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Effect of Feeding Graded Levels of White Rot Fungi Degraded Cassava Peels on Milk Yield and Composition of West African Dwarf Sheep Milk

OCHEPO, G.O
Department of Animal Production, University of Agriculture, Makurdi, Benue State, Nigeria.

Abstract: *Twenty lactating West African Dwarf (WAD) ewes, in a completely randomized experiment comprising four ewes per treatment, were used in a five-treatment feeding trial to study the influence of white rot fungi degraded cassava peels on milk yield and composition. Diet T_1 contained 32 % undegraded cassava peels (UDCP) and served as the control, while diets T_2, T_3, T_4 and T_5 contained 8%, 16%, 24% and 32% degraded cassava peels (with Pleutrus tuber-regium) (BDCP) respectively. Five hundred grammes (500 g) of given experimental diets were fed to each ewe in designated animal groups daily from 8:00 – 12:00 h and thereafter allowed access to paddocks of natural pasture predominantly of Andropogon tectorum. Milk yield was estimated by lamb suckling method once a week for a period of 12 weeks following parturition. On the days of yield determination, lambs were separated from their dams for 4-hours (08:00 – 12:00 h), after which they were weighed to obtain the weight of the lambs before suckling and allowed to suckle the dams for 10 min. The lambs were removed from the dams and weighed again to obtain the weight of the lambs after suckling. The amount of milk produced during the separation period (4 hours) was obtained by subtraction and multiplied by 6 to obtain daily milk production. The result showed that the experimental diets significantly ($P < 0.05$) influenced lactation yield; mean total milk yield was highest (41.83 kg) for ewes fed T_3 (16% BDCP). The nutrient composition of milk from ewes on the five experimental treatments were not significantly ($P > 0.05$) different. However, the Fat content of milk increased and CP decreased with BDCP inclusion in the diets. SNF and TS values were highest for ewes on T_3 (23.446 and 27.193% respectively). It was concluded that the inclusion of BDCP in the treatment diets significantly increased milk yield.*

Keywords: *Biodegraded, cassava peels, milk yield and composition.*

I. Introduction

Cassava peels has become an important by-product in Nigeria and is available from the local processing of cassava root for gari as well as from the newly introduced large scale plants producing gari and starch [13]. Cassava peels have been found as a source of energy in ruminant feeding system, serving either as the main basal diet or as supplement [5]. They are rarely fed fresh because of the high *Cyanogenic glycoside* in the material. However, sun drying, ensiling and fermentation are used to reduce the concentration of glycoside to tolerable levels [2]. Cassava peels has been upgraded through biodegradation by Solid State Fermentation technique using white rot fungi [17]. It has been reported that level of nutrition, mainly referred to as level of energy or of feed intake, is a main positive factor affecting milk yield and composition in diary ruminant. The effects of nutrition on milk composition are less clear because of interactions with the natural evolution of milk composition and through indirect effect on volume (called dilution effect) [7]. It has been observed that milk yield and milk composition are negatively correlated [11]. Due to the respective variability of milk fat and protein content, the possibilities of altering milk composition by feeding are higher for fat than for protein [20]. This study was carried out to determine the effect of feeding biodegraded cassava peels on milk yield and milk composition of West African Dwarf Sheep.

II. Materials and Method

Experimental Site

The experiment was carried out at the Livestock Unit of the Teaching and Research Farm of University of Agriculture, Makurdi. Makurdi is the capital of Benue State and is located on longitude 8^o 37^1 East and latitude 7^o 41^1 North, with annual rainfall ranges from 609.9 mm – 1219.8 mm, temperature ranges from 25.6 ^oC -39.6 ^oC and relative humidity of about 21 % - 85 % [21].

Experimental Animals and their Feeding

Five experimental diets designated T_1, T_2, T_3, T_4 and T_5 were formulated containing 0 %, 8 %, 16 %, 24 % and 32 % biodegraded cassava peels respectively. Twenty lactating West African Dwarf (WAD) sheep aged between 18 and 24 months with weight between 19 and 21 kg from the University of Agriculture, Makurdi

flock were used for the study. The animals were randomly allocated to the five treatments in a completely randomized design (CRD). The animals were tagged for easy identification and separation. Five hundred grammes (500 g) of given experimental diets were offered to designated animals groups daily before they were released to natural pasture. The trial lasted for a period of eighty four (84) days. Fresh water was served *ad libitum.*

