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Grazing behavior and milk yield of Senegalese Sahel goat

M. Cissé[a,*], I. Ly[a], A.J. Nianogo[b], I. Sané[a], J.G. Sawadogo[c], M. N'Diaye[a], C. Awad[a], Y. Fall[a]

[a]*Institut Sénégalais de Recherches Agricoles, LNERV, BP 2057, Dakar, Senegal*
[b]*Institut du Développement Rural, BP 1091, Bobo-Dioulasso, Burkina-Faso, Dakar, Senegal*
[c]*Ecole Inter-Etats des Sciences et Médecine vétérinaires, BP 5077, Dakar, Senegal*

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Abstract

In northern Senegal, 49 Sahel does, 2.7 ± 0.5-year-old were observed over 1 year while foraging in natural pasture. Does were assigned to three treatments 2 weeks after kidding: ad libitum grazing (group 1), grazing plus daily supplementation with 500 g per animal of concentrate, 66% corn flour, 30% groundnut cake, and 4% mineral and vitamin premix (group 2), and grazing plus 300 g per animal of cottonseed (group 3). The grazing behavior of goats was assessed by direct observation and the milk production was recorded weekly by the double weighing method (four times per day). Goats spent about 80% of their time eating, and time spent walking was higher in the dry season than in the rainy season (5–15% versus 0.6–2.6%). Contribution of ligneous species in the diet peaked in July (96.1%) and January (95%), then decreased reaching 5% in September, corresponding to the peak intake of herbaceous species. The goats preferred the *Acacia albida*, *Maytenus senegalensis* and *Piliostigma reticulata* browse species, and the *Ipomea pestigridis*, *Pennisetum pedicellatum* and *Brachiaria lata* herbaceous species. Supplementation did not significantly affect milk yield which peaked at week 3 (1158 ± 425 g per day per animal) for does from group 1, at week 4 (1045 ± 343 g per day per animal) for group 2, and at week 2 *post-partum* (980 ± 232 g per day per animal) for those of group 3. In the first month of lactation, body weight (BW) of twins were 1.6 kg lower than singles ($P < 0.05$). From week 1 to 14 of lactation, does from group 1 lost more BW than those of group 2 (−0.7 kg versus −0.2 kg; $P > 0.05$). Plasma urea level was higher in the early stage of lactation then decreased from week 8 post-kidding. Glycemia peaked at 24–48 h *post-partum*.

Keywords: Goat; Grazing behavior; Milk yield; Body weight; Plasma metabolites

1. Introduction

In the Sahel, livestock raising is one of the best investments despite severe droughts and claims of environmental deterioration (Brehman and de Wit, 1983). Livestock in general, and especially small ruminants play key roles in livelihood security, this being true particularly for transhumant pastoralists and poor farmers in periurban areas. Natural pastures form the main feed source and the productivity of small ruminants is highly dependent upon annual rainfall patterns (Brehman et al., 1979) and seasonal variations in pasture nutritive value. Deficiencies in nitrogen (Guérin et al., 1988) and in mineral content (Cissé et al., 1996a) limit the utilization of grasses by ruminants, leading to reduced productivity. While sheep are raised mainly for meat, goats are raised for milk and meat. There has been limited research on

* Corresponding author. Tel.: +221-832-5601;
fax: +221-832-2118.
E-mail address: maicisse@refer.sn (M. Cissé).

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meat production (Amégée, 1986), but data on the milk potential of the Sahelian doe are limited due to partial milking for human consumption. Certainly, milk production data are useful for selection purpose; furthermore, it is well known that survivability and growth of the young are closely related to the milk output of the mother. The objectives of this study were to assess the feeding behavior of goats on pasture, to investigate the effect of supplementation on their milk production, body weight (BW) and condition, and to establish the relationship between milk yield and growth of the suckling kid.

2. Material and methods

The study was carried out in the "Niayes" region in northern Senegal, with an annual rainfall of 400–600 mm. The site is a research station located in a coastal belt, in the periurban zone of Dakar. The climate is semi-arid with a rainy season from July to September and a dry one from October to June. The annual rainfall (20 years average) is 378.5 mm and varies considerably (34%) among years. The precipitation measured at the experimental site in 1992, the year of the study, was 275 mm for 13 rainy days. Daily temperatures during the cool dry season (November–February) averaged 24.4 °C with minimum values close to 18 °C. During the hot dry season (March–June) the average temperature was 30.5 °C, and maximum values approximated 40 °C. An average value of 29 °C and a maximum of 38 °C were recorded in the rainy season. The "Niayes" is a semi-arid Savanna with a vegetation composed of scattered trees, a moderate cover of shrubs, and a dense cover of annual grasses with a short life-cycle during the dry season.

