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Full Length Research Paper

Effect of supplementation in copper and zinc associated with phosphorus on the rate of abortions of goats in Burkina Faso

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Abstract

At Burkina Faso, despite the numerical importance and the socio-economic role of goats for farmers, it enjoys little care in food. This causes deficiencies and nutritional imbalances on the subjects and makes them vulnerable to many diseases, including those causing of significant cases of abortions. It is why a trial was conducted to evaluate the effect of copper (Cu) and zinc (Zn) supplementation on reducing abortions in goats of the burkinabe Sahel goats and the overall improvement of their reproductive performances. For this test, 48 goats have been divided into four (4) groups of 12 individuals: group1 natural grazing (NG) + complementation block-molasses only; group 2: NG + complementation block-molasses + Cu; group 3: NG + block - molasses + Zn and group 4: NG + block - molasses + Cu and Zn. The results of analyses showed that the availability of nitrogen (N) and phosphorus (P) of pasture grazed by goats was relatively good. These pastures were presented sub deficiencies in copper and effective deficiencies in Zinc. The Cu or Zn effect or the two effects combined, induced an overall improvement in rates of kidding and fecundity of the goats of 76 and 32% respectively. The results of the study suggest to focus future research on the identification of best forms of use of Zn on the solution of the problem of abortion of goats, in particular that of younger subjects that seem to be most affected.

Keywords: Burkinabe Sahel goat, Reproduction parameters, Abortions, Multinutritionnel block, Block-molasses, Zinc, Copper, Phosphorus.

INTRODUCTION

In Burkina Faso, the goat population is estimated at about 13 094 000 heads, or 43% of the national number of ruminants (total 30 577 000 heads), against 28% for cattle and 29% for sheep (MRA/GGESS/DSS, 2014). Despite this numerical importance and the socio-economic role of goats for Burkina Faso farmers in general, and those of the Sahelian zones in particular, it enjoys little care in food. This causes deficiencies and nutritional imbalances which inter alia, weaken the immune system of the subjects and make them vulnerable to many diseases, including those causing of significant cases of abortions (Bloch and Diallo, 1991; Quirin et al., 1993). The work of Dembelé (2000), Konaté (2000), Zoungrana (2000) and Gnanda et al (2005) report on the burkinabe Sahel goat, the abortion's rates ranging from 15 to 27%. Dembelé (2000) and Gnanda et al. (2005) have highlighted the crucial role of the season on recorded abortions. The results obtained by Gnanda et al. (2005) reported an abortion rate average of 16.9% for the dry season against a zero rate for the rainy season.

Although the manifestations of these abortions may be linked to infectious diseases, nutritional deficiencies are also implemented causes (Charray et al., 1980 ; Bloch and Diallo, 1991**;** Bocquier et al*.,* 1998; Gnanda et al*.*, 2009). Deficiencies in minerals such as phosphorus (P), copper (Cu), zinc (Zn), manganese (Mn) and iodine (I) are most frequently involved in disorders of reproduction of herbivores (Bengoumi et al*.,* 1995 ; Lhoste et al., 1993). Tropical pastures are often deficient for most of these elements (Diagayété and Schenkel, 1986 ; Faye et al., 1986 ; Guérin et al., 1992 ; Gnanda et al*.,* 2009). This study was designed to measure the effect of a complementation in P associated or not to Cu and Zn on the rate of abortions in the Sahel burkinabe goats.

MATERIALS AND METHODS

The definitions proposed by Lhoste et al. (1993) and Moulin (1993) were selected to assess reproductive parameters (fertility rate, apparent abortion, kidding, prolific rate) and fertility rate). It comes:

- breeding females: any female over the average age to the fertilization and reproduction update;
- kidding rate: number of females having kidded at term by breeding female updated reproduction, expressed as a percentage;
- fecundity rate: number of small live kids by breeding reproduction, expressed in per cent of female ;
- apparent fertility rate: number of females that gave birth at term, plus those who aborted by reproductive female, expressed in per cent;
- prolific rate : number of live born kids by calving term, expressed as a percentage;
- abortion rate: the number of does having aborted by female which gave birth or aborted, expressed as a percentage.

Experimental site

The experiment took place in Katchari station, one of the stations of “Institut de l’Environnement et de Recherches Agricoles (INERA)” of Burkina Faso. This station is located north of Burkina Faso, between 13 ° 55' and 14 ° 05' North latitude and 0 ° 00' and 0 ° 10' West longitude. The climate of the region is Sahelian’s one and the annual rainfall varies between 400 and 550 mm, approximately 3 months of rainy season (mid-June to mid-September). The pastures of the Katchari station are characterized by three main units (Poissonnet et al*.,* 1997):

The dune systems or silting pastures: They are dominated by species such as *Cenchrus biflorus* Roch, *Aristida adscensionis* L., *Eragrostis tremula* Roem. and Sch.

The pastures of glazes: They consist of *Schoenefeldia gracilis* Kunth, *Alysicarpus ovalifolius* (S. and Th.) Leon, *Latolia glochidiata* Reichb., *Eragrostis tremula* Roem. and Sch, *Aristida adscensionis* L.

