World Journal of Pharmaceutical and Life Sciences
WJPLS
www.wjpls.org
SJIF Impact Factor: 6.129

EFFECT OF FEEDING LEVELS ON PRODUCTION AND REPRODUCTIVE PERFORMANCES OF LACTATING DOES

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Article Received on 23/11/2022 **Article Revised on 13/12/2022** **Article Accepted on 03/01/2023**

ABSTRACT

Red Maradi goats from Caprine Centre of Maradi in South of Niger were used from weaning to next kidding to determine the effect of levels of feeding of dams, the effect of urea treatment and crushing of millet stover (MS) on production and reproductive performances of dams. To evaluate these effects, data from previous kidding to subsequent kidding were used. Sixty goats were sorting into six groups of 10, and randomly assigned to six treatments (T1, T2, T3, T4, T5, and T6) with four levels of feeding (g/kg DM): T1=842, T2=T5=T6=934, T3=1079 and T4=1300 corresponding to 200 g, 400g, 600g and 800g of milk production, respectively. Treatment T1 to T4, millet stover (MS) was crushed and treated with 3% urea, T5 MS was only crushed, and T6 MS was offered whole. Comparison between T2 versus T5, and T6 versus T5 evaluated the effects of urea treatment and crushing of MS, respectively. Heat synchronization was used to reproduce does after weaning kids at three months aged. The feeding level affected (P<0.001) linearly and in a quadratic fashion dry matter intake (DMI) and milk yield (myd) of doe while dam final weight (dfwt) was affected (P<0.001) in a quadratic fashion. Urea treatment of MS did not affect DMI, myd and dfwt whereas crushing of MS increased (P<0.001) dam DMI and dfwt. Pregnancy reduced myd (P<0.05) and shortened lactation length (Llact) (P<0.001), increased dfwt (P<0.001) and average periodic weight change (apwc) (P<0.001) of does at the last period of pregnancy. The period of lactation, age, parity, birth type (btype) and dam initial weight (diwt) affected (P<0.001) DMI whereas myd and dfwt were affected (P<0.001) by period, btype and diwt. The post-partum anoestrus period (Panoest), kidding interval (Kinterv), gestation length (Lgest) and lactation length (Llact) ranged from 66 to 93, 236 to 254, 145 to 150 and 155 to 185 days, respectively. Production and reproduction performances were improved with feeding level.

KEYWORDS: Red Maradi goat, production and reproduction performances, feeding levels, milk yield, Niger.

1. INTRODUCTION

The Red Maradi goat is raised in Southern-East of Niger, in Maradi and Zinder regions as its predilection area. Nowadays, this breed is diffused to other regions due to efforts of Government, NGOs and Development agencies. However, the environmental conditions of these zones are different in terms of agro-ecology, livestock system compared to the predilection habitat of Red Maradi goat. Indeed, the prevailing conditions of other zones are low availability of by-products and crop-residues, long movements in search of pastures, desertification, scarcity of feed, high ambient temperature, and water availability. Red Maradi goat, under extensive system of livestock, are subjected to environmental stresses mostly during the dry season which is characterised by low availability of feeds and water leading mainly to inadequate nutrition and consequently to low production and reproductive performances. Starvation may lead to marked decrease of cardiac output, stroke volume, mammary blood flow, blood volume and the rate of milk secretion.[1] Moreover, it was obtained water deprivation caused body losses of 32 and 23% and plasma volume losses of 30 and 34% in lactating and non-lactating goats,[2] respectively whereas another author reported 9 and 6% of body weight loss with lactating and non-lactating black Maroccan goat, respectively, and a drop of 28% of milk yield.[3] Alpine goats have an ability to produce without water during 8 hours in pasture, even in very hot weather.[4] Recent report (unpublished work) of caprine centre of Maradi, stated that more than 40% of kiddings each year was obtained in December and 25% in March/April. This is linked to availability of generous pasture in August and crop residues in November/December corresponding to period when high quality feed is available in adequate quantity to support mating resulting to success of fecundation which is in agreement that super-ovulation was a response of environmental conditions and good nutrition.[5] Studies have also shown that in pasture, better use of meadows constitutes a potential for the economic, environmental and social development of goat dairy systems, particularly in the Great West, the leading French basin for production of goat milk.[6,7] Supplementing diet gave high conception and lambing rate.[8,9] According another author, supplementing diet improved production performance of local goats in semi-intensive system under Sudan Savanah ecological zone of Nigeria.[10] However, harsh conditions had negative impact of reproductive performance.[11] Although, another author found convincing results on the question of effect of feeding level on production performance of lactating Red Maradi goats and post-natal performance of kids, very little is known about performances of Red Maradi goat under various feeding managements.[12] The objectives of this study were to determine the effects of feeding levels of Red Maradi goat on their production and reproductive performances during the interval of two kiddings.

