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Correlation Between Milk Composition and Kids Growth of West African Dwarf (WAD) Goat Fed Forage Based Diet in Southwest Nigeria

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Abstract: The study was conducted on the effects of five different forages: *Albizia odoratissima*, *Gliricidia sepium, Leuceana leucocephalla, Spondias mombin, Ficus thonningii* and *Panicum maximum* as control on milk composition, stages of lactation and growth rate of west African dwarf (WAD) goat kids. Twenty one WAD does with their kids were randomly allotted to treatments in a complete randomized design. The test materials had crude protein content (CP) between 14- 24%. Supplemented feed was provided at 2% body weight. The influence of diet on milk composition was significant ($p<0.05$) with a CP content ranging from 3.10 to 3.92%, milk fat 3.5 to 4.2%, solid-not-fat 11.7 to 13.30% and total ash (0.76-0.96%). The group of animals treated with GL + C showed the highest CP value of milk. Also, the contents of milk protein (3.00 to 3.80%), fat (3.47 to 3.88%) solid not fat (11.31 to13.24%), lactose (4.20 to 4.53%), total ash (0.64 to 0.91%) and total solid (14.83 to 17.12%) varied significantly ($p<0.05$) among the different stages of lactation. In contrast, the pH of milk (6.75 to 6.99) did not vary among the treatments. The weight of kids at twelve weeks of age was found to be significantly ($p<0.005$) different which ranged between 3.73 and 5.47kg. The kids under *Panicum maximum* were dying because their mothers were seriously emaciating and the milk yield could not sustain the kids. It is therefore suggested that browse plants or concentrate supplementation should be encouraged for low quality pasture like guinea grass.

Key words: Browse Plants · *Panicum maximum* · Milk Letdown · Weaning Weight

INTRODUCTION

Livestock production in the tropics is influenced by the availability of feed resource during a particular season of the year [1]. Multipurpose trees and shrubs (MPTS) are considered as feed resources that contribute cheaply to the nutrition of ruminants in the tropics all year round. Their immense contribution is mostly felt during the lean period of the year where most available grasses are lignified [2].

Milk contains food constituents such as lactose (milk carbohydrates), proteins, fats, minerals and vitamins but protein is the single most economically important milk component. Factors affecting milk protein include the energy and crude protein of the feed besides the breed, age and management of animal [3]. as it is well known that milk yield increases with the elevation of dietary energy intake [4] Also, it has been found] that protein content of milk increased when dietary protein of cows of similar age, stage of lactation and milk production potential increased from 11 to 16 % [5]. Others could not trace any changes in milk protein when 13 and 23 % crude protein dietary levels were fed to lactating animals[6]. Meanwhile, Sutton, Oldham and Hart [7] reported an increase in milk protein (0.4 % units) in dairy cows when the forage/ concentrate ratio decreased from 4/6 to 1/9. Also, the importance of the protein: energy ratio was confirmed by MacLeod *et al*. [8] who found that dairy cows receiving a mixed feed supply with forage: concentrate ratio of 35:65 had higher (4-5 %) milk protein content than the other groups (80:20, 65:35 and 50:50). It is concluded that dietary characteristics influence milk yield and milk composition of dairy goats as well as body weight gain [10,11].

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Recently in Nigeria, there are no much extensive studies carried out on the effect of forage diets on milk composition of WAD goats. Therefore, the objective of this study was to determine the effect of forages based diets on milk composition and body weight gain of West African dwarf kids.

MATERIALS AND METHODS

Forages Used Are: *Leucaena leucocephala* (L), *Gliricidia sepium* (Gl), *Albizia odoratissima* (A), *Ficus thonningii* (F), *Spondias mombin* (S) and *Panicum maximum* (Gr). These forages are supplemented with concentrate (C) fed at 2 % body weight. The study was conducted at Animal Genetic Resources Unit of National Centre for Genetic Resources and Biotechnology (NACGRAB) Moor Plantation, Ibadan. Forages were harvested fresh and fed the following day to animal ad- libitum.

Animals and Management: Twenty one, 15-20 kg WAD does were individually penned with wood shaving as their beddings. The quantity of feed offered and the orts were measured to determine feed intake. Feeds were offered twice daily. Concentrate was served in the morning and forages in the afternoon with free access to fresh water ad libitum. Weight of kids and does were taken weekly. Kids were allowed to run with their does throughout the experiment period.

