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Characterization of the nutritional value of the upper and lower parts of the stems of three potentially dual-purpose millet populations in comparison with those of varieties Souna 3 and Thialack 2 in Senegal

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Abstract This study focused on the characterization of the nutritional value of the upper and lower parts of the stems of 3 millet populations assumed to be dual-use (SL28, SL169 and SL423) in comparison with the Souna 3 and Thialack 2 varieties. 10 rations were made from 1 to 2 cm stemmed millet rods and distributed in a trial of differential balances to ships placed in metabolism cages with a commercially available supplement. Three trials were concomitantly conducted on three homogeneous batches of four rams. The statistical analysis of the results obtained revealed differences in the voluntary intake of dry matter (MSVI), the digestive utilization coefficients (DUC) of the nutrients calculated by the differential method, the energy values and the digestible nitrogenous matter (Pr<0.05) and the type of millet considered (Pr<0.05). The upper parts gave the best results. The variety Thialack 2 and lineage and SL169 gave the best results for the (DUC) of the different nutrients as well as the ingestions of dry matter. For the energy available per ha, SL423 and Thialack 2 provide the best results, giving them a prominent place in the idea of dual-purpose millet.

Keywords Nutritional value, millet stems, dual-purpose millet, Senegal

Introduction

In the Sahel, livestock farming is the main activity of rural populations [1]. It plays a central role in the economies of West African countries, with a contribution to agricultural GDP of up to 44% [2].

In Senegal, the livestock sector occupies an important place in the national economy, with an average contribution of 29.1% and 4.2% to primary and national GDP, respectively, the period 2000-2012 [3]. This livestock operation, which employs about 350,000 rural Senegalese families, close to 3 million people, is at the heart of the achievement of the development objectives of increasing productivity, achieving food security and fighting against poverty [4].

Indeed, Senegal has a livestock of more than 16 million head in 2014, which has grown by 2% per year over the last five years [5] and the most important are by Sheep (37.4%), goats (31.9%) and cattle (21.9%) [6]. However, recent changes in Senegalese livestock systems are dominated by successive climatic crises, deteriorating conditions in the physical environment and increasing imbalance between food needs and agricultural production [7]. During this same period, agropastoralism developed in the groundnut basin where serer families developed a model of association and intensification of agriculture and livestock [8]. Otherwise, this practice has been the cause of a considerable evolution of the forage system: residual pastoral space, completely cleared by clearing, disappearance of fallow, abandonment of valley grazing in favor of practices of appropriation and collection of by-products of culture [7]. Thus, Senegalese livestock farming, which has depended on natural pastures, continues to be progressively reduced by the reduction of areas which can be exploitable by farmers.

In addition, population growth and the phenomenon of climate change have led to increasing pressure on scarce pastoral resources [3]. This situation exposes livestock to various constraints, among which feeding remains a permanent factor contributing to poor livestock performance, particularly in the arid and semi-arid agro-ecological zones with the greatest potential [9]. Furthermore, pastoralists make use of counterfeit foods to address energy and protein needs that are not met by fodder alone. At the same time, forage production and conservation techniques are still under control or practiced by livestock farmers [10].

The combination of these hazards constitutes a major constraint to the externalization of the pastoral potential for meat and milk production in Senegal [11]. The pressure on natural pastures is very high, while the quantity and quality of these are poor during the dry season [12]. Crop residues are used in the agro-sylvopastoral zone where better legume haulms are exported to urban areas to support small ruminant farming to the detriment of peasant fattening [11].

Among the crop residues, cereal straw represents an energy source of interest in Senegal [13]. Millet stems, in particular, represent interesting forage possibilities. However, their ingestibility and digestibility vary greatly according to the period and mode of harvesting [14]. The use of millet as fodder for animals thus lends itself to a good integration between agriculture and livestock.

In Senegal, the use of millet straws by cattle has been the subject of many studies, notably on the dietary values of the stems. On the other hand, little information exists on the lines supposed to be dual-purpose developed by the Senegalese Institute of Agricultural Research (ISRA). Moreover, no study has yet been made on the difference in food values between the upper and lower parts of these millet stems; which is the subject of this study.

We present here the results obtained during a stationary farming trial to evaluate the feeding value of the upper and lower parts of the stems of three potentially dual-purpose millet populations compared to those of the varieties Souna 3 and Thialack 2.

Materials and Methods

Study Site

The work was carried out at the Center of Application of Livestock Techniques of the National School of Agriculture (ENSA) of Thies (14 ° 16'N and 16 ° 57'W). The trial took place for two (02) months (November – January, 2017).

Animals and Housing

For the purposes of the study, 27 sheep of the Peulh-Peulh breed, all male of similar age and weight were purchased at the cattle market. As soon as they arrived, the animals were dewormed and quarantined for about 20 days. After identification and weighing, 15 sheep were selected on the basis of their similarity. Thus, for the digestibility measurements, 12 animals of average weight 37 kg were selected, i.e. 4 subjects per test. Before the start of the trial, sheep was treat with anti-infectious in order to remove any disease incubation during testing. Before and after each feeding, the animals were weighed on an empty stomach.