2. METHODS

2.1 Study site

The study took place in Caprine Centre of Maradi (1850 ha and 893 animals in 2012) which is located at eastern region. It is located in the sahelo-sudanian zone of Niger with a mean annual rain fall of 350-600 mm, latitude 13^{o}30'N, longitude 7^{o}6'E and an altitude of 347 m above sea level. The climate is relatively dry and the rainy season occurs between June and September. The dry season begins around 15th October with dry and cold weather from November to February. Hot weather occurs from March to June. The mean (min/max) temperature is 22/36^{o}C with a peak in April-May (>40^{o}C); heat decreases when the rains begin. The relative humidity from October to June is < 20% and July to September is > 80%. The natural vegetation is Sahelo-Sudanian woodland dominated by various Acacia species, with sparse ground regenerating shrubs and perennial or annual grasses.

2.2 Animal and housing

Sixty (60) lactating does were used. Does were treated against external and internal parasites with Ivermectin (1%). Does were housed in individual pen (2 m x 1.5 m) in experimental feed unit with free access to a salt lick and potable drinking water. After weaning kids at 3 months age, heat was synchronized to reproduce dams by exposing males after a period of isolation (at one mile away) of one month. In this way oestrus was synchronised in goats. The physiological basis for this response is due to smell and sight of bucks but it is not effective if bucks and does are together all time. Sudden placement of bucks with does induces an LH surge and ovulation in days. Does typically exhibit oestrus or heat for 24-120 hours, suddenly, naturel mating occurs for breeding. This method had good result to less seasonal breeds like Red Maradi goat which can reproduce all year long. All bucks were taking to another herd far away (about 2 km) from the experimental group. The ratio 1 buck/10 does was used of which 35 over 58 does conceived giving conception rate of 60% after three consecutive matings of 18 days periods. Does stayed for 6 days with bucks in order to cover the entire period of 120 hours of oestrus exhibition. Two does were removed from this study for reasons related to ill-health or sickness prior to synchronisation.

2.3 Feeds and feeding management

Feed troughs were made by cutting a barrel in three parts each of which became a feed trough. Untreated and urea treated millet stover, groundnut haulms, wheat bran and cottonseed cake were used as feed ingredients. Diets were formulated using milled (10mm) urea treated or untreated and uncrushed millet stover (MS), crushed groundnut haulms (GH), cottonseed cake (CSC) and wheat bran (WB). Table 6.1 shows that treatments T1, T2, T3 and T4 were derived from diet 1. Treatment T5 was derived from diet 2 and treatment T6 was derived from diet 3. Every day, feed offered and orts in plastic bags were measured with an electronic balance (Santorin 6100g d=0.1 g) the previous day in the afternoon just to facilitate the feeding process and measuring intake. Feed was offered in the morning at 8:00 h and refusals were collected the following day between 7:00 h to 8:00 h. Mineral lick was hung in individual pen permanently per animal as supplementary ingredient. Tap water was offered ad libitum in a 10-liter basin. Representative diets and refusals were collected daily and dried (for DM determination) in an oven at 650C for 48h. An electronic balance and a scale were used for measurements. At the end of the week a composite sample (5%) of diets and refusals were taken and stored and at the end of the experiment, representative samples (5%) of diets offered and refusals were collected for chemical analyses.

Table 1: Ingredient and chemical composition of diets.

Ingredient (g of DM)		Diet 1				Diet 2	Diet 3
	Ration	T1	T2	T3	T4	T5	T6
CUTMS		385	384	385	385	-	-
CMS		-	-	-	-	384	-
MS		-	-	-	-	-	384
GH		308	307	308	308	307	307
WB		230	231	231	231	231	231
CSC		77	77	77	77	77	77

Total		1000	1000	1000	1000	1000	1000
Chemical composition							
N (g/kg DM)		16.93	16.93	16.93	16.93	16.52	16.52
ME of diet (MJ/kg DM)		9.24	9.24	9.24	9.24	8.8	8.8
Rationing							
Target milk production (g)		200	400	600	800	400	400
Rationing level (g/day)		842	934	1079	1300	934	934
Feeding level		0.65	0.72	0.83	1	0.72	0.72

MS: millet stover; CMS: crushed millet stover; CUTMS: crushed and urea treated millet stover; GH: groundnut haulms; WB: wheat bran; CSC: cottonseed cake; ME: metabolisable energy.

2.4 Experimental design

Sixty lactating does were blocked according to weight, parity and litter size into six groups of 10 animals each, which were randomly allocated to six (6) dietary treatments, making a total of ten (10) animals per treatment. These six dietary treatments were offered to lactating does from 3 months post kidding until the subsequent kidding.

2.5 Measurements

At the beginning (evening of day 90 and morning of day 91) and end (last measurement before kidding) of experiment, body weights of dams were taken during two consecutive days after starvation for 12 hours from 18:00 h to 06:00 h. The live weight of each dam corresponded to an empty live weight. Empty body weights of dams were recorded every two weeks from weaning until kidding. Feed offered and refusals were measured daily in order to determine feed intake. Milk yield was recorded every two days from weaning until dry period when milk yield decreases to 1/5th (100 g) of maximum yield or at a level when farmers stop milking their does. The onset of post-partum oestrus was recorded from day of kidding to the first oestrum of doe. The gestation length was from mating/conception to kidding; and lactation length was kidding until milk yield dropped to below 100 g.