In the present study, 49 Sahel does, aged 2.5 ± 0.7 years, were allowed to graze on pasture for 9 h per day (from 8:00 to 17:00 h). Does were vaccinated against Pasteurellosis and treated against internal and ectoparasites using Ivermectine (Ivomec-D, Merck Sharp & Dohme B.V., The Netherlands). After 2 months of daily supplementation with 300 g per animal of groundnut cake, estrus was synchronized with a vaginal sponge containing 45 mg of fluorogestone acetate (Chronogest, Intervet, France) for group kidding at the onset of the rainy season. Six bucks were introduced in the herd, on the day the vaginal sponges were withdrawn. During the second half of the dry season (from March to May), goats were offered 250 g per day per animal of groundnut cake. Pregnancy was tested by progesterone analysis in blood sampled at 10 days intervals, 6 weeks after estrus. From June to July, goats received daily 400 g per day per animal of groundnut cake and pregnant does were offered 500 g per day per animal, so as to kid in a good body condition (objective score = 3.5 points). From the third week of July to the beginning of December kidding occurred as follows: 9 in July (with 4 twin births and 2 triplets), 4 in August, 4 in September, 12 in October, 6 in November and 5 in December. After kidding, a 2 weeks preliminary phase was observed during which all animals were subjected to the same management in order to determine initial milk production levels. This was followed by assignment of does at random to one of the following treatments: group 1 ($n = 14$)—ad libitum grazing only; group 2 ($n = 14$): grazing plus supplementation with 500 g per day per animal of a concentrate containing 66% corn flour, 30% groundnut cake, and 4% of a commercial mineral and vitamin premix; this concentrate was formulated to provide 1.12 forage units (FU) (INRA, 1989) and 190 g of digestible crude protein (DCP)/kg dry matter (DM); group 3 ($n = 12$): grazing plus 300 g per day per animal of cottonseed (1.17 FU and 366 DCP/kg DM) started in November. Goats were allowed to suckle their kids continuously, except when milk consumption was measured. Animals in all groups had access to drinking water between 12:00 and 13:00 h during pasture hours, and all the time after grazing. These animals also received their concentrate allowances upon return from the pasture.

Ligneous component of pasture was studied in sample areas randomly chosen along three 10 m × 100 m transects (Pratt and Gwynne, 1977) defined, based on different itineraries taken by goats in the north, south and east of the villages of Wayambane, Noflaye and N'Guendouf, respectively. On each transect, trees and shrubs were counted and their height determined. Grazing behavior was assessed by direct observation twice a month for 1 year. Forage preferences of goats in pasture were determined, bites were counted, and samples of grazed herbage were collected by the hand-plucking method (Guérin et al., 1988). Goat activity in terms of time spent eating, chewing, walking, watering and resting was monitored every 15 min using a stop watch. DM, ash, nitrogen and organic matter contents of forage samples were determined by standard analysis procedures (AOAC, 1984) and mineral contents as in Cissé et al. (1996a). The total milk production was recorded three times a week during the first 14 days *post-partum*, and then once a week. When milk was to be recorded, does and kids were housed in adjoining pens separated by a gate preventing direct contact but allowing audiovisual contact. The amount of milk consumed by kids was estimated by weighing before an after suckling, four times per 24 h, at 8:00 h (SM_1), 13:00 h (SM_2), 18:00 h (SM_3) and 22:00 h (SM_4). Before the first suckling, a small amount was hand-milked (HM_0), with reference to a traditional practice, and the milk remaining in the udder was also hand-milked after each of the daily four sucklings (HM_1, HM_2, HM_3 and HM_4, respectively). The sum from HM_0 to HM_4, and SM_1 to SM_4 represented the total daily milk yield. Kids were separated from their mother in the evening before and between the four periods of the daily milk record. Milk was sampled (100 ml) and preserved by the addition of a 35% solution of formaldehyde (1 ml/100 ml of milk), and at 4 °C for chemical composition analysis (AOAC, 1984). From the day following kidding until week 14 of lactation, goats were weighed (birth weight (BW)) and their body condition was scored (BCS) bimonthly, after observation and palpation of the lumber and sternum area using a six points (0–5) scale (Cissé et al., 1995). The first score was occurred in July (at 16.4 ± 3.1 days before the first kidding). In order to characterize the nutritional status by plasma metabolites determination, blood was collected from each goat at 24–48 h *post-partum* and then every 14 days from the jugular vein into 5 ml heparinized vacutainers. Blood samples were immediately centrifuged at $3000 \times g$ for 20 min, plasma was collected and frozen at −20 °C until metabolites analysis. Plasma glucose and urea were determined according to Cissé et al. (1991) using enzymatic kits (Sera-Pak, Miles Italiana, and UV H.P., Merck-Biotrol, respectively). Plasma triglycerides were measured by a method described by Bucolo and David (1973). All health events that occurred during the study were recorded.