The animals were placed in individual metabolism cages in a well ventilated and continuously lit shed (24h/24h). The device, sized according to the size of the animal, makes it possible to measure precisely the quantities of food ingested and excreted by the sheep. Each cage is equipped with a feeding trough, a drinking trough and, underneath, a bucket and a basin to recover urine and feces separately.

Food: millet stems

The feed used in the study consisted of the stems of the 5 millet inlets which are the 3 populations SL28, SL169 and SL423 and the two approved varieties Souna 3 and Thialack 2. The millet was cultivated in plots at the National Center for Agronomic Research (CNRA) of Bambey, then the stems were transported to ENSA for the study.

On receipt, the stems were cut into two distinct parts, for each type of millet there were then two types of food: the upper part and the lower part of the stems. These were chopped manually in small strands to facilitate their use by the animals and then stored in a hangar reserved for this purpose. A total of 10 rations were thus obtained from the 5 millet inputs. All rations were analyzed in the laboratory to determine their chemical composition (Table 1).

Table 1: Assignment of food in the experimental units by a random number generating table

Series	Order	Number generated	Composition of the Rations	
1st	1	10	Lower part of Souna 3	+ 250 g concentrate
	2	5	Upper part of Thialack 2	+ 250 g concentrate
	3	7	Lower part of SL423	+ 250 g concentrate
2nd	4	9	Upper part of SL28	+ 250 g concentrate
	5	1	Upper part of SL423	+ 250 g concentrate
	6	3	Lower part of SL169	+ 250 g concentrate
3rd	7	2	Upper part of SL169	+ 250 g concentrate
	8	8	Lower part of Thialack 2	+ 250 g concentrate
	9	4	Upper part of Souna 3	+ 250 g concentrate
4th	10	6	Upper part of Thialack 2	only
	11	11	Upper part of SL169	only
	12	12	Lower part of SL28	+ 250 g concentrate

Construction of lots

Twelve (12) digestibility tests of which 10 differential balances and two (02) unitary were performed. The forages were supplemented with 250 g of commercial concentrate throughout the study. Three (3) trials were conducted concurrently on three (3) homogeneous lots of four (4) sheep. Each lot receives randomly, for eight (8) days, either the upper or lower parts of the millet stems as a base ration.

The concentrate was added to the rations to prevent the animals from losing too much weight during the trial period because millet stems alone would be unable to satisfy the maintenance needs of the animals because of their indigence in digestible nitrogen (DN).

Experimental device

Each batch referred to above constitutes an experimental unit or block with 4 repetitions (number of animals per block) in which the food is the only factor studied. The treatments are the 5 entries of millet with as levels or modalities the upper parts and lower parts of the millets stems.

To guard against possible fluctuations in uncontrolled factors, a completely random assignment of the tests was made to the experimental units. This random distribution of the tests was carried out using tables generating random numbers.

Conduct of the test

Pre-experimental phase

Before the start of the test, a pre-experimental period of 25 days was observed. It has allowed animals to adapt to new types of food and housing. The quantities of food distributed at each meal were weighed each morning as well as the refusals which had to be equal to 30%. The adaptation phase was stopped after the ingested food quantities stabilized at a maximum corresponding to the amount of sheep ingestion and the refusal rate equaled the threshold.

Experimental phase

During this period of 9 days, the food was distributed in 2 daily doses (at 8:00 am and 4:00 pm). Each day the concentrate (250 g) was given before the straw was distributed (7:30 am). In addition, for each animal, the meal was distributed just after the cage was cleaned and before moving to another animal to prevent it from remaining too long in front of an empty manger.

Three samples were made daily throughout the experimental period:

- A sample of the fodder distributed: obtained by sampling the fodder mass to be distributed to the animals. A portion of this sample is placed in an oven at 105 ° C. to determine the dry matter of the food and the other part conserved for subsequent chemical analyzes.

- A sample of refusal material: obtained by sampling from the remaining foods not consumed by each animal.
- A sample of fecal matter: obtained from the feces produced by each animal.

In total, therefore, in each block 7 samples of forage distributed, 28 refusal samples and 28 fecal samples were obtained at the end of the tests.

Chemical analyzes and calculation

At the end of the experiment, the samples obtained per day and per sheep were grouped together for analysis at ENSA laboratory. Thus, all the samples were first crushed with a hammer mill equipped with a 1 mm diameter sieve and then with a cyclotec to obtain a finer product. After each grinding, the dust remaining on the screen and the bag were removed to avoid contaminating the next sample.

The chemical analyzes were carried out according to the AOAC method [16]. The Dry Matter (DM) assessment used method 934.01; the Organic Matter (OM) : method No. 942.05; the Crude Cellulose (CC): method No. 978.10; for the Crude Protein (CP), the Kjeldahl method using the N x 6.25 content was used.

The non-nitrogenous extractives (NNE) are obtained by calculation method from the following formula:

NNE (%) = 100 - (M + As + CP + CC), where M (Moisture), As (Ash), CP and CB are in percent of Dry matter.