2.6 Chemical analyses

Samples of feeds offered and refusals were collected for chemical analyses. At the end of the experiment, samples of feed offered and orts were analyzed to determine DM, ash, crude protein (Nx6.25), neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL). Dry matter was determined by drying samples in an oven at 600C for 48h until weight became constant. Ash was determined by combusting 1 g of sample per crucible in a muffle furnace for four hours at 550^{o}C (method-942.05 AOAC, 1990). Nitrogen content was determined using the Leco TruMac CNS/NS (LECO Corporation USA, 2012). NDF, ADF and ADL were determined in duplicates using ANKOM-A200/2220 (2052 O'Neil Road, Macedon NY 14502, www.ankom.com) as described by some studies.[13] Neutral detergent fibre content was assayed without a heat stable amylase. Both NDF and ADF were expressed inclusive of residual ash. ADL or lignin (sa) was determined by solubilization of cellulose with sulphuric acid. Hemicellulose was obtained by difference of between NDF and ADF and cellulose was calculated as the difference between ADF and lignin (sa). All these analyses were done in the laboratory of Discipline of Animal Science, University KwaZulu-Natal, Pietermaritzburg.

2.7 Statistical analysis

Data were analyzed using the General Linear Model of SAS (Statistical Analysis System) to determine the Least Square Means (LSmeans), means and the level of differences between treatments using the following model for analysis:

$$Yijklmn = \mu + Ai + Bj + Lk + Pl + Tm + Gn + Eijklmno$$

Where: Yijklmn is the independent variable (feed intake, milk yield, live weight gain, gestation length, lactation length, kidding interval and oestrus post-natal period); µ is the overall mean; Ai is the effect of dam ages; Bj is the effect of birth type; Lk is the effect of initial live weight; Pl is the effect of parity; Tm is the effect of treatments; Gn is the effect of pregnancy and Eijklmno is the residual error. Linear and quadratic contrasts were used to compare the effect of treatment on feed intake, milk yield, lactation length, final live weight and live weight change during five periods after weaning: P1 (1-3 week), P2 (4-7 weeks), P3 (8-13 weeks), P4 (14-18 week) and P5 (>19 weeks). Categorical data (conception during 1st mating, cumulative mating, kidding interval, and anoestrus period) were analyzed using the Frequence of SAS to determine the Chi Square (Chisq) and the significance differences between treatments on conception rate and kidding rate and to evaluate the kidding intervals of does.

3. RESULTS

3.1 Chemical composition of feeds and diets

The chemical composition of feeds is shown in Table 2 and for diets offered and refusals in Table 3 Millet stover and groundnut haulms had similar dry matter (DM); however, their organic matter (OM), fibre fractions (NDF, ADF, Hcel and Cel), nitrogen (N) and metabolisable energy (ME) contents were different. Dry matter of millet stover was strongly reduced by urea treatment while the N and ME increased. Among concentrates, cottonseed cake had higher NDF, ADF, Hcel, Cel, ADL, and N than wheat bran but its ME content was lower than in wheat bran. Diets had similar chemical composition; however, the NDF and ADF contents in refusals were higher than in feeds offered (Table 3).

Table 1: Chemical composition of feeds.

Feeds	MS	MS	GH	WB	CSC
Urea treatment	no	Yes	no	no	No
Dry matter	954	619	932	953	980
Organic matter	913	911	889	951	948
Nitrogen (N)	6.20	7.28	17.50	26.07	35.45
Neutral detergent fibre (NDF)	816	799	495	477	570
Acid detergent fibre (ADF)	518	523	386	125	437
ME (MJ/kg DM)	4.57	5.71	11.31	12.65	8.30
ADIN	1.4	1.6	2.2	0.8	3.2
ADIN:N	22.8	22.4	12.5	3.0	9.1
Hemicellulose	298	276	110	352	133
Cellulose	394	406	265	86	339
Acid detergent lignin	130	118	116	35	101

ME: Metabolizable energy; ADIN: Acid detergent insoluble nitrogen; ADIN:N: ratio acid detergent insoluble nitrogen in nitogen content of feed; MS: Millet stover; GH: Groundnut haulms; WB: Wheat bran; CSC: Cottonseed cake.

Table 2: Chemical composition of feeds offered and refusals (g/kg DM).

		Diet1				Diet2	Diet3
Parameters	**Feed**	**T1**	**T2**	**T3**	**T4**	**T5**	**T6**
DM	Offered	822	822	822	822	949	949
	refusal	965	965	965	965	970	980
OM	Offered	916	916	916	916	916	916
	refusal	951	947	959	952	950	955
NDF	Offered	613	613	613	613	619	619
	refusal	704	708	760	748	752	823
ADF	Offered	385	385	385	385	383	383
	refusal	516	517	568	565	525	576

3.2 Effect of feeding levels on feed intake and production performance of dams

The level of feeding affected (P<0.001) linearly and in a quadratic fashion dam intake (dint) and milk yield (myd) while dam final weight (dfwt) was affected (P<0.001) linearly by feeding level (Table 4). Pregnancy affected myd (P<0.05) and dfwt (P<0.001); non-pregnant does had higher myd than pregnant (250 vs 180 g) but had lower dfwt (21.25 vs 24.40 kg) than pregnant once. Period highly affected (P<0.001) dint, myd and dfwt. Also treatment interacted with period to affect (P<0.001) dint without any effect on myd and dfwt, while the interaction of pregnancy and period affected (P<0.001) only dwt but did not exert any effect on dint and myd. Moreover, the three way interaction (treatment x pregnancy x period) had no effect (P>0.05) on dint, myd and dfwt.