The pastures of depression and low-lying areas: There are major following grasses: *Schoenefeldia gracilis* Kunth, *Panicum laetum*, *Cassia obtisufolia* L.

Woody forage species the most frequently encountered on the field of study are: *Acacia raddiana* Savi, *Ziziphus mauritiana* Lam., *Acacia senegal* Del., *Balanites aegyptiaca* (L.) Del., *Combretum micranthum* G. Dom. and *Combretum glutinosum* Perr. ex DC.

Experimental animals, preparation for the reproduction and period of experimentation

Forty-eight (48) females of the goat flock of Katchari station were synchronized by using the method of the “effect goat" with two (2) older males over 5 years. Selected females were aged 1 to 6 years and included 28 nulliparous, five (5) Primiparous and 15 multiparous. The following steps have been followed for 317 days:

- (i) Separation of males and females for 92 days (August 1 to October 31) prior to application of measures of health prophylaxis and flushing. During this time, goats were nourished on natural pasture without complementation.
- (ii) Vaccination against pasteurellosis and blackleg and deworming of animals (males and females) at the end of the third month of separation. The flushing of females consisted to a complementation of 150 g of cottonseed meal per day and per animal during 30 days. During the period of separation and flushing, males were kept and fed on place in box.
- (iii) Introduction of the two males at the end of the flushing for 45 days (early December to middle January). Genitor’s males were used rotary way in the following manner: the first genitor spent all day grazing with the herd of goats female and stayed overnight in one of the four batches. He was replaced the next morning by the second genitor that remained with the females for the same length of time as the first. The use of the males during the time of 45 days had intended to allow the manifestation of 2 or even 3 cycles of oestrus for goats subjected to experimentation. Once the last breeding season, the animals were followed for 150 days.

Establishment of the groups and feeding of goats

Upon introduction of the males for reproduction, 48

females was divided into four (4) groups of 12 individuals, depending on the age and parity, to take account of due to the high variability of abortions on the basis of these two factors (Quirin et al*.,* 1993 ; Dembelé, 2000 ; Gnanda et al*.,* 2005). Four (4) groups were fed together for 210 days with the natural grazing (NG) as described previously and supplemented with multinutrient blocks (MNB) enriched in phosphorus (P) with or without a complement of Cu and Zn.

- Group 1 (witness batch, MNB): NG + MNB;
- Group 2 (MNBCu): NG + MNB enriched with copper;
- Group 3 (MNBZn): NG + MNB enriched with Zinc;
- Group 4 (MNBCuZn): MNB enriched with copper and Zinc.

The MNB had the following composition: 28% molasses, 10.5% of bran mil, and 27.5% of phosphate calcium bi, 14% of rice flour, 10% of salt of iodine and 10% of cement. Copper brought in the form of sulphate of copper (24.5% copper) at 0.04% of the composition of the MNB and zinc as zinc oxide (79% of zinc) at 0.09% of the composition of the MNB. All females went to pasture during 8 h per day (from 07: 00 to 12: 00) and from 14 h to 17 h. Complementation was offered after the pasture at night. The needs of goats in P (2.55 g/kg DMI), Cu (5 mg / kg DMI) and Zn (35 mg/kg DMI) have been fixed in accordance with the recommendations of Jarrige (1988), is estimated to 4 g, 7.5 mg, 55 mg respective daily intakes.

Parameters measured during the experiment

At the trough

(i) **Births and abortions**: Births and abortions were recorded as they happen, by a daily monitoring of the animals. Registered abortions included those developed and stillbirths; embryonic mortality has not been evaluated.

(ii**) Consumption and quality of multinutrient blocks** (**MNB**): Consumption of blocks was evaluated by weekly's weighings. Sampling was carried out in the MNB offered each animal for laboratory chemical analysis.

(iii) **Blood parameters in relation to the nutritional status of goats**: Blood samples were made one day before the start of supplementation on all goats, by 11 days during a period of 120 days and subsequently by interval of 30 days for a period during 60 days.

On pasture

Goats have been followed to pasture once per month to identify and inventory the main grazed food resources. To facilitate these data collect, grazed food resources were serial in six (6) categories: (i) the herbaceous; (ii) the leaves of woody; (iii) the fruits of wood; (iv) the flowers of wood; (v) other parts of wood (twigs, bark, gum); (vi) crop residue.

Pastures monitoring started the morning at 7 h to end the evening at 17 h, with a time of rest and watering 2 h (from 12 h to 14 h) of animals in goat fold. Monitoring included:

- a step of 10 min to identify bodies or parties grazed by goats.
- a step of 10 min for identifying plant species grazed by goats.
- a step of 2 hours for samples on organs or parts of the pasture plant species.

The step of census of organs or parts grazed by goats was to make comments, minute-by-minute (during 10 min) of food intake of five (5) experimental herd animals. The number of times that a body or a part of forage is consumed during the 10 minutes is materialized the plug of collection of data in the form of lines or squares (for example: | or □).

The step of identification of plant species grazed by goats was to register or identify scientific names or the vernacular names (local language) of pasture species. Scientific correspondences of the inventoried species to left their name in local language have been subsequently established.