Determination of nutritional value

The energy value of millet straws was determined according to the new French fodder equivalents: Unite Milk Forage (UMF) and Meat Fooder Unit (MFU) from the digestibility results. For protein values, the Digestible nitrogenous matter (DNM) was calculated.

Determination of the energy value:

$$UMF = NEL / 1730 \text{ and } MFU = NEMMEP / 1855$$

With:

NEL = Net energy for lactation and NEMMEP = Net energy for maintenance and meat production.

ENL = EM x kl in kcal / kg

ENEV = EM x kmf in kcal / kg

Kl, km, kf and kmf are coefficients of use of metabolizable energy (EM):

Kl = 0.60 + 0.24 (q-0.57)

Km = 0.287q + 0.554

Kf= 0.78q + 0.006

Determination of digestible nitrogenous substances

For digestible nitrogenous matter, they are obtained by multiplying the total nitrogen content (g/kg.DM) of the diet or feed by the apparent digestibility of nitrogen.

Calculation of digestibility

Digestibility was calculated by the differential method. This makes it possible to obtain an approximation of the digestibility of the foodstuffs which can not constitute on their own a ration, either because of their composition or because of their low palatability. The typical pattern of these digestibilities is as follows: Let A and B be two components of a ration (B cannot be administered alone to the animal, for example the Concentrate), in a first step a digestibility experiment is carried out with A (Millet straw in this test) which makes it possible to know the coefficients of digestibility of A. A second experiment uses the A + B ration in known proportions. From these results, by difference and using the data of the first experiment, the coefficients of B will be determined.

Either the digestibility of a ration (dR) containing a proportion (X) on the basis of the dry matter of concentrate B and dA the digestibility of the fodder distributed alone.

$$dB = \frac{dR-(1-X)-dA}{X}$$

Processing and analysis of data

Data entry and preliminary processing was done using the Microsoft Excel 2013 spreadsheet, which also made it possible to make simple descriptive statistics of certain data and graphic design. The other data were analyzed using a Generalized Linear Model (Proc GLM) from SAS (Statistical Analysis System, 2000). The following model was used:

Y = μ + αi + βj + αiβj + £

Where :

μ : overall average

αi : effect of the "variety" of millet "i": SL28, SL169, SL423, Souna 3 or Thialack 2

βj : effect of the part of the rod considered "j": upper part or lower part

αiβj : interaction between effect of the "variety" of millet "i" x effect of part "j"

£ : random residual difference between the "variety" of millet "i" and the portion of stem "j"

Results

Table 2: Synthesis of the results of the study

	SL28		SL169		SL423		SOUNA 3		THIALACK 2		P-value
	UP	LP	UP	LP	UP	LP	UP	LP	UP	LP	
VIDM (Kg.DM)	39.81 a	33.52 b	41.95 a	29.77 bc	42.49 a	27.02 c	32.36 b	30.13 bc	38.53 a	40.93 a	*< 0.001*
Forage Congestion (CU)	1.66 bc	1.94 bc	1.56 c	2.20b	1.54 c	2.94 a	2.02 b	2.23 b	1.70 bc	1.59 bc	*< 0.001*
Digestibility (%)											
Dry Matter	40.93 a	36.28 b	40.89 a	38.21 b	43.18 a	35.79 b	36.53 a	38.97 ab	44.26 a	41.46 a	*0.002*
Organic Matter	45.65 a	50.50 ab	43.70 a	42.37ab	45.93 ab	40.97 b	38.25 b	41.82 ab	47.32 a	44.97 a	*0.017*
TNM	36.26 a	33.76 a	35.88 a	34.17 a	34.64 a	32.15 a	35.27 a	34.33 a	37.34 a	35.21 a	*0.395*
Crude Fiber	48.64 a	36.22 c	42.17 b	40.94 b	43.06 b	44.84 b	31.55 c	42.09 b	40.93 b	42.46 b	*0.001*
NNE	42.73 b	40.74 b	44.88 b	42.49 b	45.19 b	37.24 c	40.50 b	42.73 b	52.64 a	43.85 b	*0.016*
Nutritional values											
Milk forage unit	0.51	0.44	0.48	0.46	0.51	0.44	0.41	0.43	0.53	0.50	
Meat forage unit	0.39	0.31	0.36	0.34	0.39	0.32	0.29	0.31	0.42	0.38	
Nitrogen value	19.51	15.09	21.60	17.77	18.36	12.89	20.67	13.73	25.17	16.13	
Forage yield (Kg.DM/ha)	3059.00		5213.84		7403.12		3044.82		5214.29		
Energy yield per hectare	1071.92		1764.96		2624.31		900.16		2060.67		

The averages which are followed by the same letter are not significantly different with the Duncan test (P ≤ 0.05). ***UP:** Upper part; **LP:** Lower part**;** **VIDM**: Voluntary ingested dry matter (Kg.DM); **CU**: congestion unit; **TNM**: Total Nitrogenous Matter; **NNE**: Non-nitrogenous extractives; **MkFU**: Milk Forage Unit, **DM**: Dry matter; **ha**: hectare*

Voluntarily ingested dry matter

The dry matter voluntarily ingested by the sheep during the test is given in Figure 1. The statistical analysis revealed highly significant differences (Pr<0.001) between the upper and lower parts of the millet stems. With the exception of the Thialack 2 variety, the best ingestions were observed with the upper parts of the millet stems.