Table 4: Effect of level of feeding on production performances of dams.

Treatment	Dam initial weight (kg)	DM intake (g)	Milk yield (g)	Dam final weight (kg)
T1	20.95	706	198	20.70
T2	22.25	759	216	22.00
T3	22.15	876	241	23.15
T4	24.05	980	332	25.10
T5	22.00	759	206	21.50
T6	20.00	708	200	20.20
Variation sources				
RMSE		88.12	87.51	1.61
Treatment		***	***	***
Pregnancy		NS	*	***
Week		***	***	***
Treat*Wk		***	NS	NS
Preg*Wk		NS	NS	***

Treat*Preg*Wk		NS	NS	NS
Age		***	NS	NS
Parity		***	NS	**
Btype		***	***	***
Diwt		***	***	***
Linear		***	***	***
Quadratic		***	***	NS
Contrast				
T2 vs T5		NS	NS	NS
T6 vs T5		***	NS	***

Diwt: dam initial weight; DM: dry matter; Treat: treatment; Preg: pregnancy; Wk: week; Btype: birth type; Means in the column with the same lowercase letter are not significantly different at P<0.05; RMSE: Root mean square error; NS (P > 0.05); * (P < 0.05); ** (P<0.01); *** (P<0.001).

Both age and parity affected (P<0.001) dint but not myd. The birth type (btype) and dam initial weight (diwt) affected (P<0.001) dint, myd and dfwt. Consequently, dams with twins had higher dint (904 vs 778 g, t = 5.25, P<0.001), myd (289 vs 222 g, t = 3.57, P<0.001) and dfwt (25.00 vs 21.50 kg, t = 5.02, P<0.001). Also a change of 1 kg in diwt would elicit an increase of 0.660 (±0.022) kg on dfwt (t = 29.72, P<0.001), 9.3 (±0.94) g of feed intake (t = 9.87, P<0.001) and 7.38 (±1.05) g of myd (t = 7.00, P<0.001).

3.3 Effect of urea treatment and crushing of millet stover on feed intake and production performance of dams

The contrast between treatments 2 versus 5 and between treatments 6 versus 5 showed that urea treatment did not affect (P>0.05) dam intake (dint), milk yield (myd) and dam final weight (dfwt) whereas crushing of millet stover increased (P<0.001) dint and dfwt of lactating does but not myd (Table 4).

3.4 Effect of level of feeding on average periodic weight change of dams

Feeding level of dams and pregnancy did not affect (P>0.05) average periodic live weight change (apwc) (Table 6.5) except during gestation corresponding to the period from 2nd month to 5th month of pregnancy in which apwc was affected linearly (at least P<0.01) by treatment and pregnancy; consequently, pregnant does gained more (383 vs 118 g) than non-pregnant. However, the interaction between treatment and pregnancy did not affect apwc. All parameters related to dams except diwt and age of dam had no influence (P>0.05) on apwc. The apwc was highly affected (P<0.001) by diwt during the 1st month post-kidding; and it was affected (P<0.05) by the age of doe by the end of gestation.

3.5 Effect of urea treatment and crushing of millet stover on average periodic weight change of dams

The contrast between treatments 2 versus 5 and between treatments 6 versus 5 showed that both urea treatment and crushing of millet stover did not affect (P>0.05) average periodic live weight change (Table 5).

Table 5: Effect of level of feeding on average periodic weight change (g/day) of dams.

Treatment	**Period 1**	**Period 2**	**Period 3**	**Period 4**	**Period 5**
T1	-619	122	60	-84	159
T2	-647	-144	14	44	154
T3	-379	107	78	-189	353
T4	-653	300	44	-15	456
T5	-303	113	-61	-22	106
T6	-441	-41	-10	-66	251
Variation sources					
RMSE	590.22	371.80	132.96	406.42	140.27
Treatment	NS	NS	NS	NS	**
Pregnancy	-	-	-	NS	***
Treat*Preg	-	-	-	NS	NS
Age	NS	NS	NS	NS	*
Parity	NS	NS	NS	NS	NS
Btype	NS	NS	NS	NS	NS
Diwt	***	NS	NS	NS	NS
Linear	NS	NS	NS	NS	**
Quadratic	NS	NS	NS	NS	NS
Contrast					
T2 vs T5	NS	NS	NS	NS	NS
T6 vs T5	NS	NS	NS	NS	NS

Treat: treatment; Preg: pregnancy; diwt: dam initial weight; Btype: birth type; Means in the column with the same lowercase letter are not significantly different at P<0.05; RMSE: Root mean square error; NS (P > 0.05); * (P < 0.05); ** (P<0.01); *** (P<0.001).

3.6 Effect of level of feeding on reproductive performance of dams

Feeding levels of dams did not affect (P>0.05) kidding interval (Kinter), gestation length (Lgest), and lactation length (Llact), whereas the anoestrus period (Panoest) was quadratically affected by feeding level (Table 6). The age, parity and birth type had no effect on Kinter, Lgest, Panoest and Llact. However, pregnancy shortened (P<0.001) the lactation length of does relative to non-pregnant does (152 versus 197 days).