Chemical Composition of the Feed Samples: Each fresh sample consists of leaves and small part of stems were oven-dried to constant weight at 105°C for 2 days to determine dry matter (DM) and later ground to pass through 1mm sieve for later use. Crude protein (CP), ether extract (EE), crude fibre (CF), ash content of the fodders were determined as outlined [12]. Neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were analyzed [13]. Milk samples were collected once a week over 12 weeks of lactating period, bulked together in plastic sample bottles mixed and stored in deep freezer at -5°C till required for analysis and analyzed for crude protein, lactose, fat, total solid, solid-not-fat, total ash and milk pH according to AOAC [12].

Experimental Design and Statistical Analysis: All data were subjected to statistical analysis using ANOVA procedure of [14] in a complete randomized design model. Significant means were compared by Duncan option of SAS [14].

RESULTS AND DISCUSSION

The chemical composition of the browse species is presented in Table 1. Dry matter (DM) of the feed resources varied from 22% in Ficus to 35% in Leucaena. The ash content was lowest (5%) in Albizia while in Ficus spp was the highest (12 %). Ether extract (EE) which signifies fat content of the diet was also lowest in Panicun (3%) but highest in Leucaena and *Gliricidia spp* (12 %). The crude protein (CP) contents of the browse species ranged from 7 % in Panicum to 24 % in *Leucaena* spp. Variations were also observed in fiber fractions of the fodders. Neutral detergent fibre (NDF) varied from 45 % in Luecaena to 73 % in Panicum. Acid detergent fibre ranged between 32 % in Leucaena and 48 % in Ficus. Again, Acid detergent lignin (ADL) contents were ranged from 6 % to 12 % in Ficus. The DM and ash content obtained were similar to those reported of earlier work [15]. The level of CP of the browse spp agreed with the reports of Omokanye *et al.* [16]. However, CP content of the browse spp are within the range required for optimum performance of WAD goats expect for *Panicum maximum* which fell below the minimum requirement for ruminants (7%) [17]. The fibre contents of the plant species were consistent with the report of previous studies [18]. Although, Meissner *et al.* [19] reported that browse spp with NDF above 55-60 % will reduce the intake of such fodder by ruminants, that contradict our findings. It then showed that many other factors could be responsible for the consumption of fodders by ruminants.

The gross milk composition of West African dwarf does' milk as reflected by crude protein (% CP), total ash (%), total solid (% TS), solid-not-fat (% SNF), lactose (%) is presented in Table 2. The effect of diets on milk composition was significant ($P < 0.05$). Milk protein and fat ranged from 3.10 to 3.92 and 3.51 to 4.16 respectively. Lactose and total ash composition varied from 4.28 to 4.59 and 0.73 to 0.97. Meanwhile, the values were in variance with the result of previous studies [20, 21]. Figure 1 reflected the birth weight and litter size of kids. It was revealed that there are significant differences ($P < 0.05$) in the birth weight and litter size of kids. The average birth weight of animals fed with Leucaena was the highest (1.57 kg) while animals fed with grass only recorded the lowest (1.17 kg). Good nutrition is known to favour a high ovulation rate which in effect establishes whether there will be multiple births or not [22]. Presented in Figure 2 is the pH values of milk of WAD does which did not show any significantly different. The result agreed with the report of Alfa-laval [23].

Table 1: Chemical composition of the forages (%)

Parameters	Leucaena leucocephala	Gliricidia sepium	Albizia odoratissima	Spondias monbim	Ficus thoningii	Panicum maximum
DM	32	25	41	32	22	34
CP	24	20	16	16	14	7
Ash	9	8	5	7	12	11
EE	12	12	9	11	10	3
NDF	45	49	60	55	64	73
ADF	32	34	33	40	48	37
ADL	6	7	9	8	12	9

Table 2: Milk composition (%) of WAD does milk fed different forages

Diet	Protein (Nx6.38)	Milk fat	Solid not-fat	Lactose	Total ash	Total solid
Gl+C	3.92a	3.56c	12.39b	4.59a	0.77b	16.03b
A+C	3.82a	3.51c	12.19b	4.56ab	0.73b	15.71b
L+C	3.72a	3.84b	13.30a	4.54ab	0.97a	17.14a
F+C	3.38b	3.53c	11.73b	4.32ab	0.76b	15.26b
S+C	3.19b	4.16a	11.85b	4.39ab	0.79b	16.01b
Gr+C	3.10b	3.63c	11.78b	4.28b	0.79b	15.41b
SEM	0.07	0.04	0.15	0.05	0.02	0.16

abc = means on the same row with the same letter are not significantly (P>0.05) different