Calculations were made on 34 goats, while the remaining were excluded from the analysis due to health problems: two for rickettsioses, one for mastitis, one for diarrhea, and two deaths due to snake bite. Data on response of milk yield to supplementation was analyzed using a mathematical model that included fixed effect due to treatment (groups 1–3), type of birth (tb) (single versus twins), season (rainy versus dry), concentrate (with or without supplement), regression on the mean value of milk yield measured during the first 14 days of lactation, all two factor interactions and residual error. Data on does from group 3 were compared to those obtained from dry season does of the controls (group 1) and, for that, the season of birth was deleted from the model. The model used for kid data accounted for variation due to concentrate supply, sex, season and tb. Within-group differences in BW and BCS were assessed by a paired *t*-test. Data on BW, BCS and plasma metabolites of supplementation (treatment), season of kidding (sk), tb, and day of sampling (ds) were analyzed using a mathematical model that included fixed effect due to treatment, goat-within-treatment (error 1), season, season × treatment, season × goat-within-treatment (error 2), tb, tb × treatment, tb × goat-within-treatment (error 3), tb × season, tb × season × treatment, tb × season × goat-within-treatment (error 4), dry season (effect 8), dry season × treatment (effect 9), dry season × goat-within-treatment (error 5), dry season × sk (effect 10), dry season × sk × treatment (effect 11), dry season × sk × goat-within-treatment (error 6), dry season × tb (effect 12), dry season × tb × treatment (effect 13), dry season × tb × goat-within-treatment (error 7), dry season × treatment × sk × tb (effect 14), dry season × sk × tb × goat-within-treatment (error 8) (SAS, 1987).

3. Results

The grazing area of goats showed variation in plant cover (mean density of 156 plants/ha including 50% of shrubs with a height below 1.50 m) that was dominated by *Crateva religiosa*, *Maytenus senegalensis*, *Acacia albida* and *Parinari macrophylla* with difference among transects. For instance, *Parinari macrophylla* represented 25% of the ligneous species in the eastern transect, 6% in the northern, and 8% in the southern transect. During the rainy season, goats spent most of their grazing time on a herbaceous land dominated by grasses. Time spent eating was important (Fig. 1), and time spent walking was greater in the

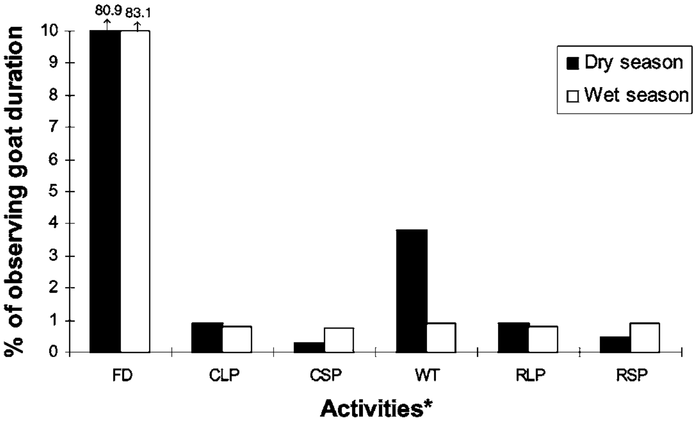

Fig. 1. Pasture behavior of does. Activities—FD: feeding, CLP: chewing in a lying posture, CSP: chewing in a standing posture, WT: watering, RLP: resting in a lying posture, RSP: resting in a standing posture.

