Indian Journal of Ecology (2021) 48 Special Issue (17): 290-293

Manuscript Number: S-720
NAAS Rating: 5.79

Effect of Rations Containing Various Percentages of Crushed Dates Pits Treated with Urea on in Vitro Digestion

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Abstract: The present study aims at finding out the effect of the use of crushed dates pits at different levels with urea in in vitro digestion processes and the number of microbes of sheep rumen fluid. The rumen fluid was collected from five adult ewes of the Animal Field/ University of Basrah. Fifty ml was collected from each ewe and mixed together. Date pits were added to a concentrate diet by a percent of 0, 15, 30 and 45%. Rumen parameters included pH, volatile fatty acid concentrations, total bacteria count and cellulolytic bacteria count. The second treatment (15% date pits) did not differ significantly from control group in the digestion rate of dry and organic matter, protein, ether extract and nitrogen-free extract, but showed a significant decrease in the rate of fiber digestion and extract of ether. The low levels of digestion of nutrients as a result of the addition of date pits, especially in the treatments added to 30 or 45%. The total number of bacteria was also increased with the increase in the level of date pits in the diet by a significant increase of all the treatments on the control treatment. The fourth group recorded (45% date pits) the highest numbers (11.37×10^8) cfu/ ml. In the same direction, the number of the cellulolytic bacteria increased significantly by adding different levels of the date pits, the third and fourth (30% and 45% date pits) treatments recorded the highest levels. These bacteria (8.68×10^7) and 8.70×10^7 cfu/ ml for both treatments, respectively. Low pH of the control group results from the availability of large quantities of fast-fermented carbohydrates released from feed materials such as barley and wheat bran, while their release rates in the diets containing date pits were very low.

Keywords: In vitro digestion, Date pits, Rumen fluid parameters, Urea

Iraq produces about 432 thousand tons of dates annually and the number of date palm trees about 12396000. Dates pits represent about 25% of the weight of the fruit (Awadalla et al 2002). Date residues and their production are non-traditional feed available (Al-Shanti et al 2013). Dates pits contain relatively high energy compared to coarse feed but have relatively low nitrogen content, so they need nitrogenous additives (Selmi et al 2011). The use of dates pits has a positive effect on the rates of increase of the weight of fattening animals because of the presence of some growth hormones, which helps to increase the growth rates of the animal by increasing the level of amino acids in the blood and accelerate the entry of these acids to different tissues in the body (Al-Sawaf 2011). In addition, the date nuclei increased the total intake of feed (Abd-El-Hay et al 2012). In some studies, the use of date residues was replaced by 50% of the concentrated fattening rations with wet dates and 0.2% urea were provided with green fodder to ad libtium level for Awassi lambs and obtained the best results in growth and fattening. Dates nuclei were also used mainly as feed for cattle, sheep, camel and rabbits (El-Manylawi and El-Banna 2013), poultry (Daneshyar et al 2014) and fish (Gaber et al 2012). There are successful manufacturing systems for the production of many animal feed from dates and date residues (Rahman et al 2007).The present study aims at finding out the effect of the use of crushed dates pits at different levels with urea in in vitro digestion processes and the number of microbes of sheep rumen fluid.

MATERIAL AND METHODS

The rumen fluid (50 Ml) was collected from five adult ewes at University of Basrah, and was mixed. The pH was measured directly and then samples were transfer to the laboratory in a refrigerated by using a case with ice. The rumens liquid was strained through four layers of cheese cloth and take the rumen liquid to conduct various nutritional treatments. A total of four different diets, were evaluated (Table 1). Feed and rations chemical composition is shown in Tables 2 and 3. Total count of bacteria, cellulolytic bacteria and the pH was estimated by pH meter digital 9909 pw Philips. The volatile fatty acids measured by GC Mass (Himadzu – Japan).