The best ingestions were given by the SL423 (42.5 g.Ms/kg0.75) and SL169 (42.00 g.MS / kg0.75) lines. Compared to the Souna 3 and Thialack 2 varieties, the strains (SL28, SL169 and SL423) have the best ingestions, particularly in their upper part.

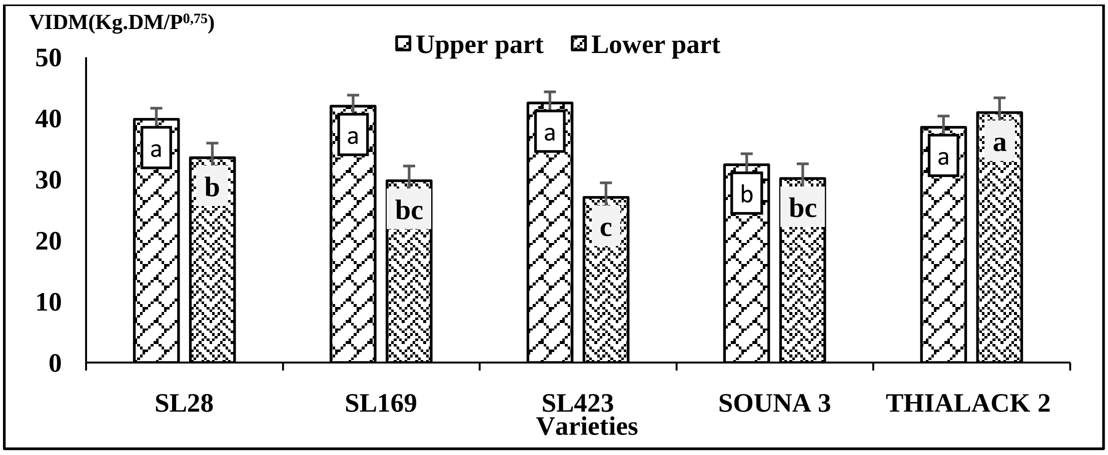

Figure 1: Voluntary ingestions of the upper and lower parts of the varieties Souna 3 and Thialack 2 compared to those of the 3 potentially dual-purpose millets populations SL28, SL169 and SL423

The averages which are followed by the same letter are not significantly different with the Duncan test (P ≤0.05).

Values of forage congestion

Statistical analysis showed that the congestion values of the different types of rations show highly significant differences (Pr<0.001) (Figure 2). Unlike ingestions, the largest congestion values were obtained with the lower parts of the millet stems except for the Thialack 2 variety (1.59 and 1.70 CU respectively for the lower and upper parts). The largest congestion values were observed with line SL423 (2.94 CU), followed by the variety Souna 3 (2.23 CU) and line SL169 (2.20 CU). Forages from the upper parts of populations SL423 and SL169 have the lowest congestion values of 1.54 and 1.56 UE, respectively.

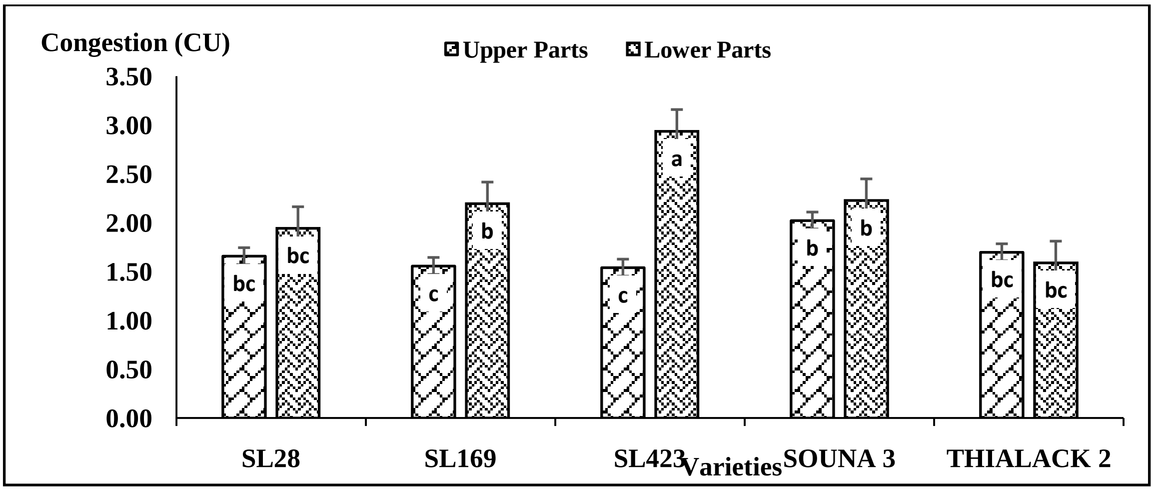

Figure 2: Upper and lower congestion values of the millet varieties Souna 3 and Thialack 2 compared to those of the potentially dual-purpose millet populations (SL28, SL169 and SL423).