Milk yield and Milk Composition

Milk yield was estimated by lamb suckling method once a week for a period of 12 weeks following parturition [9]. Animals were incorporated each week as they lambed. The initial milk yield for each animal was determined at the first week post partum. Thereafter, milk yield was determined every week up till the 12^{th} week of lactation. On the days of yield determination, lambs were separated from their dams for 4-hours (08:00 – 12:00 h), after which they were weighed to obtain the weight of the lambs before suckling and allowed to suckle the dams for 10 min. The lambs were removed from the dams and weighed again to obtain the weight of the lambs after suckling. The amount of milk produced during the separation period (4 hours) was obtained by subtraction and multiplied by 6 to obtain daily 24 hours milk production [6].

Determination of Milk Composition

About 50 to 100 ml of milk samples were obtained and stored in the refrigerator at - 4 ^{o}C for analysis to determine the chemical composition of the milk. All the milk samples collected were analyzed for fat by the Rose-Gottlieb's method [19]. The crude protein content (N x 6.38), lactose, total solids and ash were determined by methods [3]. Solids not-fat (SNF) concentration was derived from total solids and fat concentrations by difference. The energy value (EV) of milk was calculated using the equation developed for sheep [10].

$Y = 1.94 + 0.43x_1$

Where Y is the caloric value of milk in MJ/Kg and X is the percent fat.

Statistical analysis

Data obtained from this study were subjected to two-way Analysis of variance (ANOVA) using the Minitab Statistical Software [15].

III. Results and Discussion

The proximate compositions and fibre fraction of the experimental diets were presented in Table 2. The crude protein (CP) content ranged between 16.38 - 18.88 % and is a reflection of the levels of BDCP in the diets. The levels of CP fed in this experiment are higher than the range of 9 -14 % recommended as minimum requirement for maintenance and production for ruminants [1]. It has been reported that the effects of dietary protein level on milk production of early lactating ewes are mainly attributed to energy saving as a consequence of an increase in body fat mobilization [8] and utilization. The crude fibre content were 13.88, 13.64, 13.39, 13.15 and 12.90 %, the Ash were 13.95, 14.24, 14.53, 14.81 and 15.10 % while dry matter were 95.20, 95.20, 95.30, 95.30 and 95.15 % for T_1, T_2, T_3, T_4 and T_5 respectively. The high DM and CF content of the experimental diets could be due to the fact that it was prepared from dried feed ingredients which are characteristically high in CF and DM [4]. The Ca and P content were above the critical levels (0.3 % Ca; 0.25 % P) and would adequately meet ruminant requirements in warm wet climate [14].

The mean total milk yield and nutrient composition of milk of ewes fed graded levels of BDCP diets were presented in Table 3. The milk yield was 25.73, 41.58, 41.83, 37.37 and 37.34 % for T_1, T_2, T_3, T_4 and T_5, respectively. The inclusion of BDCP in the experimental diets significantly ($P < 0.05$) influenced the total 12 week lactation yield. Mean total milk yield was highest for ewes on T_3 (41.829 kg) fed 16 % BDCP.

The nutrient composition of milk from ewes on the five experimental treatments were not significantly ($P > 0.05$) different. The CP content was 5.90, 4.82, 4.58, 4.89 and 4.93 %, fat content was 2.67, 3.95, 3.75, 3.63 and 3.69 %, lactose was 2.31, 3.00, 3.39, 2.62 and 3.14 %, total solids was 12.69, 13.01, 27.19, 14.76 and 17.86 %, while SNF was 10.02, 9.06, 23.45, 11.12 and 14.47 % for T_1, T_2, T_3, T_4 and T_5, respectively. The Fat content of milk increased and CP decreased with BDCP inclusion in the diets. SNF and TS values were highest for ewes on T_3 (23.446 and 27.19 3 %, respectively). The CP content recorded in this study was similar to value reported by other authors [18] [12]. The energy values (MJ/Kg) were higher, while the Fat content was lower than the values reported by these authors. The lowest CP value observed for ewes on T_3 which recorded the highest milk yield is in agreement with other authors [16] who reported that the concentrations of both fat and protein were found to fall by about 10 g/kg as milk production increased. This observation is also in agreement with the findings of other researchers [11] who reported that milk yield and milk composition are negatively correlated. It has reported that the effect of nutrition on milk composition are less clear because of interactions with the natural evolution of milk composition and through indirect effects of nutrition on milk volume (called dilution effect) [7]. Furthermore, these authors [7] observed that in the middle and at the end of lactation, changes in

nutrition mainly affect the persistency and / or the body reserves reconstitution; this is why limited effects are generally observed on milk yield or composition.