The last step of the goat monitoring on pasture was to observe carefully for 10 to 20 seconds, eating an animal of parts or organs of grazed plant species, and then to realize samples near possible instead of grazing, representative samples of those parts or components for chemical laboratory analyses.

Serological, biochemical and chemical laboratory analysis

Search brucellosis and chlamydiosis, Campylobacteriosis

The serodiagnosis of animals in the study conducted depending upon the quick slide agglutination technique by the buffered antigen testing, particularly for brucellosis and Campylobacteriosis. All of these tests have been made within the national laboratory for breeding (LNE) in Burkina Faso and have focused on blood samples taken on the 66th day of trial on station and those derived from samples realize on farm goat having gat abortion.

Blood and food analysis

Analyses of serum components focused on the blood samples formed during first sampling and those prepared in the 33rd and 110th days of monitoring of goats to the

pasture. On these samples of blood, glucose, P, Cu, and Zn concentrations were determined. Fodder samples taken to the pasture and those collected multinutrient blocks, were analyzed to determine their total nitrogenous matter content, P, Cu, and Zn contents. The determination of glucose used the enzymatic colorimetric assay. This assay was conducted within the national laboratory for breeding (LNE) of Burkina Faso. The determination of total nitrogen matter of fodder and that of P (fodder and blood) were made by Colorimetry spectrophotometry using Nessler's reagent for nitrogen and nitro-vanadomolybdate as an indicator for phosphorus.

Cowper (Cu) and zinc (Zn) of fodder and those of blood samples were assayed at the atomic absorption spectrophotometry. Both analyses (nitrogenous matter and mineral interest of the study) were conducted in the laboratory of “Bureau national des soils (BANASOL)” of Burkina Faso using the processes and the reagents of Bio-direct laboratory of “La Villeneuve” of France.

Treatments and statistical analyses of the data

Data on the nutritional status and consumption of MNB were the subject of analysis of variance (ANOVA) using the SPSS software and the comparison of means was carried out according the SCHEFFE test. The Chi-square test was used for the analysis of goat reproductive parameters.

RÉSULT

Result of the test on abortion pathologies

The tests revealed no positive for three targeted abortion diseases including brucellosis, chlamydia and Campylobacteriosis.

Use and exploited pasture quality and consumption of blocks-molasses

The results on the relative contributions of fodder components consumed by the goats on the course (figure 1) indicate that the leaves of woody fodder natural grass and Woody fruit accounted respectively 37, 35 and 7% of this forage offered exploited. The main grazed woody species have been: *raddiana* Savi, *Balanites aegyptiaca (*L.) Del*., Bauhinia refuscens*, *Sclerocaria birera*, *Combretum glutinosum* Perr. ex DC*., Combretum aculeatum* Vent*., Combretum micranthum* G. Dom*., Acacia nilotica (*L.) Willd. ex Del*., Guiera senegalensis* J. F. Gmel*., Ziziphus mauritiana* Lam*.*

Among the herbaceous natural exploited by goats, the most dominant were: *Schoenefeldia gracilis* Kunth*, Zornia glochidiata* Reichb*. Cassia obtisufolia, Alysicarpus ovalifoliu et Leptadenia hastata (*Pers.).

The chemical composition of fodder consumed by goats grazing (table 1) indicates a significantly higher total nitrogen matter (TNM) content for the Woody component, compared to herbaceous food (cereal and bush straws combined) : 139 g TNM/kg DM against about 97 g TNM/kg DM. Phosphorus concentrations were close in value for the two components of fodder. The results on the levels of trace elements (Cu and Zn) in these forages consumed by animals show effective deficiency of Zn (table 1). The observation on the temporal evolutionary state of nutrient of forage eaten by goats to pasture (figure 2), shows changes in their concentrations from one month to another. These changes were less sensitive to phosphorus and copper. On the other hand, changes recorded on the zinc and nitrogen were significantly higher (figure 2). Consumption of multi nutrient blocks was an average of 28.75 g/animal/d (table 2), corresponding to intakes estimated by 0.11 g, 1.6 and 7.6 mg/animal/day for the P, Cu, and Zn respectively.

On a reasoned based of average consumption of 600 g DM/day/animal, by virtue of the low availability of food resources of the pastures during the study period (warm-season period), contributions cumulative pasture and complementation to the multi nutrient blocks satisfy 103, 105 and 68% of animal’s needs of P, copper and zinc respectively.

Serum parameters

When considering the values of serum parameters (table 2), there is overall a hypoglycemic nutritional status in all the goats monitored. The concentration obtained in this study about phosphorus remains within the limits of the recommended values for the element (3, 7-6, 1 mg / 100 ml).

The values of Cowper concentration of batch 3 and 4 have been higher than the reference value of the element, usually ranging between 70 and 140 µg/100 ml. However, all the goats of the study presented by the sub deficiencies, or even effective deficiencies in Zn (table 3), the recommended value the element being from 95 to 140 µg/100 ml.

