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Chemical Composition and Protein Degradability of Watermelon (*Citrullus lanatus*) Seeds Cake grown in Western Sudan

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ABSTRACT

A study was conducted to estimate the chemical composition and crude protein degradability of whole seed, cake and pulp of watermelon seeds were grown in Kordofan state, western Sudan. Samples were collected from Kordofan crops market. Two fistulated steers were fed with green alfalfa during trial period. Approximate analysis was used to determine chemical composition. Whenever protein degradability was determined used in situ polyester bag technique. The individual sample was incubated in rumen for 2, 4, 8, 16, 24, 36 and 48 h. Significant different ($p \leq 0.05$) were observed in dry matter, crude protein, ether extract, crude fibre and ash of whole seed, cake and pulp. This study revealed that watermelon seed cake had lower dry matter degradability than whole seed and pulp, respectively. Whereas, watermelon seed cake was higher ($p \leq 0.05$) in crude protein degradability following the pulp and whole seed in the first trial times but there was linear increase in protein disappearance of pulp with increase in period of incubation in rumen up to 48 h than cake and whole seed.

Key words: Chemical composition, degradability, kordofan, protein, watermelon

INTRODUCTION

Watermelon seeds are one of the common protein supplements like cotton seeds, groundnut seeds, soybean seeds and rape seeds. Watermelon seeds are cultivated in large quantities in western Sudan. They could be used as a non-conventional animal feed because the availability, low cost and non human feed. Watermelon cake is good source of protein for animal and it is comparable to cotton cake, linseeds cake and neem seeds cake (Pal and Mahadevan, 1968).

Protein and energy are considered a basic feed component that belongs to the abnormally high cost of concentrate of ruminant feed, because of the continuous increase in their price. Protein supplement are integral component of animal diets, are needed to increase the total quantity of protein as well as satisfy to essential amino acid requirements (WHO, 2007). There are several methods used to estimate ruminal degradation of CP (Hvelplund and Weisbjerg, 1998). The nylon bag technique is a simple method of obtaining estimates of potential degradability of supplements and feedstuff for ruminants. Where, the rate of disappearance of tested material from the bags is particularly sensitive to the basal diet or the cannulated animal inclusion of values for fractional clearance of undigested food residues from the rumen into calculation of degradability provide estimates of degradability rate of various component of test material which are more closed to the approximate true degradability of the material in rumen (Kempton, 1980). Diets must be

supplemented with forms of rumen, no degraded dietary protein (bypass protein) to increase the efficiency of nutrient utilization and hence production (Kempton *et al.*, 1977). The main objective of this study was to evaluate the nutritive value and the degradability parameters of crude protein in whole, cake and pulp of watermelon seeds.

MATERIALS AND METHODS

Collection of samples: Samples have been collected from Kordofan crops market, where it is the main market of rain fed grown watermelon in western Sudan. The seeds were cleaned and sun dried in shallow trays then stored in polythene bags until being analyzed.

Preparation of samples: Watermelon seeds samples are divided into 4 categories which are whole seed, cake, hull and pulp. The pulp and hull were made from seeds which were outer hull and remove before grinding. But cake was made from seeds which was processed after extracted oil from it. Samples were grounded in small iron rod in a clean local condiment grinder through 1 mm screen and kept for further analysis.

In sacco degradability: The procedure was used to determine the dry matter degradability of feeds that was described by Qrskov *et al.* (1992). Three grams of ground samples were weighed into nylon bags (pore size 5 microns) then each bag was attached to plastic tubes. Bags were incubated in the rumen of fistulated of calf for 2, 4, 8, 16, 24, 36 and 48 h. The bags were immediately withdrawal from rumen at the end of each incubation period then immediately placed in a bucket of cold water to prevent further fermentation and to wash off the feed particles adhering to the outside of the bags, washed by hand under running tap water until the water run clear then dried into constant weight. Replaced each samples was placed in rumen. Residues in bags were over dried at 60°C for overnight. Then taken out, cooled in desiccators and weighed to measure the percentage of dry matter loss. Degradation at zero time was estimated by weighing 3 g of each sample inside the nylon bag washed under running tap water without rumen incubation the dry matter. Therefore, the dry matter loss percentage in this method which is the soluble fraction was determined.