The contrast between treatments 2 versus 5 and between treatments 6 versus 5 showed that both urea treatment and crushing of millet stover did not affect (P>0.05) kinter, Lgest, and Llact, however Poest was surprisingly lengthen (P<0.05) by urea treatment (T2 vs T5) (Table 6).

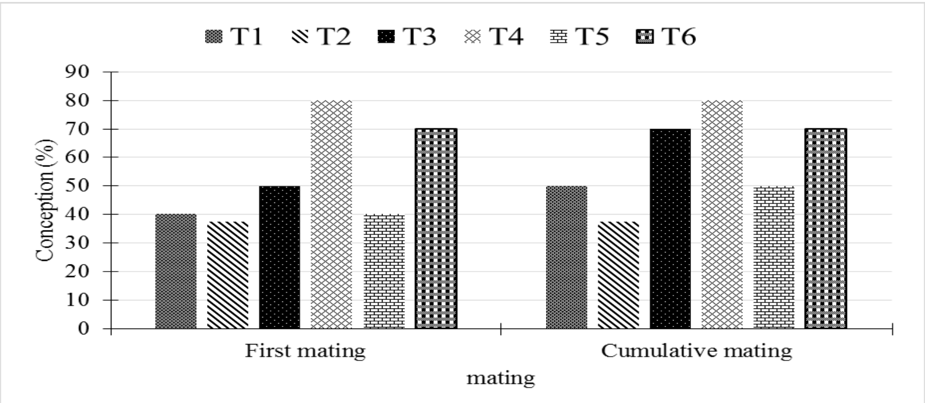
Table 6: Effect of level of feeding on kidding interval, gestation length, anoestrus period and lactation length (days)

Treatment	Kinterv	Lgest	Panoest	Llact
T1	237[a]	145[a]	64[a]	175[a]
T2	240[a]	150 [a]	93[a]	185[a]
T3	238[a]	147[a]	70[a]	168[a]
T4	236[a]	148[a]	66[a]	171[a]
T5	254[a]	148[a]	73[a]	168[a]
T6	240[a]	147[a]	72[a]	155[a]
Variation sources				
RMSE	13.36	3.46	19.49	25.28
Treatment	NS	NS	NS	NS
Pregnancy	-	-	-	***
Age	NS	NS	NS	NS
Parity	NS	NS	NS	NS
Typeb	NS	NS	*	NS
Linear	NS	NS	NS	NS
Quadratic	NS	NS	*	NS
Contrast				
T2 vs T5	NS	NS	*	NS
T6 vs T5	NS	NS	NS	NS

Kinterv: kidding interval; Lgest: length of gestation; Panoest: anoestrus period; Llact: lactation length; Typeb: type of birth; ND: no determined, RMSE: Root mean square error; Means in the column with the same lowercase letter are not significantly different at P<0.05; NS (P > 0.05); * (P < 0.05).

3.6.1 The conception rate and kidding rate

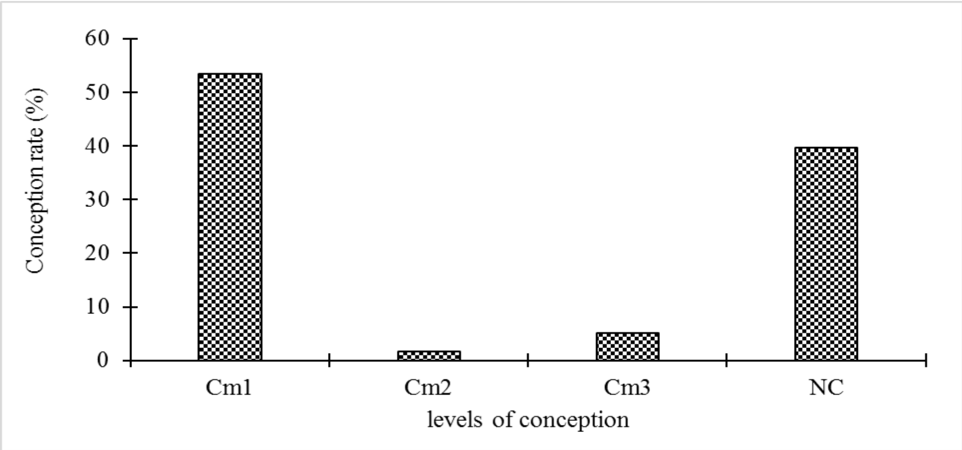
Levels of feeding had no effect (P>0.05) on the rate of conception of does in this study (Figure 6.1), however, the rate of conception tended to increase with feeding levels of dams. Once does were confirmed pregnant, they all kidded, hence the kidding rate was similar to conception rate.



Cm1: conception rate at the 1st mating; Cm2: conception rate at the 2nd mating; Cm3: conception rate at the 3rd mating; NC: non conception after three mating.

Figure 1: Effect of dietary treatment on conception rate of does (Chi-Square = 5.03; P>0.05)

The conception rate of the experimental herd differed (P<0.001) among the three mating sessions; first mating had the highest conception rate (54% of the herd) and the second had the lowest. Forty percent of does failed to conceive after third mating (Figure 6.2) and were removed when the pregnant ones started giving birth.