The averages which are followed by the same letter are not significantly different with the Duncan test (P ≤ 0.05).

Digestibility of nutrients

Digestibility of the dry matter (ddm)

The results of dry matter digestibility analyzes show highly significant differences between different food types (Pr = 0.002) (Figure 3). The dry matter of the upper parts of the stems proved to be more digestible than that of the lower parts in all the millet types studied except for the variety Souna 3. For this, the lower parts gave better digestibilities (38.97% against 36.53% for the upper parts). Overall, Thialck 2 and SL423 and SL28 gave the best digestibilities (43.18%, 40.93% and 40.89%, respectively).

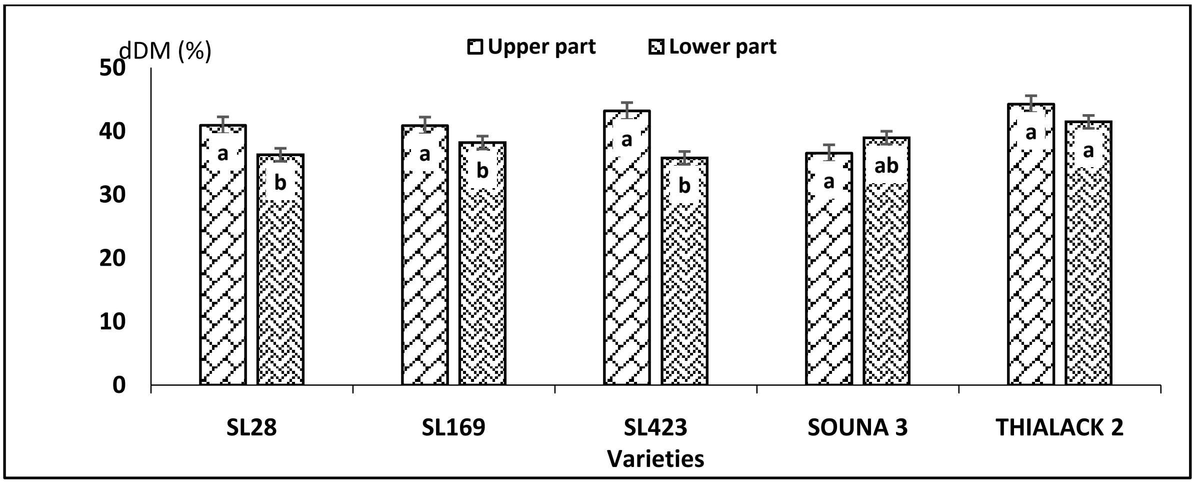

Figure 3: Dry matter digestibility of the upper and lower foods of the Souna 3 and Thialack 2 millet varieties compared to the 3 potentially dual-purpose millets populations (SL28, SL169 and SL423)

The averages which are followed by the same letter are not significantly different with the Duncan test (P ≤ 0.05).

Digestibility of the organic matter (dom)

Analysis of the results indicates significant differences (Pr = 0.017) on the digestibility of the organic matter (dOM) of the different rations (Figure 4). The upper parts gave the best digestibilities, except for the variety Souna 3. Overall, the Thialack 2 variety gave the best digestibilities (47.32% and 44.97% respectively for the upper and lower parts).

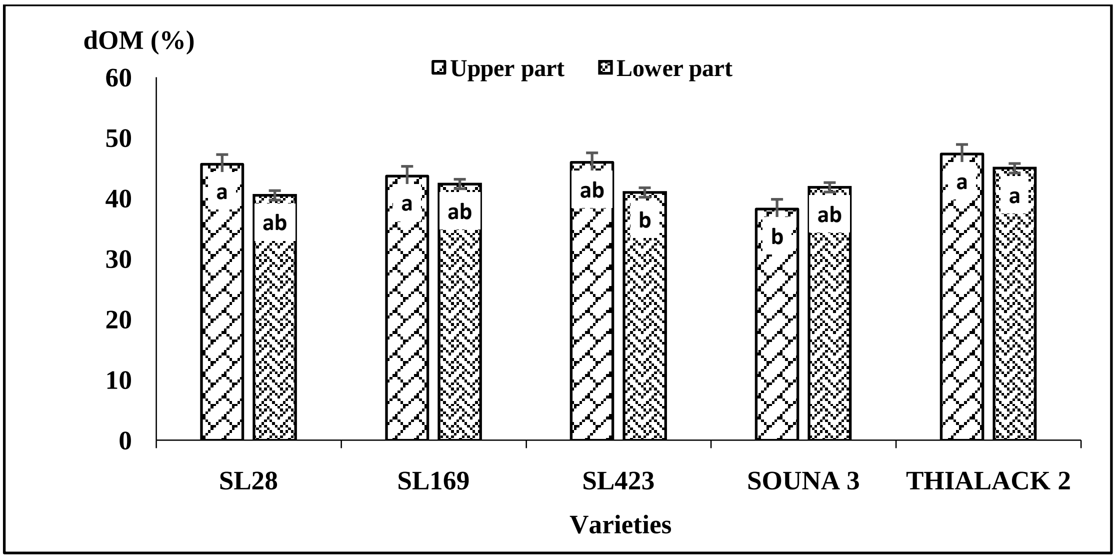

Figure 4: Digestibility of the Organic matter of forage constituted by the upper and lower parts of millet varieties Souna 3 and Thialack 2 compared to that of the 3 potentially dual-purpose millets populations (SL28, SL169 and SL423).