dry season than in the rainy season (5–15% versus 0.6–2.6%). It was the same for the day's runs (4.5–6.5 km versus 2–3 km). In August and September, goats started grazing much earlier than usual (about 10:00 h), after disappearance of leaf moisture. Diet composition varied between seasons with the contribution of ligneous species increasing after the rainy season. From 16% in October, it peaked in January (95%) and in July (96.1%) then decreased, reaching 5% in September, corresponding to the peak of herbaceous intake (Fig. 2). Among the herbaceous species preferred by goats, *Ipomea pestigridis* predominated in the diet, followed by *Pennisetum pedicellatum* and *Brachiaria lata*. The three most preferred browse species were *Acacia albida*, *Maytenus senegalensis*, and *Piliostigma reticulata* (Figs. 3 and 4). Vegetative stage of plants also influenced the diet, as goats ate more *Acacia* pods than leaves and inflorescences of other species at the end of the dry season in May. Intake of concentrate averaged 456 ± 25 g per day per animal in the group 2, and 202.8 ± 65.3 g per day per animal in the group 3. Some chemical constituents of plants selected by goats like DM, CP, Na and Cu content showed significant difference between the dry and the wet season (Table 1).

Concentrate supply did not significantly affect milk production and composition (Table 2). From week 3 to

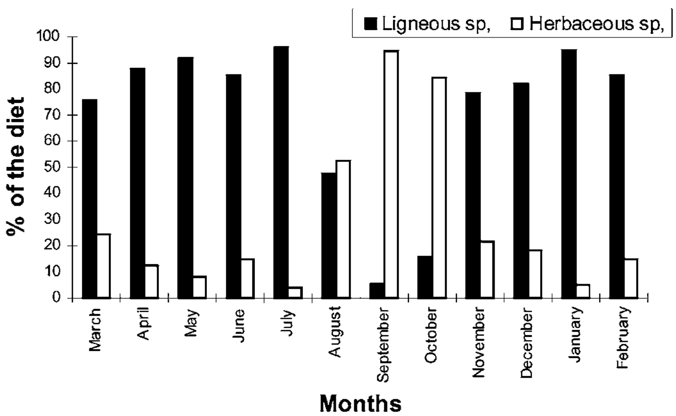

Fig. 2. Diet composition of does.

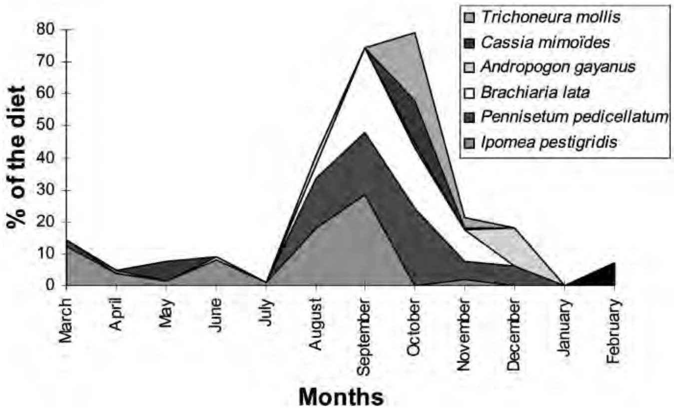

Fig. 3. Predominant herbaceous species selected by does.

10 of lactation, milk yield was higher ($P > 0.05$) in does nursing twins than in those with singles. Though not significant, goats kidding during the rainy season also produced more milk than those kidding in the dry season. During the first 2 months of lactation, the amount of milk (g per day per animal) consumed by kid at the first suckling and hand-milking before and after suckling were significantly higher when compared to the respective values subsequently measured during the day (Table 3). There were no sex differences in the quantity of milk consumed by kids. The milk secretion curve of goats from group 1 showed a peak of 1158 ± 425 g per day per animal at week 3 *post-partum* and a plateau until week 7, then declined, while remaining at a higher level compared to the other groups (Fig. 5). For group 2, milk yield peaked at week 4 (1043 ± 343 g per day per animal), and in group 3, milk yield peaked earlier (980 ± 232 g per day per animal at week 2 of lactation).

Supplementation had a positive but not significant effect on BW and BCS. Does from group 2 maintained their BW (Table 4) while those of group 1 tended to lose BW (Fig. 6). The same trend was observed for does kidding during the dry season. At the end of the study, goats from group 2 were in better condition than the others (Table 4, Fig. 7). The BW of kids was lower in the control group (Table 5), due to the higher number of twins and triplets ($n = 6$), when compared to the groups 2 and 3, with 3 and 0 twins, respectively. During the first month of lactation, single kids gained more BW (1.6 kg) than twins. Amount of milk consumed (g per day) by kid (y) could be estimated