Cm1: conception rate at the 1st mating; Cm2: conception rate at the 2nd mating; Cm3: conception rate at the 3rd mating; NC: non conception after three mating.

Figure 2: Rate of the herd (Chi-Square = 45.44; P<0.001)

3.6.2 The Kidding intervals

Greater number of does (54%) had kidding interval between 211-241 days whereas 40% of does did not conceive (Figure 3.).

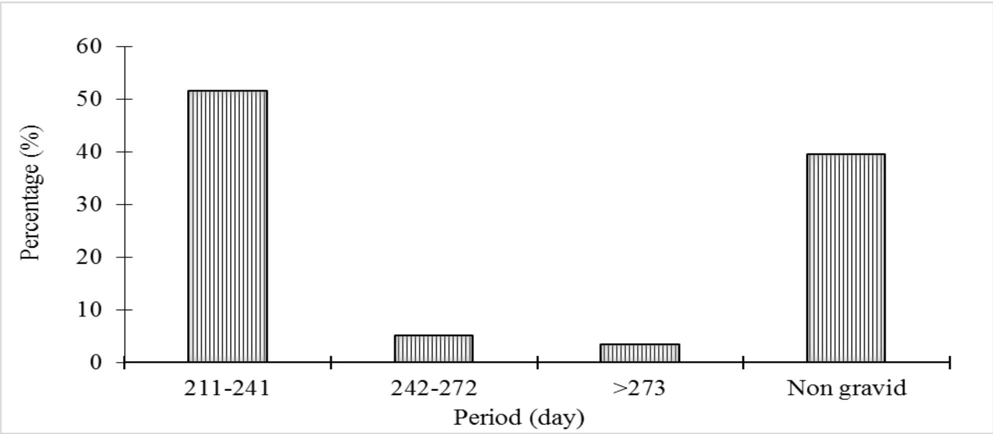


Figure 3: Kidding interval of does (Chi-Square = 41.44; P<0.001)

3.6.3 Anoestrus period

Greater proportion of does (50%) had anoestrus period between 75 to 105 days (Figure 6.5).

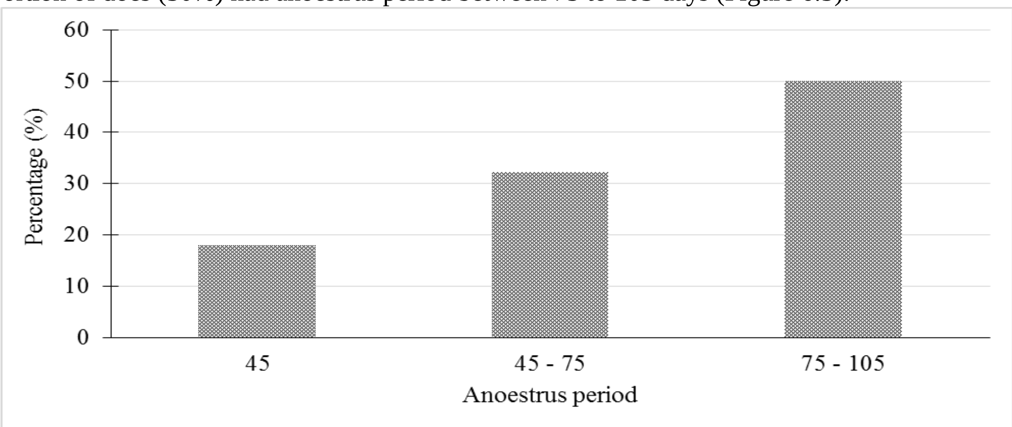


Figure 4: Anoestrus periods of does (Chi-Square = 4.35; P>0.05).

4. DISCUSSION

4.1 Chemical composition of feeds offered and refusals

Tropical cereal straws, legume forages and concentrates are generally high in dry matter (DM) content during the dry season due to high temperature and low humidity. The differences in chemical composition between millet stover, groundnut haulms, wheat bran and cottonseed cake are consistent with other studies.[14,15,16,17] Dry matter for millet stover and groundnut haulms are similar to those reported by some authors.[18,19,20] The drastic decrease of DM of urea treated cereal straws after treatment could be explained by the water used for urea treatment. Moreover, samples were taken to evaluate the DM immediately at the end of the treatment. These results are in agreement with the study of a researcher who recorded increase change of physical characteristic after treatment, showing by duration and number on jaw movements to eating untreated and treated straws.[21] Similarly, it has been reported a decrease of DM after urea treatment of rice straw.[22,23] The difference in organic matter (OM) content between millet stover and groundnut haulms were in conformity with those reported by several studies.[19,24,25] The variability in OM content among these feeds may be due to differences in chemical, physical and thermodynamic properties. The high fibre and low protein contents of millet stover are in agreement with some author.[26] The relative NDF and ADF contents of millet stover and groundnut haulms are close to findings of other studies.[14, 20, 27]

Treating millet stover with urea slightly decreased NDF content is in agreement for some researcher who reported on rice straw a significant decrease of NDF using 5.5% of urea.[22] The NDF (g/kg DM) and ADF (g/kg DM) in groundnut haulms were lower than NDF (566) and ADF (422) observed by some studies.[20] Nitrogen content of millet stover in the present study is far lower than the minimum required level of 12.8 g/kg DM to stimulate rumen microbial activity.[28] But it was close to results obtained by some studies.[20,29] That urea treatment increased nitrogen in the form of ammonia was supported by others[23,24,25,30] who found significant increase of crude protein after treating rice straw.

