficiency of rumen microbial activity

The data of **Table (5)** showed that metabolizable energy (ME) and short chain fatty acids (SCHFA) were increased ($p<0.05$) with corn sample more than DPC treatment, while microbial biomass production (MP) and efficiency of microbial biomass production (EMP) were increased ($p<0.05$) with DPC treatment compared to corn treatment **Table (6).** On the other hand, ME and SCHFA values were not significantly different between corn treatment and DPC supplemented with ZAD1+U, ZAD2+U with or without ensiling and ZAD2 without ensiling. The significant increase in both MP and EMP with DPC were a logical consequence of increasing TVFA, DMD and GP with the same treatment.

These results were consistent with a previous study of **(Zadeh et al 2015)** where they found that increase synthesis of microbial protein (MP) in rumen when the animal feed with different levels of discarded dates.

Table 5. Effect of ensiling and/or exogenous fibrolytic enzyme supplementation of date press cake on estimating ruminal microbial efficiencies.

items		ME (mJ/kg DM)	MCP (mg/g DM)	EMP	SCHFA (mmol/200 mg DM)
Corn		4.04^{a}	93.28^{c}	0.49^{d}	0.56^{a}
DPC		3.18^{bc}	128.74^{ab}	0.58^{ab}	0.46^{bcd}
Ensiled DPC with	ZAD1	2.98^{c}	118.91^{abc}	0.57^{abc}	0.46^{cd}
	ZAD2	3.02^{c}	130.57^{a}	0.57^{abc}	0.50^{abcd}
	ZAD1+ urea	3.67^{abc}	120.99^{abc}	0.54^{bcd}	0.54^{ad}
	ZAD2+ urea	3.62^{abc}	123.26^{ab}	0.54^{bcd}	0.53^{abc}
	urea	3.79^{abc}	125.99^{ab}	0.57^{abc}	0.49^{abcd}
Supplemented DPC with	ZAD1	3.07^{c}	146.64^{a}	0.62^{a}	0.44^{d}
	ZAD2	3.44^{abc}	138.07^{a}	0.61^{ab}	0.47^{bcd}
	ZAD1+ urea	3.95^{ab}	101.07^{bc}	0.49^{cd}	0.53^{abc}
	ZAD2+ urea	3.82^{abc}	119.86^{abc}	0.54^{bcd}	0.50^{abcd}
	urea	3.71^{abc}	125.81^{ab}	0.58^{ab}	0.47^{bcd}
SE		*0.17*	*5.44*	*0.02*	*0.01*
P.Value		0.0004	0.0001	<.0001	<.0001

DPC, Date press cake – SE, Standard error of mean – ME, Metabolizable Energy – MP, Metabolizable Protein – EMP, Efficiency of Microbial Biomass Production – SCHFA, Short Chain Fatty Acids.

CONCLUSION

The current *in vitro* study indicated that using of DPC, ZAD1 or ZAD2 were analogous to the results of corn grains. Moreover, the existence or absence of the ensiling process did not have a clear effect on rumen activity. However, further work is recommended on the use of DPC in *in vivo* studies.

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تأثير عملية الكمر على إستخدام المنتج الثانوى لصناعة دبس التمر المعامل بالانزيمات على نشاط الكرش معمليا

[32]

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الموجـــــز

تم إجراء هذه الدراسة لتقييم تأثير مخلف صناعة دبس التمر المعامل بالإنزيمات قبل وبعد عملية الكمر (السيلجة) على نشاط الكرش فى تجربة معملية . وكان الغرض الاساسى من التجربة هو تحسين القيمة الغذائية لمخلف صناعة دبس التمر عن طريق إستخدام نوعين من الانزيمات (zad1,zad2) واليوريا والخلط بين الانزيمات واليوريا معا بنسب مختلفة وأيضا إجراء عملية الكمر. وتم تقسيم التجربة الى إثنتا عشرة مجموعة هى كالتالى: مجموعة الذرة فقط، مجموعة مخلف دبس التمر فقط (بدون معاملة أو إضافة)، وعشرةٍ مجاميع عبارة عن مخلف صناعة دبس التمر مضافا اليه (zad1، zad2، zad1+ يوريا، zad2+يوريا، يوريا) خمسة منهم تم كمرهم والعينات المتبقية بدون كمر. وتم إستخدام ثلاثة مكررات من كل مجموعة وإستمرت عملية الكمر لمدة 45 يوم . وكانت نسبة إضافة الانزيمات 2مل/ 1 كجم مادة جافة من المخلف ونسبة إضافة اليوريا كانت 1.5%/ 1كجم مادة جافة. ومن أهم النتائج المتحصل عليها:– لم تتأثر نسبة الاحماض الدهنية الطيارة الكلية بأى من المعاملات وبعضها، ولكن حدثت زيادة معنويه فى تركيز الامونيا مع مجموعة (zad2+ يوريا) ومجموعة اليوريا فقط عن مجموعة المخلف فقط ، كما زادت قيمة الاس الهيدروجينى مع المعاملات المكمورة زيادة غير معنوية، ولوحظ ايضا عدم وجود أى فرق معنوى فى قيمة كل من المادة الجافة المهضومة والمادة العضوية المهضومة بين المعاملات وبعضها ولكن زادت قيمة كل من NDF المهضوم وِADF المهضوم معنويا مع مجموعة الذرة فقط. أيضا لم يتأثر إنتاج الغازات فى الكرش بين مجموعة الذرة ومجموعة المخلف. حققت قيمة الطاقة الممثلة والبرو تين الميكروبى المنتج زيادة معنوية مع مجموعة المخلف مقارنة بمجموعة الذره ومن ذلك يتضح أن عملية الكمر لم تحدث أى تأثير واضح على المخلف المعامل لتحسين تخمرات الكرش.

الكلمـات الدالـه: مخلف تصنيع دبس التمر، تخمرات الكرش معمليا، انتاج الغازات بالكرش

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