Table 3: Milk composition as affected by duration

Month	Protein	Milk fat	Solid not-fat	Lactose	Total ash	Total solid
1	3.80a	3.88a	13.24a	4.40a	0.91a	17.12a
2	3.43b	3.76a	12.32b	4.53b	0.82b	16.09b
3	3.17c	3.60b	11.71cb	4.42cb	0.73c	15.31c
4	3.00c	3.47c	11.31c	4.20c	0.64d	14.83c
SEM	0.07	0.04	0.15	0.05	0.02	0.16

abc = means on the same row with the same letter are not significantly (P>0.05) different

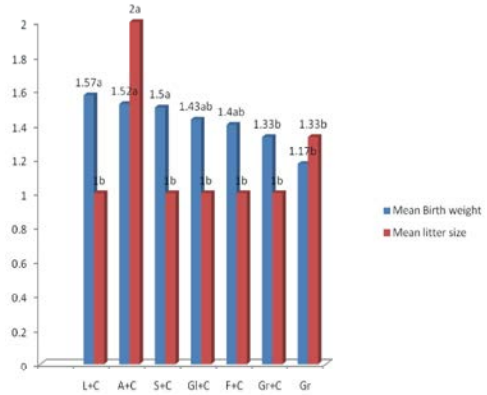

Fig. 1: Average Number of kids per treatment and weight

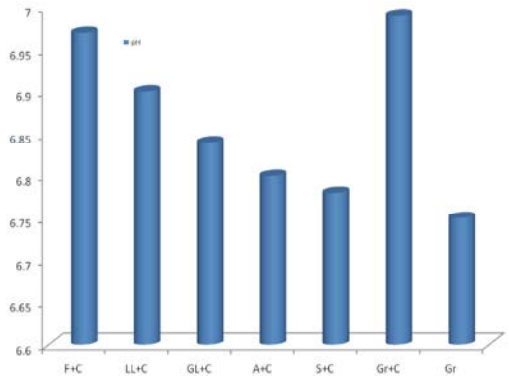

Fig. 2: pH value of milk of does fed different forages

Table 3 presents the mean milk composition of WAD does fed different forages with advancing lactation. Milk components decreased with advancing lactation except lactose that shoot up in the second month but drooped gradually till the end of lactation period. The decreased level of milk protein with the increased lactation level was in agreement with earlier reports [20, 21, 24].

Likewise the weaning weight of the kids ranged from 3.73 to 5.47kg (Figure 3). The mean live weight gain of kids increased with the level of crude protein content of the forage fed to the does. Min [9] observed that the value of a feed for animal production depends on its quality and level of voluntary feed intake in small ruminants. This could be due to the higher milk production and composition of does with increasing protein in diets.

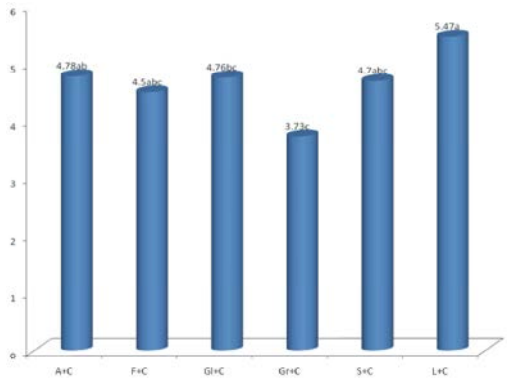

Fig. 3: Weaning weight (kg) of kids under different forages

Growth of kids was found to be dependent on quantity of milk [25]. Low level of nutrition was reported to reduce milk yield and composition which may have deleterious effect on the rate of weight gain of kids [26, 27]. The weaning weight of kids under Albizia treatment was lower than that of kids under Leucaena. This is because kids reared as single grow faster and heavier at weaning than the kids reared as multiple. This observation was consistent to the report of Madibela *et al.* and Ola and Egbunike [27, 28].

CONCLUSION

It is therefore concluded that high quality forages can improve production and that browse plants or concentrate supplementation should be encouraged for low quality pasture like guinea grass

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