RESULTS AND DISCUSSION

The digestion coefficients of dry matter, organic matter, crude protein, ether extract and nitrogen free extract were significantly higher (of both the third and fourth treatments (Table 4). The second treatment did not differ significantly from control group in the digestion rate of dry and organic matter, protein, ether extract and nitrogen-free extract, but

Table 1. Composition of different studied rations (%)

Feed	Percent of feed in treatment			
	First	Second	Third	Fourth
Barley	60	44	29	14
Wheat bran	36	36	36	36
Urea	-	1	1	1
Date pit	-	15	30	45
Vitamins & minerals	3	3	3	3
NaCl	1	1	1	1

Table 2. Chemical composition of different rations (%)

Traits	Feed items			
	Barley	Wheat bran	Urea	Date pits
Dry matter	92.85	90.42	100	92.37
Crude protein	10.72	15.86	288	6.37
Ether extract	1.42	4.05	-	5.96
Crude fiber	6.50	10.63	-	17.41
Free nitrogen extract	70.39	54.89	-	60.46
Organic matter	89.03	85.43	-	90.20
Ash	3.82	4.99	-	2.17

Table 3. Chemical composition of experimental rations based on dry matter

Chemical compositions (%)	Feeds			
	First	Second	Third	Fourth
Dry matter	92.32	88.30	88.22	88.15
Crude protein	12.90	14.27	13.41	12.96
Ether extract	1.13	2.97	3.66	4.34
Fiber	7.50	9.30	10.93	12.57
Free nitrogen extract	66.38	59.70	58.31	56.82
Organic matter	87.91	83.45	74.71	70.42
Ash	4.41	3.80	3.56	3.31
Metabolizable energy (MJ/kg DM)*	9.35	11.73	11.63	11.49

*ME=(0.12xCP) + (0.31xEE) + (0.05xCF) +(0.14xNFE)

showed a significant decrease in the rate of fiber digestion and extract of ether. The low levels of digestion of nutrients as a result of the addition of date pits, especially in the treatments added to 30 or 45%, because of the negative relationship between the chemical composition of dates and fermentation and digestion rates in the rumen, as barley and wheat bran contains 70.39% extract free of nitrogen, while date pits have only 60.46%. The barley and wheat bran contain twice as much protein content as date pits, which increases the microbial protein synthesis to provide both energy and nitrogen. The date pits contain more raw fiber than about 17.41%, three times as much as barley (6.50%) and wheat bran (10.63%). The coefficient of digestion of dry matter, organic and crude protein were significantly influenced by the addition of date pits at 10 and 15% of crashed pits, with no negative effect of 20% The current results are consistent with those of Azzaz et al (2017), where date pits to feed the Rahmani lamb instead of barley by 12.5%.

The pH of the rumen fluid showed a significant increase in the addition of date pits to the diet at different rates (Table 5). All the treatments containing the date pits (15, 30 and 45%) exceeded significantly over the control group, although the value of the pH did not drop to abnormal value. The fourth treatment showed the highest pH of 6.84. The total number of bacteria was also increased with the increase in the level of date pits in the diet by a significant increase in all the treatments than the control. The fourth group recorded the highest numbers (11.37×10^8) cfu/ ml. In the same direction, the number of the cellulolytic bacteria increased significantly by adding different levels of the date pits, the third and fourth treatments recorded the highest levels of 8.68×10^7 and 8.70×10^7 cfu/ ml for both treatments, respectively. Low pH of the control group results from the availability of large quantities of fast-fermented carbohydrates released from feed materials such as barley and wheat bran, while their release rates in the diets containing date pits were very low. These results are in line with what Mahmoud and El-Bana