The averages which are followed by the same letter are not significantly different with the Duncan test (P ≤ 0.05).

Digestibility of total nitrogenous matter (dtnm)

Analysis of the results shows that no significant difference was observed in the digestibility of the Total Nitrogenous Matter between the different foods constituted by the 5 millet inputs (Pr = 0.395) (figure 5).Considering the absolute value, dTNM is relatively higher with the upper parts in all varieties (about 35.85% versus 33.92%).

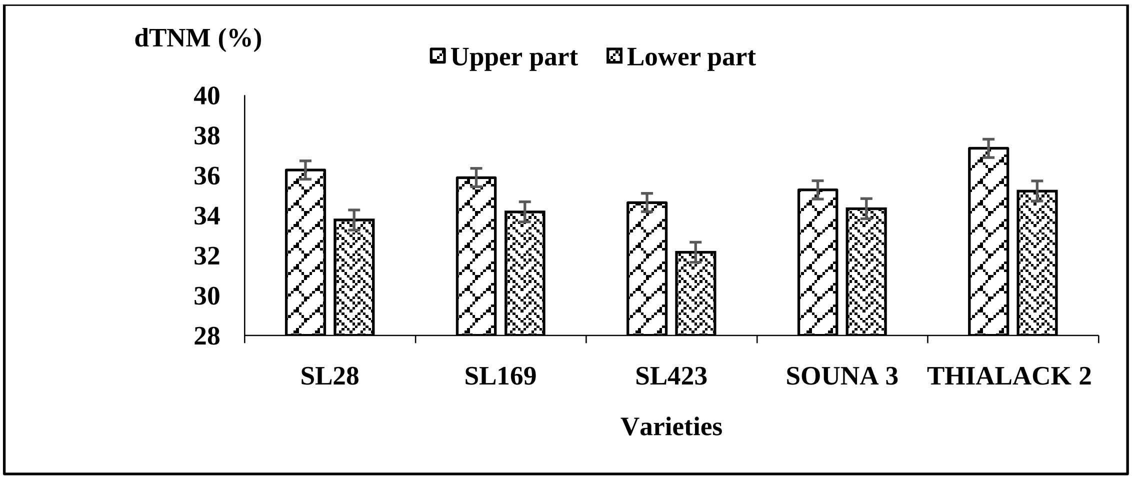

Figure 5: Digestibility of the total nitrogenous matter of fodder constituted by the upper and lower parts of the millet varieties Souna 3 and Thialack 2 compared to that of the 3 potentially dual-purpose millets populations (SL28, SL169 and SL423).

The averages which are followed by the same letter are not significantly different with the Duncan test (P ≤ 0.05).

Digestibility of crude fiber

Highly significant differences were observed in the digestibility of crude fiber (dCF) in different foods (Pr = 0.001) (Figure 6). For the upper parts, the three lines (SL28 SL423 then SL169) gave the best digestibilities (respectively 48.64%), 40.93% and 42.17%) followed by the Thialack 2 variety. SL423 and SL169 gave values similar to those of the Souna 3 and Thialack 2 varieties.

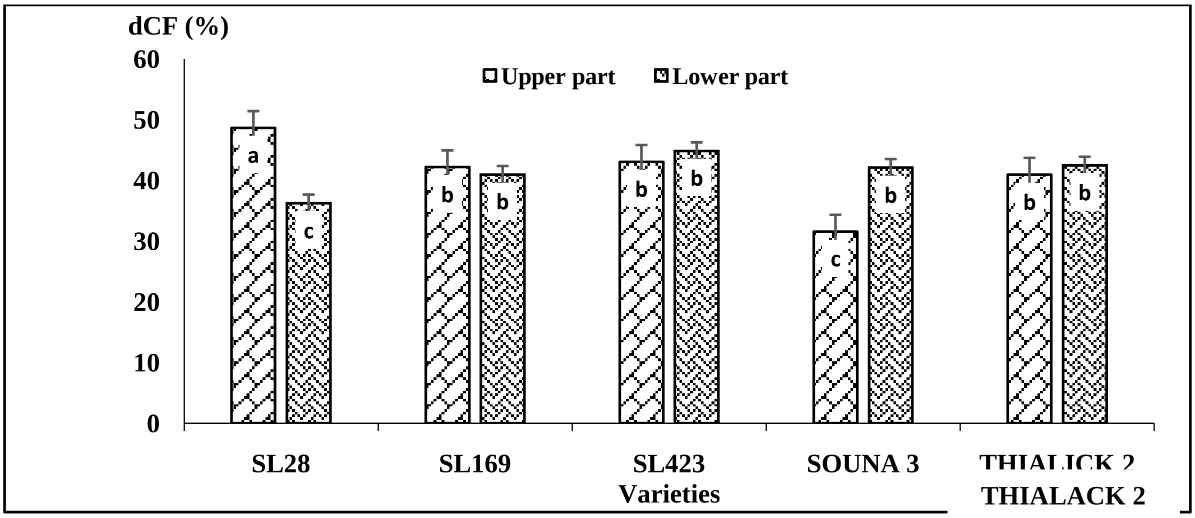

Figure 6: Digestibility of crude fiber from forage constituted by the upper and lower parts of the millet varieties Souna 3 and Thialack 2 compared to that of the 3 potentially dual-purpose millets populations SL28, SL169 and SL423.