Reproduction parameters

The use of the MNBZn induced a slightly greater reduction in the rate of abortions than that induced by the MNBCu, although this does not result in a significant difference (table 3). These are the younger goats that have the most aborted. Indeed, 60% of the cases of registered abortions focused on the subjects of this age group (table 4) and more than half (54%) of them were nulliparous. Complementation with Cu or Zn or both at

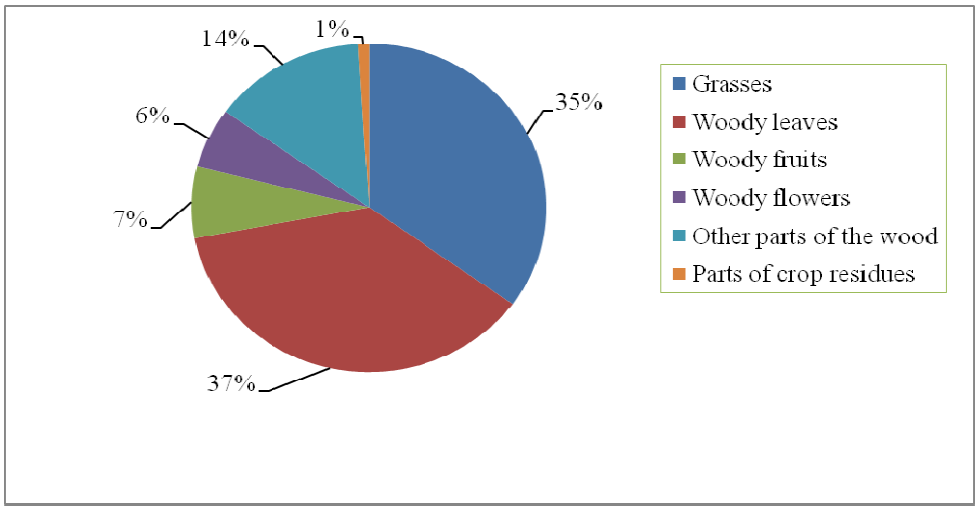

Figure 1 : Relative contributions of the different forage components consumed by the goats on the pasture during the trial

Table 1: Average nutrient contents of organs and part taken by animals during their food on pasture

	TNM (g/kg DM)	P (g/kg DM)	Cu (mg/kg DM)	Zn (mg/kg DM)
Woody forage	139,0±25,1	4,0±2,2	6,2±2,4	28,0±6,3
Grass forage	96,9±45,6	4,3±2,5	5,8±1,9	25,6±7,1
General average	117,9±41,1	4,2±2,3	6,1±2,1	26,8±6,5

NB. TNM: Total nitrogen maters

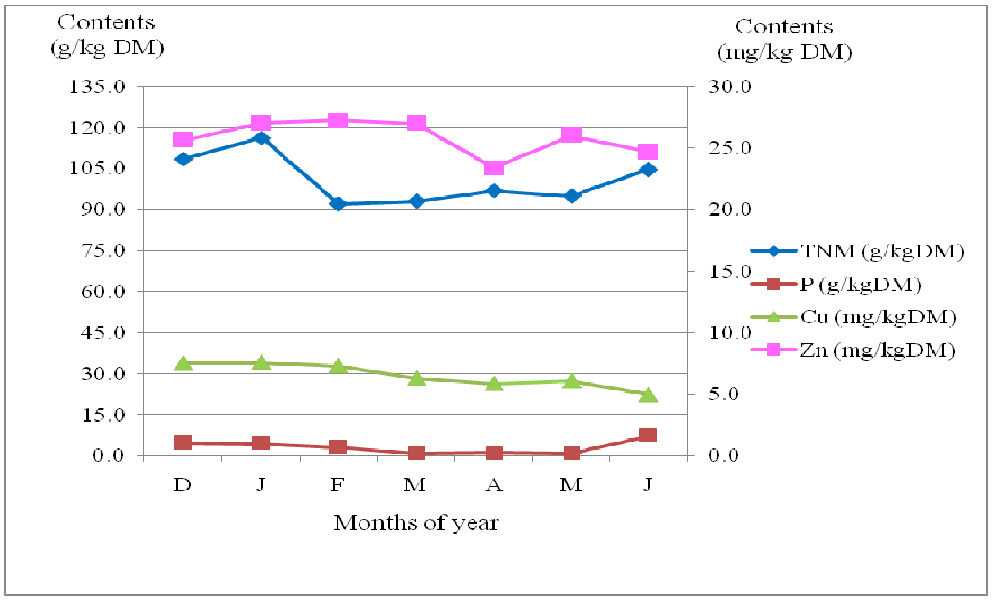

Figure 2 : Overall evolution of nutrients contents of the forage grazed by goats during trial on the pasture

the same time, induced for all three combined terms, an overall improvement of the rate of kidding and fecundity of 76 and 32 per cent respectively. The complementation with Cu or Zn or both at the same time, induced, for all

Table 2: Results on the use of blocks to molasses and goats reproductive parameters