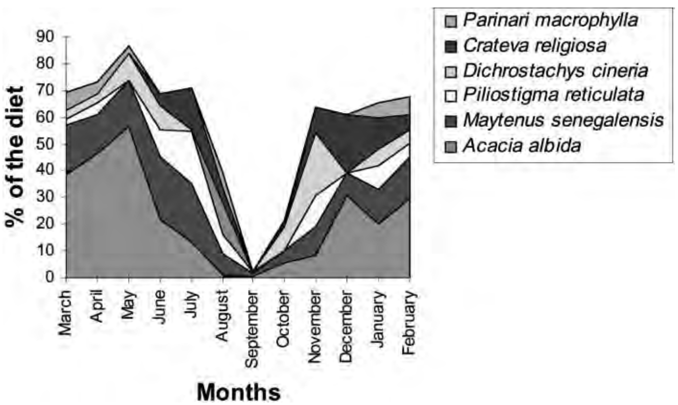

Fig. 4. Predominant ligneous species selected by does.

Table 1
Chemical composition of forage samples derived from the hand-plucking method

	Dry season[a]	Wet season[a]	Extremes[b]			
			Value	Month	Value	Month
DM (g/kg)	90.9 a ± 13.2	88.6 b ± 10	88.6	September	96.5	August
Organic matter (g/kg DM)	88.7 ± 19.9	88.3 ± 7.8	88.3	June	95.6	May
Crude protein (g/kg DM)	140.3 a ± 30.2	197 b ± 2.1	86.0	April	191.1	September
Crude fiber (g/kg DM)	174.2 ± 23.6					
Lignin (g/kg DM)	211.7 ± 24.4					
Ca (g/kg DM)	9.7 ± 6.0	8.2 ± 12.1	3.9	May	20.4	January
P (g/kg DM)	1.8 ± 0.5	1.5 ± 0.1	1.4	January	2	July
Na (g/kg DM)	1.08 a ± 1.1	4.2 b ± 1.0	1	May	5	September
Mg (g/kg DM)	0.7 ± 0.4	0.6	0.2	May	0.6	August
K (g/kg DM)	1.07 ± 0.3	2.05 ± 0.3	0.5	April	2.2	September
Fe (mg/kg DM)	484.1 ± 546	702 ± 101	35	May	2930	March
Cu (mg/kg DM)	9.94 a ± 2.9	15.0 b ± 6.0	4.0	September	20.1	March
Zn (mg/kg DM)	43.6 ± 16.5	42.3 ± 6.5	24.4	April	65.9	May

[a] For each nutrient, the month corresponding to the minimum and maximum value is reported.
[b] Mean values not followed by the same letter differ significantly ($P < 0.05$).

Table 2
Estimated yield and composition of milk from Sahelian does

	Group 1 control ($n = 13$)	Group 2 supplemented ($n = 11$)	tb[a]	Covariate[a]	S.E.	Group 1[b] control ($n = 6$)
Weeks 3–6[c]						
Total milk yield (g per day)	1093	947	NS	**	53	800.4
Sucked milk (g per day)	619	561	237**	**	35	579.0
Hand-collected milk (g per day)	474	386	NS	NS	36	221.4
Fat (g/kg)	40	38	NS	NS	0.6	
Protein (g/kg)	43	49	NS	NS	0.7	
Lactose (g/kg)	41	41	NS	NS	0.7	
Weeks 3–10[c]						
Total milk yield (g per day)	1010	865	NS	*	52	759.8
Sucked milk (g per day)	600	579	243*	*	36	530.3
Hand-collected milk (g per day)	410	285	NS	NS	39	229.5
Fat (g/kg)	40	37	NS	NS	0.6	
Protein (g/kg)	49	48	NS	NS	0.8	
Lactose (g/kg)	41	41	NS	NS	0.7	
Weeks 3–14[c]						
Total milk yield (g per day)	873	742	NS	NS	49	704.1
Sucked milk (g per day)	575	479	225**	*	40	461.9
Hand-collected milk (g per day)	298	262	NS	NS	42	242.2
Fat (g/kg)	40	37	NS	NS	0.6	
Protein (g/kg)	44	48	NS	NS	0.8	
Lactose (g/kg)	40	40	8*	NS	0.7	

[a] NS: tb (twin − single birth) effects adjusted for covariate were significant at $P > 0.05$.
[b] Calculations on 6 does from group 1 that kidded in the dry season.
[c] *Post-partum*.
* tb (twin − single birth) effects adjusted for covariate were significant at $P < 0.05$.
** tb (twin − single birth) effects adjusted for covariate were significant at $P < 0.01$.