$$p = a + b\left(1 - \exp^{(-ct)}\right)$$

P potential degradability, t incubation time, a axis intercept at zero time percent soluble and completely degradable substrate that is rapidly washed out of bag. b the difference between intercept (a) and the symptomate percentage the insoluble but potentially substrate which is degraded by the micro organisms according to first order kinetics. c rate constant fitted by interactive least squares procedure. Equation provides curve constant that can be used in conjunction with predicated valued after rates for specified diets to estimate the potential degradability (McDonald *et al.*, 1987).

$$\text{Potential degradability} = a + \frac{ab}{c + k}$$

a, b and c are constant. K rumen out flow rate. Then a graph was plotted by observed values of dry matter disappearance percentage against time of incubation in hours to form a curve. A computer program was used to draw the graph which represent the DM degradability.

Statistical analysis: This experimental design used was Completely Randomize Design (CRD) where used LSD test for comparison different between means.

RESULT AND DISCUSSION

Chemical composition: Higher value (p< 0.05) of CP content was observed in pulp; it was 33.20% and agreed with finding by Mustafa *et al.* (1972). CP value of pulp is consistence the result obtained by Al-Khalifa (1996) and higher than finding obtained by Mustafa *et al.* (1972) of hull. Where crude fiber of hull was high amount (p<0.05), it was 73.47 and lowest amount found in pulp is agreed with Al-Khalifa (1996). He is ranged between 2.5-6.14% but in hull is similar to finding by Hayat (1994). Whereas EE content of pulp was highest significant (p<0.05) when compared with other samples, it was 45.38 and lowest value founded by hull is similar to result obtained by Hayat (1994). Ash content of whole watermelon seed in this study is in line with range of 1.85-5.2% (Hayat, 1994; Mustafa *et al.*, 1972). Accordance to below data of chemical composition of watermelon seed were varied with other studies in many areas (Table 1). This variation may be due to many factors concluded in climate, soil, variety, variation in seeds component, cultivation method, harvesting time, irrigation, growing condition and amount rain fall during the growing season. The ash content of pulp had been lowest amount, it was 1.43 closed followed by cake.

Dry matter disappearance: Mean proportion of dry matter disappearance from whole seed, cake and pulp of watermelon seed at different period of incubation in the rumen illustrating graphically in Fig. 1 the dry matter proportion disappearance from whole seed and cake was slightly lower than pulp of watermelon seed. Where in later continues increasing of loss with increasing time of incubation. The values of dry matter loss in this paper is highest than 20.2% for cotton cake on dry

Table 1: Chemical composition of whole seed, cake and pulp of watermelon seeds in dry matter basis

Parameter	CP	CF	EE	Ash	DM
Whole seed (%)	20.873c	38.4b	30.1b	4.23b	96.1c
Cake (%)	25.4b	27.4c	7.84c	2.70c	95.5d
Pulp (%)	33.2a	5.42d	45.4a	1.43d	98.1a
Hull (%)	8.36d	73.5a	3.33d	5.46a	97.4b
S.E. of mean	0.22	0.32	0.68	0.18	0.10

Values in the same column with different superscripts differ significantly (p<0.05), DM: Dry matter, CP: Crude protein, CF: Crude fibre and EE: Ether extract
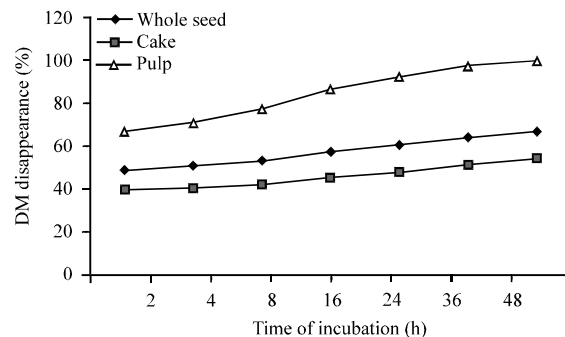