The averages which are followed by the same letter are not significantly different with the Duncan test (P ≤ 0.05).

Digestibility of non-nitrogenous extractives (NNE)

The results of the statistical analysis showed a significant difference (Pr = 0.016) between the different food types for the digestibility of the non-nitrogenous extractives (dNnE) (Figure 7). With the exception of the Suna variety 3, the dENA of the upper parts is higher than that of the lower parts in all the different rations. The Thialack 2 variety showed the best digestibilities (52.64%), the 3 SL423, SL169, SL28 lines gave respectively 45.19%, 44.88%, and 42.73%.

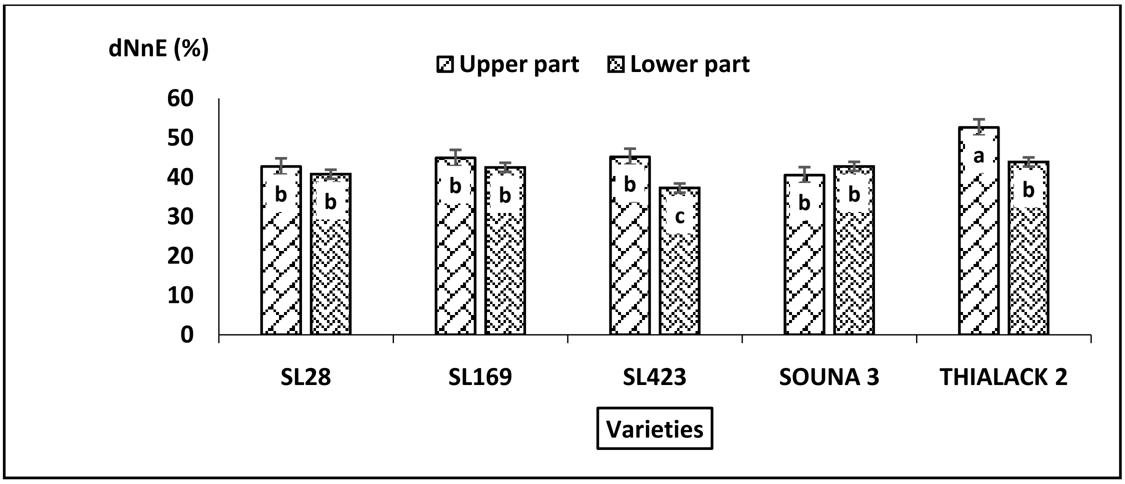

Figure 7: Digestibility of non-nitrogenous extractives from the upper and lower parts of the millet varieties Souna 3 and Thialack 2 compared to the three potentially dual-purpose millets populations (SL28, SL169 and SL423).

The averages which are followed by the same letter are not significantly different with the Duncan test (P ≤ 0.05).

Nutritionals Values

Energy values: milk forage unit (MKFU) and meat forage unit (MTFU)

The upper parts of the stems of the Thialack 2 variety and the 3 millet populations (SL169, SL423 and SL28) gave the best energy values (0.53 MkFU/kg.DM, 0.48 MkFU/kg.DM, 0 .51 MkFU/kg.DM). For the lower parts, the Thialack 2 variety offers the best energy content (0.50 MFU/kg.DM); followed by the line SL169 (0.46MkFU/kg.DM). The SL423 and SL28 have the similar energy value for both the upper and lower parts.

For meat forage units, the results show the same trends as for UFL with lower values (ranging from 0.29 to 0.42 MtFU/kg. DM and from 0.31 to 0.38 MtFU/kg.DM for the upper and lower parts respectively).

Nitrogen value

The evaluation of the protein values was limited to the calculation of the digestible nitrogenous matter (DNM) of the different foods. The general observation is that the upper parts are richer in DNM than the lower parts in all the different millet stems. For the upper parts, the best MAD content was obtained in the Thialack 2 variety (25.17 g.DNM/kg.DM) while the SL169, SL28 and SL423 lines gave relatively lower values (21, 60, 19.51 and 18.36 g.DNM/kg.DM).

For the lower parts, the most important value was obtained with line SL169 (17.77 g.DNM/kg.DM). The Thialack 2 variety and the SL28 line have intermediate values with respectively 16.13 and 15.09 g.DNM/kg.DM.