Table 3
Amount of milk suckled and hand-collected during the first 2 months of lactation[a]

	All goats	Does with singles	Does with twins
Suckled milk[b] (g per day per animal)			
SM_1	219 a ± 80.5	202 a ± 72.2	280 a ± 84.3
SM_2	108 b ± 53.9	87 b ± 35.9	179 b ± 44.9
SM_3	114 b ± 46.6	101 b ± 32.8	159 b ± 63.0
SM_4	95 b ± 33.4	90 b ± 30.9	112 c ± 39.0
Hand-collected milk[c] (g per day per animal)			
HM_0	130 b ± 51.8	114 b ± 33.1	183 b ± 71.9
HM_1	126 b ± 96.9	114 b ± 90.7	166 b ± 116.0
HM_2	54 c ± 37.0	46 c ± 35.7	82 c d ± 28.6
HM_3	52 c ± 45.6	37 c ± 30.6	104 c ± 53.6
HM_4	36 c ± 32.8	30 c ± 32.9	58 d ± 23.3

[a] Mean values not followed by the same letters differ significantly ($P < 0.05$).

[b] The amount of milk consumed by kids was recorded four times per 24 h, at 8:00 h (SM_1), 13:00 h (SM_2), 18:00 h (SM_3) and 22:00 h (SM_4).

[c] Amount of milk hand-collected before the first suckling (HM_0), and after SM_1 (HM_1), SM_2 (HM_2), SM_3 (HM_3), and SM_4 (HM_4).

according to the following equation: $y = 0.087\text{BW}_0 + 0.10\text{BW}_4 - 38.7$, $r^2 = 0.50$, R.S.D. = 128.3, where BW_0 and BW_4 represent BW of kids at birth and at week 4 of lactation, respectively. Milk conversion index was 6.24 per unit live weight gain in the kid.

Plasma glucose was relatively low at the end of gestation (Fig. 8). It peaked at 24–48 h *post-partum*, remained stable from week 2 to 8 *post-partum*, then declined. Neither season of birth nor concentrate supply affected plasma glucose (Table 4). At the end of pregnancy, plasma glucose level was lower in the mother of twins (−6 mg/dl; $P > 0.05$) than in singles. Plasma urea was higher from week 2 to 8 of lactation, when compared to the subsequent period (Fig. 9). Plasma triglyceride level did not differ significantly among groups (Fig. 10).

4. Discussion

Plant species were selected differently by goats during grazing. While some species remained untouched, others, like *Acacia albida*, were regularly and frequently consumed. There were large seasonal variations in diet composition, but the consumption of ligneous species remained high as goats are natural browsers (Osolo et al., 1996). However, low rainfall contributed to the scarcity of herbaceous species in the year of the study. The forage preferences of goats on pasture (Devendra and Burns, 1970) or under stall-feeding conditions (Aboud et al., 1994) is far from being elucidated. It is generally known that ruminants on pasture tend to selectively graze plants that contain a high level of crude protein (Osolo et al., 1996), but it is not always the case, as goats may sometimes choose browse species of low nutritive value for pharmacological reasons (Becker and Lohrmann, 1992), or reject some plants containing toxins or substances with smells unattractive to ruminants (Malechek

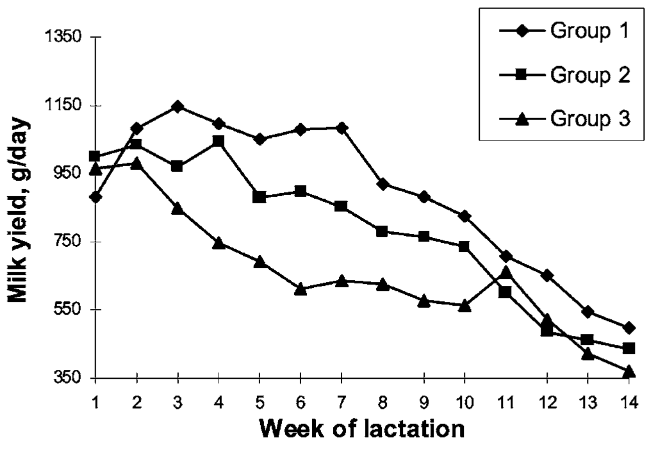

Fig. 5. Milk yield of does.