Parameters	Group1 (batch witness, MNB)	Group 2 (MNBCu)	Group 3 (MNBZn)	Group 4 (MNBCuZn)
Consumed quantities and contents of molasses blocks				
Quantity consumed (g/animal/d)	27±9 [a]	28±8[a]	31±6[a]	29±5[a]
Contents of TNM (g/kg DM)	62 [a]	54,3 [a]	54,4 [a]	62 [a]
Contents of P (g/kg DM)	3,5 [a]	4,1 [a]	3,8 [a]	3,5 [a]
Contents of Cu (mg/kg DM)	15 [a]	106,7 [b]	12,4 [a]	87,2 [b]
Contents of Zn (mg/kg DM)	67,1 [a]	33,6 [a]	458,5 [b]	490,4 [b]
Serum parameters				
Blood sugar (mg/100ml)	40±23 [a]	39±23 [a]	34±19 [a]	37±16 [a]
The phosphoremie (mg/100ml)	5,3±2,0 [a]	5,9±3,1 [a]	4,7±2,7 [a]	6,2±',2 [a]
The cupremie (µg/100ml)	122±58 [a]	124±59 [a]	169±79 [a]	163±90 [a]
Zincemie (µg/100ml)	94±26 [a]	88±33 [a]	97±33 [a]	95±34 [a]
Reproduction parameters of goats				
Apparent fertility rate (%)	66,67 [ab]	69,23 [ab]	75 [b]	41,66 [a]
Abortion rate (%)	55,56 [a]	33,33 [ab]	20 [b]	20 [b]
Kidding rate (%)	25 [a]	46,15 [ab]	58,33 [b]	33,33 [ab]
Fecundity rate (%)	33,33 [a]	46,15 [ab]	58,33 [b]	33,33 [ab]

NB : MNB = Multinutritionnel Bloc ; P = Phosphorus ; Cu = copper et Zn = Zinc ;
TNM : Total nitrogenous maters
NB : [a b] : The numbers on the same line by parameters and marked with different letters differ significantly at the 5% threshold according to the SCHEFFE test.

Table 3: Blood glucose and serum mineral elements of the animals under the influence of the complementation

Factors	Blood sugar (mg/100ml)	Phosphoremie (mg/100ml)	Cupremie (µg/100ml)	Zincemie (µg/100ml)
Before the complementation	44±15 [a]	6,4±3,3 [a]	101±32 [a]	115±26 [a]
33[e] day after complementation	32±21 [a]	4,2±2,5 [a]	235±79 [b]	68±26 [b]
110[e] day after complementation	37±20 [a]	6,0±3,2 [a]	128±89 [c]	99±22 [c]
General average	**38±20**	**5,5±3,2**	**154±78**	**94±32**

NB: [a b]: The number on the same column and marked with different letters differ significantly at the 5% threshold according to the SCHEFFÉ test.

Table 4: Influence of age on rates of abortion and calving of the goats of the study

Age class of goats	Abortion rate (%)	Kidding rate (%)
1-2 years	61,54	17,86
2-3 years	50	28,57
3-4 years	16,67	71,43
4-5 years	0	100
5-6 years	0	100
General average	35,48	40

NB: The values in brackets indicate the number of goats in the updated reproductive age

three combined terms, an overall improvement of the rate of kidding and fecundity to 76 and 32 per cent respectively.

DISCUSSION

Zoosanitary tests

The status of the goats from the three abortive diseases diagnosed by the study, can be attributed to the method of applied test (Chartier and Chartier, 1988) or may correspond to a proven epidemiological reality. Indeed, authors such as Akakpo (1987) and Chartier and Chartier (1988), who had use the buffered Antigen test (BAT), have also found void prevalence rates. Most of the positive results that have been reported in the literature relating to the space eco-climate of the study area (Bloch and Diallo, 1991; N'diaye et al., 2000) relate to the use of the complement fixation process. For example, by using the process of complement fixation, Bloch and Diallo (1991) recorded on the Niger goats, prevalence rates depending on sites of investigations from 0.6 to 11.6% for brucellosis and 0.03 to 1% for Chlamydiosis. Also, it is shown that the prevalence of the affection of the diseases such as brucellosis and chlamydiosis, Campylo bacteriosis, is function of agro-climatic zones. It is higher in areas with warm and humid climate, at sedentary farming than in those with a hot and dry climate, at breeding transhumant (Akakpo, 1987). The fact that our study community climate is hot and dry, with a breeding mainly of mobility, could partly limit the presence or prevalence of these three abortion infectious diseases. In addition, it seems that inside a particular agro-climatic zone, the animal overload per unit area increases the chances of a high infection rate, while it is weak in the low number flocks (Akakpo, 1987; Bloch and Diallo, 1991).

Some authors (Tourrand and Landais, 1996) highlight the fact that in warm and dry areas, there is always in small ruminants, particularly among goats, a moderate infection of diseases such as brucellosis compared to cattle. In these areas, it is primarily malnutrition and parasitism which are frequently responsible for sterility problems, prolonged anoestrus and abortions in small ruminants (Bloch and Diallo, 1991).

Use and quality of tested multi nutrient blocks and food resources of the exploited pastures

The average level of consumption of the blocks (averaged 28.75 g/animal/day) may translate a low palatability of these products related in part to their hardness due in part to the mere presence of cement as a binder rate of 10%. Indeed, it seems that when using cement as a binder, it is still necessary to find an optimal rate of incorporation of the product, or a good balance between this product and the kaolin that would ensure a good intake of blocks (Kessé, 1999; Ouédraogo et al., 2005).The multinutritionnel block must be consistent, without being very hard to compromise its voluntary intake on the threshold of not being able to induce a significant effect on animals (McDowell et al., 1984).