Table 4. In vitro digestion rate for nutrients of different rations

Traits*	In vitro digestion rate (%) of treatment			
	First	Second	Third	Fourth
DM	67.68 ± 0.74^{a}	$66.68^{ab} \pm 0.52$	$65.08^{b} \pm 0.17$	$62.19^{c} \pm 0.13$
OM	$70.03^{a} \pm 0.24$	$67.48^{b} \pm 0.16$	$66.57^{c} \pm 0.28$	$65.92^{c} \pm 0.43$
CP	$71.20^{a} \pm 0.86$	$70.67^{a} \pm 0.36$	$70.59^{a} \pm 0.48$	$68.11^{b} \pm 0.36$
CF	$55.82^{a} \pm 0.60$	$52.84^{b} \pm 0.64$	$51.01^{bc} \pm 0.75$	$50.64^{c} \pm 0.61$
EE	$75.03^{a} \pm 0.45$	$72.84^{b} \pm 0.68$	$71.04^{bc} \pm 0.53$	$68.69^{c} \pm 0.56$
NFE	$78.64^{a} \pm 0.73$	$77.59^{a} \pm 0.71$	$75.11^{b} \pm 0.86$	$72.91^{c} \pm 0.54$

DM=Dry Matter, OM=Organic Matter, CP=Crude Fiber, EE=Ether Extract, NFE=Nitrogen Free Extract.
Means with different superscripts differ significantly at 5% significant level within each row.

Table 5. pH, total bacteria count and cellulolytic bacteria of different rations

Rations	pH of rumen liquid at		Total bacteria count x10^{8} cfu/ml	Cellulolytic bacteria count x10^{7} cfu/ml
	0 h	3 h after feeding		
First	6.42^{a}±0.10	5.94^{d}±0.08	6.63^{b}±0.23	5.21^{c}±0.36
Second	6.43^{a}±0.10	6.37^{c}±0.03	6.70^{b}±0.38	5.77^{b}±0.29
Third	6.44^{a}±0.11	6.53^{b}±0.05	10.67^{a}±0.48	8.70^{a}±0.31
Fourth	6.43^{a}±0.11	6.84^{a}±0.06	11.37^{a}±0.47	8.68^{a}±0.33

Means with different superscripts differ significantly at 5% significant level within each column

Table 6. Volatile fatty acids (mmol/L) concentration of rumen fluid of different rations

Treatments	Acetic	Propionic	Butyric	Total fatty acids	Acetic: Propionic
First	43.12±3.20	12.15^{a}±1.10	7.11±0.66	63.51±6.71	3.55^{b}±0.29
Second	44.40±4.11	12.01^{a}±1.31	8.52±0.65	65.22±6.62	3.69^{b}±0.32
Third	45.31±3.75	10.64^{b}±0.92	6.45±0.60	63.67±6.51	4.26^{a}±0.34
Fourth	46.22±3.63	10.40^{b}±0.93	7.14±0.61	65.38±6.32	4.44^{a}±0.33

Means with different superscripts differ significantly at 5% significant level within each column

(2013) by feeding barley grains and date pits for camel. The increase in the number of microorganisms and the of cellulolytic bacteria due to the improve of rumen pH and increased fiber ratio in the diets containing dates pits. These results agreed with Azzaz at el (2017), Mahmoud and El-Bana (2013) and Taghineiad - Roudbaneh et al (2015). The results of this study were in consistent with what Rajabi et al (2016) indicated a significant linear increase in the cellulolytic bacteria and protozoa with increased dates level in the diet.

The concentration of acetic acid in rumen fluid was not affected by the use of different percentages of date nuclei (Table 6), while the concentration of propionic acid was decreased) when the date pits were added (30 and 45%) as compared to the control t. Acetic and propionic percent was significantly affected by adding date pits. The concentration of volatile fatty acids was not significantly affected by the different treatments. Kholif et al (2015) observed a decrease in the concentration of total fatty acid in the diets containing the date pits when fed to goats. The increase in starch fermentation resulted in an increase in the concentration of volatile fatty acids especially propionic acid, which negatively affects the activity of protozoa.

CONCLUSION

The prospect of adding crushed dates pits to the diets of ruminants, particularly sheep, up to 30% instead of barley, for availability and low cost, can be investigated, as this has no detrimental impact on rumen parameters.

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Received 12 May, 2021; Accepted 18 September, 2021