Discussion

Ingestions

Overall, the amounts of food ingested in this study are relatively low (39.03 and 32.27 g.DM/kg$^{0.75}$ on average respectively for the upper and lower parts). These results differ slightly from those reported by Fall *et al.* [14] under the same conditions (31.50 g.DM/kg$^{0.75}$). The best ingestion was obtained with the upper parts of the stems of the SL423 line (42.49 gDM/kg$^{0.75}$). On the other hand, the ingestions obtained with the upper parts of the Souna 3 and Thialack 2 varieties are superior to those reported by Kaboré [17] and Nantoumé and Kouriba. [18] (34 and 35 g.DM/kg$^{0.75}$, respectively).

The variability of these ingestions would be due to the late exploitation of fodder, which would have led to a change in the chemical composition of the food; which would justify their high walls contents (NDF) (78%) and low TNM (Total Nitrogen Matter) contents (<7%). Moreover, this distinction could also result from a severe selectivity of the animals with a clear preference for the leaves to the detriment of the stems, which has contributed to an increase in the quantity of foods refused. Indeed, according to Dulphy *et al* [19], high wall contents lead to a slower rate of degradation; which, combined with an insufficient nitrogen supply for the cellulolytic activity, limit the ingestion. Riviere (1978) quoted by Nantoumé and Kouriba [18] also reported that there is a strong negative correlation between forage intake and its proportions in lignified tissues and membrane constituents that increase with age of the plant.

Congestion Value

The congestion values provided by the fodder used in this test averaged 1.70 2.18 CU for the upper parts and the lower parts of the different millet inputs, respectively. These results are in line with those of Sall [20] and Dulphy *et al* [19] which report that low creep straw ingestions result in a high coefficient of congestion. This could result from the intake amount bonding-bulkiness of forages due to their high load in lignified walls. In addition, Archimedes *et al.* [21] reported that the influence of the walls on ingestibility is due to the phenomenon of buccal obstruction because daily masticatory work is limited to about 1000 minutes per day. Therefore, the greater the required masticatory work, the less the animal will ingest dry matter.

Digestibility of Nutrients

The digestibility of nutrients was relatively low on all millet inputs regardless of the part of the stem concerned. For the dry matter, organic matter and nitrogenous matter, the upper parts of the stems of the Thialack 2 variety provided the best digestibilities (44.26%, 44.17% and 37.37%, respectively) at the level of the part Upper stem). These values confirm those reported by Xandé [22] and Dulphy *et al.*, [23] (between 40% and 50%).

The results found with the upper parts of the Thialack 2 variety are similar to those reported by Nantoumé and Kouriba [18] (44%) and Gado [24] (44.78%) on another local variety of millet called Sadoré. On the other hand, they remain lower than those reported by Fernandez *et al.* [25] and higher than those of Sall [20] (47.4% and 34% respectively).
This distinction between the results could be explained by a temperature-related effect close to 37°C. Lamas and Combs [26] reported that in sheep, high temperatures (>30°C) decrease the digestibilities of dry matter and proteins, in addition to the amount ingested.
Dulphy *et al* [19] also reported that the digestibility of a diet is lower when the animal is fed ad libitum than when it is fed in shrunk quantities.
The harvesting and storage conditions of millet stems would also have a negative effect on the digestibility of the various nutrients. For according to Jarrige *et al* [27] digestibility of preserved fodder depends on green fodder at the time of mowing but also on changes resulting from harvesting and storage.
The low digestibility of the organic matter may be justified by the observation made by some authors [27] that this digestibility decreases when the wall content and lignification increase, the case in this study.

Energetic Values

The energy values (milk forage unit: MkFU and meat forage unit: MtFU) of this study were higher than those obtained by Richard *et al.* [28], Kabore *et al* [29] and Nantoumé and Kouriba [18] (0.49 MkFU/kg.DM and 0.37 MtFU/kg.DM against 0.38 FMtU/kg.DM, 0.37 MkFU/kg.DM,0.42 MtFU/kg.DM respectively).
The lower parts of the millet stems gave the best energy values (0.49 UFL/kg.MS and 0.37 MtFU/kg.DM against 0.45 MkFU/kg.DM and 0.33 MtFU/kg.DM for the lower parts). The same is true for digestible nitrogenous matter (DNM) (21.06 g.DNM/kg.DM and 15.12 g.DNM/g.kg.DM respectively for the upper and lower parts). The nitrogen value of the upper parts of line SL28 (19.51 g.MAD/kg.DM) is similar to that reported by Richard *et al* (1989). Of all the millet inputs, it is the Thialack 2 variety which presents the best nutritive values whatever the part of the stem considered.

Conclusion

The 5 millet inputs used in this study showed significant differences in the parameters studied (ingestion, digestibility, digestible nitrogenous matter and energy value). This variability is also evident in the upper and lower parts of each type of millet. For all of the parameters studied (digestive utilization rates, dry matter ingestions, nutrient digestibility, biomass yields and nutritive values), the Thialack 2 variety and the SL423 line were the most important. These results give the latter a place of choice in the notion of dual-purpose millet compared to other types of millet (SL28, SL169 and Souna 3). The SL423 lines follow slightly with intermediate results justifying its interest for animal feed.
However, the use of millet straws for animal feed poses the problem of nitrogen availability. However, this protein value can be improved by appropriate techniques in order to enable these millet to satisfy the needs of the animals as well as possible.

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