The special predilection of the goat for ligneous fodder has already been referred to by a number of authors (Tezenas du Montcel, 1991; Kessé, 1999). It is recognized that through this particular food behaviour, goat accesses more diets, nitrogen and minerals compared to other ruminants such as sheep and cattle (Faye and Bengoumi, 1997). The relatively large contribution of herbs to the food intake of the goats of this study (35% average share of forage consumed) is explained by the presence on the pastures, the legumes such as *Zornia glochidiata*, *Cassia obtisufolia, Alysicarpus ovalifoliu* which agree well with the palatability of these animals.

Overall, total nitrogenous maters (TNM) of fodder, in particular those of the Woody component of the study, are close to the results reported by a number of previous work (Guerin et al*.,* 1988; Zoungrana, 1991; Ickowicz, 1995). Values reported by Guerin et al. (1988) on a sample of analysis of five (5) Woody, are averaged 150 g TNM/kg DM.

Levels of copper of pasture operated by the goats of the study (on average 6.1 mg/kg DM) are close to the values of deficiency relative to that element, estimated to be between 5 and 10 mg/kg DM (Faye et al*.,* 1986). According to these authors, the threshold of deficiencies for zinc varies from 45 to 50 mg/kg DM. That highlights the state of real deficiency in zinc of the pastures of the middle of study.

We may however underline the peculiarity of the leaves of certain trees such as *Pteracarpus lucens* and *Balanites aegyptiaca* for which the levels recorded for these two nutrients were relatively interesting, up to 15 mg/kg DM for copper and 60 mg/kg DM for zinc.

The average values recorded during this study for the two nutrients (zinc and copper) are comparable to those reported in several research studies (Faye and Grillet, 1984; Diagayété and Schenkel, 1986; Prasad and Gowda, 2005).

The levels for phosphorus remain slightly higher than the recommended minimum concentration which is 2.3 g/kg DM, with a limit of deficiency estimated at 1.8 g/kg DM (Guerin et al*.,* 1992).

Serum parameters

The standard of glucose content recommended by the literature for ruminants is 63 mg / 100 ml (Michel, 1980). Hypoglycemia observed with goats of the study is consistent with the findings already made by other authors (Kessabi, 1983; Gnanda, 2008). In ruminants, these are mainly volatile fatty acids (VFA) that constitute the main source of their energy supply (Kessabi, 1983). The mechanism of digestion in these ruminants provides generally very little glucose (Bocquier et al*.,* 1998).

However, dietary deficiencies that have always marked the Sahelian pastures of dry season during which this research is performed, have no doubt influenced the drop in blood sugar in goats. The low quantities of forage ingested daily as well as long distances to find the limited resources available on the pasture, did that cause additional costs in energy.

In a certain extent, low blood sugar in animals in the study could also have a link with the overall richness of their phosphoric diet. Indeed, literature (Kessabi, 1983) teaches that a diet rich in phosphorus can cause a decrease in blood glucose levels. However, as the results have shown, fodder collected by goats on the pasture, had a relative good phosphorus wealth, without forgetting the due contributions to the molasses blocks for this element. The results on the General concentration in phosphorus of animals suggest the confirmation of this observation of the satisfactory nutritional status of goats in phosphorus.

This study animals plasma copper levels are satisfactory. Two likely explanations can be advanced about that situation. First, there are contributions in copper due to the operation by the goats, food resources of course which offered relative availability of this element. Then, there's the contribution of multi nutrient blocks, especially copper used in their manufacture (copper sulfate) and which is of a high biological availability (McDowell et al., 1984).

The hypozincemie of the animals in this study seems to have as first cause, the state of deficiency of pasture in this element. The complementation was unable to cover the needs, probably because of the unsatisfactory level of consumption of the blocks, but also the low biological availability of zinc oxide. In addition, the fact that all the goats of the study were in a situation of hypoglycemia, may also help to explain their hypozincemie state. Indeed, it seems that animals energy deficient (who have so a tendency to mobilize their body reserves) have more limited capacities to use from the food rations, trace elements such as zinc (Faye and Mulato, 1991). We also know that there is no form of zinc at the tissue level storage. It is only stored temporarily in the sex cells, so reproductive function is seriously affected by a food deficiency of zinc (Michel, 1977).

Parameters of Reproduction

Several results have highlighted the susceptibility higher abortion in young subjects (Tekelye et al*.,* 1991; Quirin et al., 1993; Dembelé, 2000). One of the explanations for this situation would be that young females have not yet acquired immunity and development enough their genitals to properly support the gestation (Lhoste et al., 1993). The results reported by Quirin et al (1993) showed that among abortions that they have registered, 74.4% came from young goats from 0 to 1 year and other cases remaining (25.6%) affected the animals over age one (1) year. It seems that the low prevalence rate of abortions among the multiparous is explained partly by the fact that this category of subjects is immune in a sustainable manner with certain diseases abortion during previous pregnancies (Quirin et al*.,* 1993). That would explain the high rate of abortion among nulliparous because they have not yet acquired immunity and development of their genitals. Nutritional deficiencies, including the seasonal variations, are that animals are lagging behind in their development.