The DM, OM, N and ADF content in wheat bran are similar than those reported by a study.[20] A researcher reported close values of DM, OM, N and ADF in cottonseed cake than those reported in the present study.[31] Nitrogen (g/kg DM) content of wheat bran and cottonseed cake are also consistent with those reported by.[20] Similar results were observed on nitrogen content of cottonseed cake.[23] The relatively low fibres and high contents of protein and ME for groundnut haulms as forage legume and for wheat bran and cottonseed cake, as concentrates compared to those in millet stover may be due to their chemical proprieties. These results are in agreement with several workers.[20,29,33,34,35] Thus, groundnut haulms, wheat bran and cottonseed cake may be considered as good supplements to increase nutritive values of millet stover.[20] On the other hand, some results have shown that the in vitro digestibility of the dry matter of millet stovers was much higher during the vegetative stage than after harvest (660 g / kg DM versus 452 g / kg DM).[36]

The high DM, OM, NDF and ADF contents of refusals may be explained by differences in physical and chemical characteristics of feeds due to feeding behaviour of goats known to select feeds based on prehension ease, nutrient content and post-ingestive effects. This is in agreement with other works.[37, 38, 39]

4.2 Effect of level of feeding

The levels of feeding affected dam intake and milk yield in agreement this result which found that feed intake and milk yield of Red Sokoto goats increased with concentrates supplementation.[40] Similarly,[41] reported that increasing level of feeding resulted in a linear increase of final body weight of goat. However, it has been reported a non-significant effect of graded levels of feeding on feed intake and milk yield in Alpine dairy goat.[42] Animal consumption is subject to various variation factors such as type and quality of feed, palatability of feed, form of presentation and season, animal behavior and physiological stage). Milk yield values in the present study are lower than those reported by some studies[43] on Red Maradi goat (600 g for 200 to 220 days of lactation),[44] on Saanen (2.63 kg/day) and Alpine (2.08 kg/day) dairy goats. This milk production is different (0.46 Kg / d) from that obtained by Boujenane.[45] in Draa goats in Morocco whose food distributed was based on alfalfa hay, wheat bran, of dates and food made from dry beet pulp. Values of feed intake ranging from 72.10 to 90.24 g/kg W0.75/d in the present study were relatively similar to those reported by Fedele.[46] on Maltese goats during dry to gestation periods (74.68 to 89.03 g/kg W0.75/d) but lower than for lactation period (96.084 to 120.59 g/kg W0.75/d) of same species.[46]) However, our values of feed intake were higher that values of 60 g/kg W0.75 /d for on West African Dwarf goats).[47] and 27.74 to 48.75 g/kg W0.75 /d for Matebele goats.[48] but lower than values (102-116 g/kg W0.75/day) obtained by Chowdhury.[49] with German Fawn goats and recommended values of 119.6g /kg W0.75 /d.[50] The significant effect of levels of feeding on dam final weight (dfwt) is in agreement with work.[42] This may be due to an increase in dry matter intake and nutrient intake with increasing feeding levels of dams attributable to feed utilisation in order to meet requirements of host body and those of development of foetus and milk production.

The relative increase of conception rate with increasing levels of feeding is in agreement with others.[51,52,53,54,55,56] and this may be due to higher nutrient intakes of T3 and T4 and the good quality of T6 where does selected the more palatable parts of the diet. In fact, favourable season with feeds availability in quantity and quality may influence positively the conception rate. Geographic location, particularly degree of latitude, has a significant impact on timing and length of the breeding season. At locations close to the equator, tropical breeds of goats often breed throughout the year. Other stresses such as transportation or diseases may cause a temporary stoppage of oestrus activity.

4.3 Effect of urea-treatment of millet stover

Urea treatment is known to increase feed intake because it reduces lignification and increases the rate of digestion. However, after kidding the intake of lactating does was low but increased thence. That is why there appears to be an increase of feed intake with stage of lactation due to the physiological changes of does.[46] Secondly, the environment was dry and hot with low humidity, so treated feed dried out quite rapidly as shown by DM of refusals (Table 6.3). Thus, there was no difference in DM intake between T2 and T5 implying that urea treatment of millet stover did not affect dam intake which may be explained by the increase of doe's live weight and intake with advancing lactation period (Table 6.4 and Table 6.5). Furthermore, at this phase of lactation does were able to eat the enough feed to meet the ME requirements for maintenance and milk yield. In fact, treatments T2 and T5 had the same level of feeding and similar weight, suggesting an intake capacity 3-4% of live weight.[57]; so the improvement of DM intake may explain the no-effect of urea treatment which is in agreement for work with Red Maradi goats.[58] The statistical analysis of the results of the Duncan's test shows that there is a significant difference (P <0.05) between the mean quantities of raw materials ingested from the T1 treatment (824.53 g / d) of which the ration contains millet stalks not treated with urea and those of treatment T1 (1065.61 g / d) whose ration contains millet stalks treated with urea. This shows the effect of millet stem urea treatment on food consumption in animals.[59] This corroborates the result of another research, which explains that the treatment with urea of fodder improves the ingestibility, increases the quality of food and its digestibility. The increase of anoestrus period by urea treatment by comparing T2 to T5 is difficult to explain as other does were also fed on the same diet with urea treatment.