Table 4
BW and BCS of does

	Group 1 ($n = 13$)	Group 2 ($n = 11$)	S.E.	Group 1[a] ($n = 6$)	Group 3 ($n = 10$)	S.E.
Initial BW[b] (kg)	27	27	0.5	26	27	0.5
Final BW (kg)	26	27	0.4	25	26	0.3
Change in BW[c] (kg)	−0.7	−0.2	0.004	−1.2	−0.5	0.002
Initial BCS[b]	2.7	3.1	0.03	2.3	2.1	0.05
Final BCS	2.1	2.9	0.03	1.5	1.73	0.04
Change in BCS[c]	−0.6	−0.1	0.004	−0.8	−0.4	0.003

[a] Calculations on six does from group 1 that kidded in the dry season.
[b] At week 1 *post-partum*.
[c] Weeks 14–1 of lactation. Factors included in the model were not significant.

and Provenza, 1983). The crude protein content of goats diet did not show great variation among seasons, unlike data from grazing cattle (Guérin et al., 1988) because of the high presence of ligneous species. Mineral content of forage sampled by the hand-plucking method was high for Ca, K and Mg, low for P, very low for Na and Zn, and Cu content reached and sometimes exceeded the toxicity threshold for small

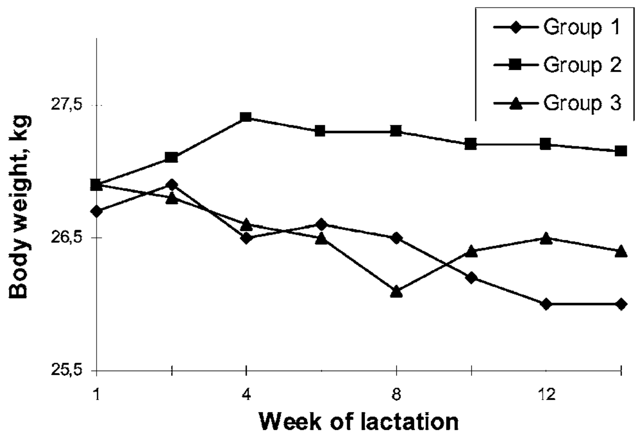

Fig. 6. Change in does BW.

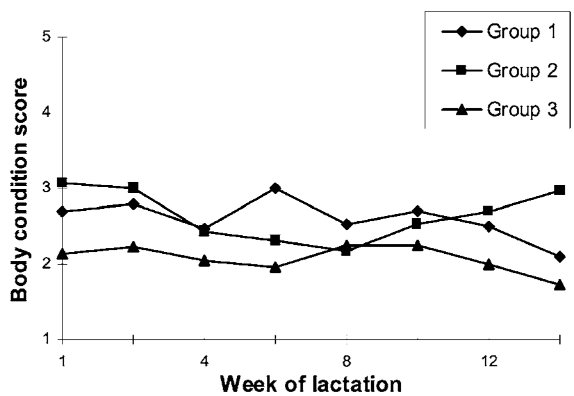

Fig. 7. Change in does body condition score.

Table 5
BW of kids

	Estimated			Effects		
	Group 1 ($n = 19$)	Group 2 ($n = 14$)	Group 3 ($n = 10$)	tb[a]	Covariate[a]	S.E.
BW at birth (g per animal)	1551	1839	1976	479*	NS	105
ADG week 1[b] (g per animal)	104	116	113	NS	NS	33
ADG month 1[b] (g per animal)	95	100	88	NS	NS	19
ADG month 2[b] (g per animal)	75	63	62	NS	NS	42
Change in BW[c] (g per animal)	2666	2808	2472	−1620**	*	184

[a] NS: significant at $P > 0.05$.
[b] ADG: average daily gain in BW, at week 1 or at month 1 or 2 *post-partum*.
[c] Weeks 14–1 of lactation.
* $P < 0.05$.
** $P < 0.01$.

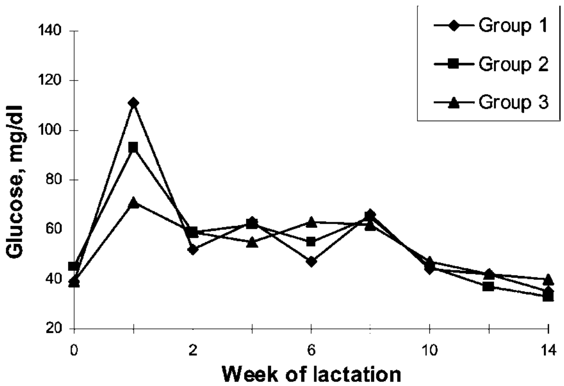

Fig. 8. Does plasma glucose content. Week 0: during the first 24–48 h post-kidding.