CONCLUSION

This study has shown that our trial community pastures have a satisfactory qualitative supply relatively sufficient in total nitrogenous matter and phosphorus. On the other hand, their levels of Cu are at a critical threshold and are deficient in Zn. The use of a multinutritionnel block at zinc effect in a this situation had a more interesting effect on reproductive parameters of goats compared to that at copper effect or at copper effect associated with zinc. This suggests that our future investigations focus on the assessment of the impact of the use of zinc to reduce the rate of abortion in goats, and especially among the young who are remain most affected. In this perspective, it would be desirable to use subsequently sulfate or carbonate replacement of zinc oxide. It will be also necessary to carry out tests of palatability and appetence on the molasses block used to gauge its consistency and its ease to be ingested to optimize the feeding of animals for this product.

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REFERENCIES

Akakpo AJ (1987). Brucelloses animales en Afrique tropicale. Particularités épidémiologique, clinique et bactériologique. Revue Elev. Méd. vét. Pays trop. 40 (4) : 307-320.

Bloch N, Diallo I (1991). Enquête sérologique chez les petits ruminants dans quatre départements du Niger. Revue Elev. Méd. vét. Pays trop. 44 (4) : 397-404.

Bocquier F, Leboeuf B, Rouel J, Chilliard Y (1998). Effet de l'alimentation et des facteurs d'élevage sur les performances de reproduction de chevrettes Alpines. INRA Prod. Anim. 11 (4) : 311-320.

Charray J, Coulomb J, Haumesser JB, Planchenault D, Pugliese PL (1980). Synthèse des connaissances sur l'élevage des petits ruminants dans les pays tropicaux d'Afrique Centrale et d'Afrique de l'Ouest. Rapport, FAC, Paris, France, 121 p.

Chartier C, Chartier F (1988). Enquête séro-épidémiologique sur les avortements infectieux des petits ruminants en Mauritanie. Revue Elev. Méd. vét. Pays trop. 41 (1) : 23-34.

Dembélé I (2000). Pathologies de la reproduction des caprins : enquêtes sero-épidémiologiques sur les avortements des chèvres au Burkina Faso. Mémoire de Technicien Supérieur d'Elevage