Fig. 1: Disappearance of dry matter in nylon bags in the rumen of cattle given whole seed, cake and pulp of watermelon seed over time
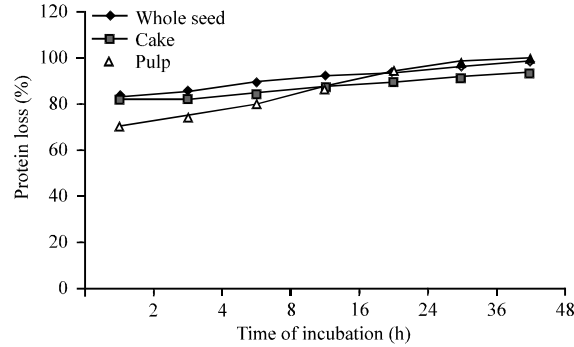
Fig. 2: Disappearance of crude protein in nylon bags in the rumen of cattle given whole seed, cake and pulp of watermelon seed over time

Table 2: Percentage of kinetic degradation of CP of whole seed, cake and pulp of watermelon seed

Parameter	A	B	A+B	C	ED 0.02	ED 0.05	ED 0.08
Whole seed	79.2[ab]	34.6[a]	113	0.10	95.0[a]	90.2[a]	88.1[a]
cake	82.2[a]	17.2[b]	99.4	0.20	91.9[b]	88.1[ab]	86.5[a]
Pulp	68.4[b]	33.1[a]	101	0.06	93.5[ab]	86.7[b]	82.9[b]
S.E. of mean	3.65	10.1	9.30	0.04	0.62	1.61	2.06

Values in the same column with different superscripts differ significantly (p<0.05). A: Water soluble fraction, B: Water insoluble fraction, A+B: Potential degradability and C: Rate of degradation. ED: Effective degradability at three levels of rumen out flow rate

matter basis and too than 19.65 obtained when cotton was incubated in combination with maize (Sibanda *et al.*, 1993).

Crude protein degradability: A Mean proportion of crude protein disappearing from whole seed, cake and pulp of watermelon seed at various periods of incubation (hr) in the rumen are shown graphically in Fig. 2. The proportion of CP disappearing from whole seed and cake are highest than that values from pulp especially in first times (2, 4,8,16, 24, 36 and 48 h). There was linear increase in the period of incubation in rumen to 48 h. than whole seed and cake.

Lowest value of water soluble fraction was observed in pulp and lowest value of degradable fraction showed in cake Table 2. Whereas, cake reached higher degradation rate following whole seed. Water soluble fraction of CP results in this study was higher than that obtained by Tona *et al.* (2003). Who reported that water soluble fraction and degeneration rate of combination cotton seed cake, dried brewers and lablab hay were ranged between 6.49-11.11 and 0.02-0.03, respectively. The degradable fraction values of CP are lower than value of 72.9% and CP potential degradability values are highest than 82.7% for cotton cake and 49.6% for soybean meal finding by Sibanda *et al.* (1993) and Promkot and Wanapat (2004), respectively. The potential degradability in present paper is similar to obtained by Asaad (2006). Who reported the CP potential degradability of sesame cake 100%. Whereas, CP degradation rate is higher than 0.043 and 0.078 for cotton meal and soybean meal, respectively finding by Promkot and Wanapat (2004). The values of CP effective degradability at all levels of rumen out flow rate are higher than that reported by Asaad (2006).

CONCLUSION

The watermelon seed cake is a good source of protein supplement. Whereas, crude protein of watermelon seed cake and pulp were highly degradable. Therefore, I recommended using the chemical or physical treatment to protect WMS cake protein from microbial degradation.

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