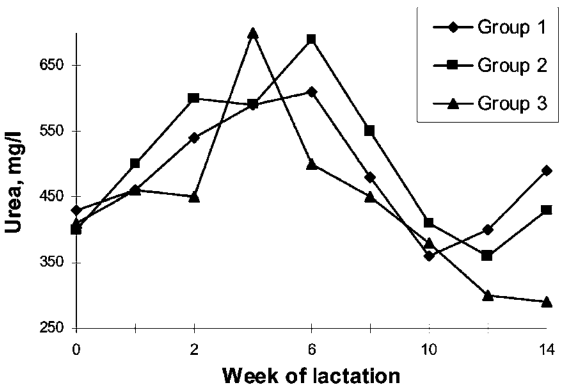

Fig. 9. Does plasma urea content. Week 0: during the first 24–48 h post-kidding.

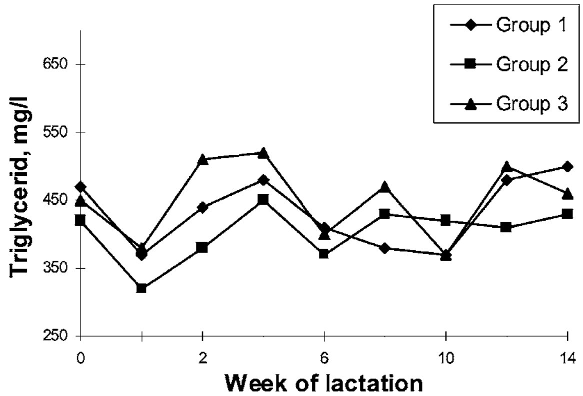

Fig. 10. Does plasma triglyceride content. Week 0: during the first 24–48 h post-kidding.

ruminants (Cissé et al., 1996a). The assumption in this study was that from grazing, does are able to meet a fraction (0.4 FU and 50 g DCP/kg of 4% fat corrected milk) of their nutrient requirements (Rivière, 1977). Milk yield response to supplementation was not significant, probably because does were still young and had to meet growth requirements. Moreover, the hand-plucking method only allows a qualitative evaluation of diet composition. A better estimation of the actual feed consumption level of grazing goats could give more information on the levels of nutrient intake, and its relationship with milk production. Higher milk yield during the rainy season (Cissé et al., 1996b) is to be associated with greater availability of good quality fodder (legumes and grasses). It is also likely that goats provided no supplement ate more forage in the pasture than those that received supplement. Concentrate substitution by the basal diet has been observed by others (Rémond et al., 1991) under controlled situations. Possibly, the intake of the basal diet (the pasture) in the mid dry season was low enough to upset the effect of supplementation. In fact, supplementation was shown to be without any effect when the basal diet is limited in quantity (Ricca and Combellas, 1993). Among factors reflecting a low level of intake on pasture, there is the low rainfall, the loss in BCS observed in does at the end of the study, and the importance of time spent walking (to select or look for food) during the dry season. Energy expenditure resulting from more walking may have increased at a moment where the level of intake was low. It was also impossible to quantify the effect of parity on milk yield because it was unknown in our trial. Does nursing twins produced more milk from hand-milking and suckled milk yield than those with singles, suggesting that udder stimulation and evacuation may be associated with higher milk production when does nurse additional kids. The double weighing method for milk yield estimate is often used and gives interesting results but presents some disadvantage when animals defecate or urinate. There may also be some stress on the mother and offspring when they are separated and mixed again for the purpose of measuring milk consumption. Does kidding during the rainy season mobilized their body reserves following peak lactation. Conversely, does kidding during the dry season did not have enough food to meet their requirements for body maintenance and milk production. Consequently, body reserves were mobilized before the peak milk yield, to meet this energy short fall, resulting in loss of BW and BCS. Hyperglycemia observed in the 24–48 h *post-partum* was probably due to the stress of parturition (Rémésy et al., 1984). During the first month *post-partum*, the decrease in plasma glucose (Vernon, 1980) could be explained by a decrease in the rumen activity during this period, by the utilization of glucose for milk lactose synthesis, and by uterine involution. *Post-partum* increase of plasma urea has been previously reported (Rémond and Journet, 1978). In conclusion, the milk yield and kid growth response to supplementation was not significant in this study, however, information on behavior, milk potential traits and kid growth of the Sahel goat in the periurban area has been presented. The assessment on forage preferences could enhance the fodder production in order to improve goat production systems in this zone where goat milk yield contributes to the food needs of populations.

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