Spécialisé (TSES), Ecole Nationale d'Elevage et Santé Animale (ENESA) à Ouagadougou, Burkina Faso, 92 p.
Diagayété M, Schenkel H (1986). Composition minérale des ligneux consommés par les ruminants de la zone sahélienne. Revue Elev. Méd. vét. Pays trop. 39 (3-4) : 421-424.
Faye B, Grillet C (1984). La carence en cuivre chez les ruminants domestiques de la région d'Awash (Ethiopie). II. Origine de la carence en cuivre dans la région d'Awash. Revue Elev. Méd. vét. Pays trop. 37 (1): 42-59.
Faye B, Mulato C (1991). Facteurs de variations des paramètres protéo-énergétiques, enzymatiques et minéraux dans le plasma chez le dromadaire de Djibouti. Revue Elev. Méd. vét. Pays trop. 44 (3) : 325-334.
Faye B, Bengoumi M (1997). Données nouvelles sur le métabolisme des principaux éléments-traces chez le dromadaire. Revue Elev. Méd. vét. Pays trop, 50 (1) : 47-53.
Faye B, Grillet C, Tessema A (1986). Teneur en oligo-éléments dans les fourrages et le plasma des ruminants domestiques en Ethiopie. Revue Elev. Méd. vét. Pays trop. 39 (2) : 227-237.
Gnanda BI (2008). Importance socio-économique de la chèvre du Sahel burkinabé et amélioration de sa productivité par l'alimentation. Thèse de Doctorat Unique en Développement Rural, Institut du Développement Rural/Université Polytechnique de Bobo-Dioulasso, Burkina Faso, 188 p.
Gnanda BI, Nianogo JA, Zoundi SJ, Faye B, Meyer C, Sanou/Ouédraogo GMS, Zono O (2009). Relation entre état nutritionnel, avortements et fertilité de la chèvre du Sahel burkinabé. Revue CAMES, 9 : 104-110.
Gnanda BI, Zoundi SJ, Nianogo JA, Meyer C, Zono O (2005). Test d'un complément minéral et azoté sur les paramètres de reproduction de la chèvre du Sahel burkinabé. Revue Elev. Méd. vét. Pays trop. 58 (4): 257-265.
Guérin H, Richard D, Heinis V (1992). Variations de la composition minérale des fourrages en zone tropicale sèche : conséquences pour la nutrition des ruminants domestiques. Poster présenté à la 41e réunion annuelle de la Fédération européenne de zootechnie (FEZ), tenue à Toulouse (France) du 9 au 12 juillet 1992.
Guérin H, Friot D, Mbaye ND, Richard D, Dieng A (1988). Régime alimentaire des ruminants domestiques (bovins, ovins, caprins) exploitant des parcours naturels sahéliens et soudano-sahéliens. II. Essai de description du régime par l'étude du comportement alimentaire. Facteurs de variation des choix alimentaires et conséquences nutritionnelles. Revue Elev. Méd. vét. Pays trop., 41 (4) : 427-440.
Jarrige R (1988). Alimentation des bovins, ovins et caprins. INRA (Institut National de la Recherche agronomique), Paris (France), 476 p.
Kessabi M (1983). Etude de quelques paramètres biochimiques sériques chez le mouton en zone Darmous. Ann. Zootechn. 27 : 583-584.
Kessé GPH (1999). Mise au point d'une pierre à lécher pour les ruminants. Mémoire de fin d'étude d'ingénieur de développement rural, option élevage, IDR, Université Polytechnique de Bobo-Dioulasso, Bobo, Burkina Faso, 77 p.
Konaté S (2000). L'élevage des caprins au Séno : Résultats de quelques paramètres de production en station et dans les exploitations traditionnelles de Lelly. Mémoire de Technicien Supérieur d'Elevage Spécialisé (TSES), Ecole Nationale d'Elevage et Santé Animale à Ouagadougou, Burkina Faso, 48 p.
Lhoste P, Dollé V, Rousseau J, Soltner D (1993). Manuel de zootechnie des régions chaudes. Les systèmes d'élevage. Ministère de la Coopération Française, Paris, France, 288 p.
McDowell LR, Ellis GL, Conrad JH (1984). Supplémentation en sels minéraux pour le bétail élevé sur pâture sous les tropiques. Revue Mondiale de Zootechnie, 52 : 2-12.
Michel MC (1977). Les profils métaboliques chez les bovins. In : Cottereau P. J. Gleize, A. Magat MC, Michej G, Mouthon JM, Perrier RW (Eds). Profils métaboliques en médecine vétérinaire et en médecine humaine, table ronde N° 10, pp. 878-885.
Michel MC (1980). Utilisation des profils métaboliques dans l'élevage bovin : quelques résultats statistiques obtenus de 1975 à 1980. Bull. Techn. C.R.Z.V.Theiz, 41: 23-31.
Moulin CH (1993). La diversité du fonctionnement des troupeaux de petits ruminants dans la communauté rurale de Ndiagne (Sénégal), Thèse de l'INA, ENSA/Dijon (France), 248 p.
MRA/DGESS/DSS, 2014. Annuaire des statistiques de l'élevage. Annuaire 2012. 180 p.
N'diaye M, Tillard E, Faye B, Lancelot R, Akakpo AJ, Richard D (2000). Relations entre performances de reproduction, statuts maternels physiologiques, infectieux et nutritionnels des chèvres des régions sahéliennes et soudaniennes du Sénégal. In : Faye Bernard (Eds). Bilan et perspectives de programmes européens sur les petits ruminants en Afrique », symposium technique T1 intitulé Montpellier, pp. 175-197.
Ouédraogo T, Bougouma-Yaméogo VMC, Bama S, Ouédraogo H (2005). Mise au point de blocs multinutritionnels à base d'ingrédients locaux : utilisation par les ruminants. *Revue Etudes et recherches sahéliennes*, N° 12 : 65-78.
Poissonnet J, Sanon HO, Kiema A (1997). Etude des potentialités d'un terroir comme base de réflexion pour la gestion des ressources naturelles renouvelables dans une option de développement villageois. Rapport final R/D 4 du 7e FED, Institut de l'environnement et de recherches agricoles (INERA), Ouagadougou, Burkina Faso, 46 p.
Prasad C, Gowdan N (2005). Importance of trace minerals and relevance of their supplementation in tropical animal feeding system. Review Indian Journal of Animal Sciences 75 (1): 92-100.
Quirin RT, Leal M, Guimaraes FC (1993). Epidémiologie descriptive des avortements caprins en élevage traditionnel du Nord Est brésilien. Enquêtes rétrospectives de carrières de femelles. Revue Elev. Méd. vét. Pays trop. 46 (3) : 495-502.
Tekelye B, Kasali OB, Tsion A (1991). Reproductive problems in crossbred cattle in central Ethiopia. Animal. Reproduction Sci, 26: 41-49.
Tezenas du Montcel L (1991). Capacité de charge en saison sèche d'un parcours en zone Nord soudanienne : cas d'une utilisation des petits ruminants. In : Actes du IVéme Congrès international des terres de parcours, 22-26 avril à Montpellier, France, volume I, p. 663-667.
Tourrand JF, Landais E (1996). Productivité des caprins dans les systèmes de production agricole du Delta du fleuve Sénégal. *Revue Elev. vét. Pays trop*., 49 (2) : 168-173
Zoungrana TD (2000). Etude comparative de la productivité des ovins et caprins de type sahéliens dans les élevages traditionnels en zones pastorales et agro-pastorales du Sahel burkinabé. Mémoire de Technicien Supérieur d'Elevage Spécialisé (TSES), Ecole Nationale d'Elevage et Santé Animale (ENESA), Ouagadougou (Burkina Faso), 75 p.