4.4 Effect of crushing of millet stover

Goats change their feeding behaviour according to diet availability.[60,61] Goats, more than other species, are selective animals and are able to choose among the available feedstuffs parts of plants with the highest protein content and the highest digestibility. They select feed on the basis of prehension ease, sensorial characteristics and post-ingestive effects learnt from their own experience.[37] Goats' behabiours would explain why DM intake was higher with T5 than T6 diet. Crushing (T5) of millet stover reduced particle size and made it easy to be ingested in diet formulated with palatable ingredients according to physiological change of lactating does.[46] We can say that with the advent of shredders (locally designed machines), there has been a craze for the use of millet straw in livestock feed in Niger. The use of millet stalk after crushing is one of the alternatives that allows the enhancement of local food resources and the improvement of the palatability of coarse fodder such as millet straw.[62] Based on NDF (g/ kg DM) of feed offered (619) and orts refused (752) goats offered crushing millet stover were able to ingest various parts justifying higher intakes with T5 than T6.

4.5 Effects on feed intake and production performance of dams

Pregnant does had lower milk yield than non-pregnant ones in accordance with work of a researcher who found in Murciano-Granadina dairy goats that pregnancy reduced milk yield.[63] According to another studies, pregnancy has an inhibitory effect on milk production and the increase in estrogen and progesterone level during pregnancy inhibits milk secretion.[64] In fact, final live weights of pregnant does were higher than that of non-pregnant does which could be explained by increased body size and development of the foetus. Periodic variation of dam intake and milk yield may be due to physiological changes of body weight with advancing lactation and pregnancy as shown by the present results where periodic average weight change significantly increased with increasing levels of feeding and pregnancy at the end of gestation.

That increasing parity and age of dam increased dam's intake could be explained by physiological changes of dam with age/parity which increased dam's liveweight.[44] and consequently, increased feed intake since body weight is correlated to DM intake.[57] Twinning relative to single birth increased DM intake and milk yield in agreement with using German Fawn goats.[49] Similarly, it has been reported for Jamunapari goats that dams had higher milk yield with twin than with single kids.[65] Similar findings were observed in some study with Red Sokoto goat that does kidding single had lower milk yield than does kidding twins.[10] The weight of these horses varies according to the types of feed, hence work on kids of the dwarf goat in the Sudanian zone in Benin, whose feed comes from pastures on natural ranges have registered 6.81kg live weight.[66] The influence of dam initial weight on loss of body weight at the beginning of lactation is in agreement with other workers.[58,67] and this may be explained by loss of appetite at the post kidding period when does mobilises body energy to satisfy requirements of milk production for new born kid.

4.6 Effects on reproductive performance of dams

A greater proportion of does had kidding interval between 211 – 241 days which is similar to some work of.[53] witch found average kidding interval of 238 days but lower than that observed by another studies.[68] However, a researcher observed in traditional farming conditions of Maradi area, higher average values of 386 and 363 days with Red Maradi goat and its relative Black goat, respectively, and explained that the relatively long interval in traditional system may be due to few bucks in villages particularly when goats are kept at home for a period of about six months during the rainy season (June to November).[69] It has been reported various values, 240±57.8 (n=51) days at Shika (Nigeria) and 332±109 (n=665) days in Niger traditional system and noted that the kidding interval is influenced by abortion, kid deaths and the season of previous kidding. Thus, intervals following an abortion (220±16 (n=59)) and those following kid deaths in the first 15 days of life (269±22 (n=32)) were shorter than all intervals.[70] Kidding interval obtained in this study were higher than 215, 204 and 207 days respectively reported by another research with Red Sokoto goats raised under traditional system, a researcher with Kecang goats of Indonesia and the one with Red Sokoto goats in Nigeria.[71,72] The relatively high kidding interval in the present study may be explained by experimental conditions where heat synchronisation was started later after weaning kids (at 91 days).

The gestation length and anoestrus period in the present study were higher than those (135.4 - 143.9 days and 51 days) reported by a researcher with Jamunapari goats respectively, but the observed (152.8±17.6 days) gestation length by the same authors with Jamunapari goats was similar to our observation.[65] The higher lactation length of non-pregnant does than the pregnant is in agreement with studies witch reporting that lactation can last for long without kidding.[63] The lactation length in the present study is higher than 120 days.[73] with Red Sokoto goats. The persistency of lactation length of 152 and 197 days for pregnant and non-pregnant does respectively was high and demonstrates the ability of Red Maradi goat to maintain milk production throughout the year with non-pregnant does.

5. CONCLUSION

Levels of feeding affected linearly dry matter intake, milk yield, and final liveweight of lactating Red Maradi goats during interval of two kiddings. Urea treatment did not affect feed intake and milk yield, whereas crushing of millet stover increased intake and liveweight of doe. The expected milk yield was not obtained despite that the rationed diets met nutrients requirements to attain our goals. Further investigation is required based on livestock system, nutritional status and selection aspects to improve this breed in Caprine Centre of Maradi.

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