IV. Conclusion

The results suggest that inclusion of BDCP in the treatment diets significantly increased milk yield. Additional nutrient obtained from the degraded cassava peels may have been responsible for the increases observed in fat, total solids, lactose and energy value of milk of ewes fed BDCP. Cassava peels is cheap, available and it's biodegradation on farm can easily be carried out. It could be recommended that livestock farmers use BDCP to feed their lactating animals to improve milk production.

Table 1: Percentage Composition of Experimental Diets

Ingredients	Level of inclusion (%)				
	T_1	T_2	T_3	T_4	T_5
Cassava peels	32	24	16	8	0
BDCP*	0	8	16	24	32
Soybean	10	10	10	10	10
Dried Brewer's grain	40	40	40	40	40
Palm kernel cake	12	12	12	12	12
Bone ash	4	4	4	4	4
Salt	2	2	2	2	2
Total	100	100	100	100	100

BDCP- Bio-degraded cassava peels

Table 2: Proximate Composition and Fibre Fraction of Experimental Diets(%) (DM)

	T_1	**T_2**	**T_3**	**T_4**	**T_5**	**SEM**
CP	16.38	17.56	17.89	18.22	18.88	0.018
CF	13.88	13.64	13.39	13.15	12.90	0.015
EE	4.23	4.21	4.19	4.18	4.16	0.001
Ash	13.95	14.24	14.53	14.81	15.10	0.010
NFE	51.56	50.35	50.00	49.64	48.96	0.146
NDF	50.57	50.30	50.02	49.75	49.47	0.011
ADF	26.30	26.40	26.49	26.59	26.69	0.022
ADL	11.4	11.32	11.24	11.17	11.09	0.010
Hemicellulose	24.27	23.90	23.53	23.16	22.78	0.012
Cellulose	14.90	15.08	15.25	15.43	15.60	0.013
Ca	1.78	1.79	1.80	1.81	1.82	0.006
P	0.42	0.42	0.41	0.41	0.41	0.001
DM	95.20	95.20	95.30	95.30	95.15	0.015
GE MJ/kg	1.721	1.721	1.717	1.713	1.711	

T_1= Diet containing 32 % UDCP, T_2= Diet containing 8 % BDCP, T_3= Diet containing 16 % BDCP, T_4= Diet containing 24 % BDCP, T_5= Diet containing 32 % BDCP
SEM = Standard error of mean NDF =Neutral Detergent Fibre
ADF =Acid Detergent Fibre ADL =Acid Detergent Lignin
UDCP = Udegraded cassava peels BDCP= Bio-degraded cassava peel

Table 3: Mean Total Yield (Kg) and Proximate Composition (%) of Milk of Ewes Fed Graded Levels of Biodegraded Cassava Peels (BDCP)

	T_1	**T_2**	**T_3**	**T_4**	**T_5**	**SEM**
Milk yield	25.73^b	41.58^a	41.83^a	37.37^a	37.34^a	2.858
P^H	6.52	6.42	6.56	6.66	6.57	0.052
CP	5.90	4.82	4.58	4.89	4.93	0.375
Fat	2.67	3.95	3.75	3.63	3.39	0.542
TS	12.69	13.01	27.19	14.76	17.86	3.889
SNF	10.02	9.06	23.45	11.12	14.47	3.804
Lactose	2.31	3.00	3.39	2.62	3.14	0.210
Ca	0.25	0.31	0.30	0.27	0.26	0.028
P	0.04	0.03	0.16	0.16	0.28	0.068
EV (MJ/kg)	3.09	3.64	3.55	3.50	3.40	

[ab] Means on same row with different superscripts differ significantly ($P<0.05$)
SEM = Standard error of mean
UDCP = Undegraded cassava Peel
BDCP = Biodegraded Cassava Peel *(Pleurotus tuber-regium)*
TS = Total solid, SNF= Solid Not Fat, EV= Energy value of milk

T_1= Diet containing 32 % UDCP, T_2= Diet containing 8 % BDCP, T_3= Diet containing 16 % BDCP, T_4= Diet containing 24 % BDCP, T_5= Diet containing 32 % BDCP

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