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Effect of Season and Age on Dry Matter Intake in Female Camels on Sahara Rangelands of Algeria

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ABSTRACT

Background: The aim of this study was to determine the influence of season and age on intake in female camels.

Methods: Study was conducted in the El Alia region (South-East of Algeria). In order to measure bite counts and dry matter intake (DMI) in the dry and wet seasons, monitoring were made on 64 females camels consisted of two age categories, 32 adult (AF) and 32 young (YF). This was done by following one animal randomly selected/day/category. Thus, sixteen simple were observed during each season. Forage intake for each preferred plant species was estimated by multiplying bite counts by the average mass per bite. Forage consumption was quantified by the bite count technique (Gauthier-Pilters and Dagg,1981).

Result: The results showed that there was a significant difference ($p<0.05$) in the number of bites between seasons and age categories, with a maximum average 63.33±23 for AF and a minimum average 16.8±12.47 for YF in the dry season and wet season respectively. The highest amounts of dry matter intake (DMI) are recorded in the wet season on *Traganum nudatum* 1.9 kg DM for YF and 0.34 kg DM in YF. The season influences the feed intake of female camels on course.

Key words: Arid rangelands, Camel, Feed intake, Forage preference, Seasonal variations.

INTRODUCTION

Camels are important livestock species that significantly contribute to the livelihood of the pastoralists in the arid and semi-arid areas. In Algeria, the dromedary has a great interest in the various Saharan regions, because it occupies a preponderant place in the economic and social life of the Saharan populations (Senoussi, 2012; Faye *et al.,* 2017: Hamad *et al.,* 2018). It also has a positive ecological impact on the valuation, rational use and preservation of vegetation cover of Saharan rangelands (Khenfer *et al*., 2019; Julien *et al.,* 2021).

Today, the dromedary is affected by the scarcity of natural food resources and the feeding of camel herds on the rangeland to be a source of great difficulties for the breeders. As such, feed becomes the most important single factor affecting productivity of camels. According to Kuraz, *et al.* (2021) the global climate change is a pressure to animal production due to the impact on forages quality and water availability.

This is why one of the questions considered urgent is to be able to determine continuously all the indicators of dromedary farming, especially those concerning its feeding on rangeland, because the dromedary feeding seems little known as compared with the studies carried out in sheep, goats and cattle. Camels are both grazers and browsers of a broad spectrum of preferred for ages whose nutrient composition is not well documented (Ikanya, 2022).

Moreover, it is necessary to understand the foraging behavior of dromedaries in order to predict their impact on the vegetation and their nutrient requirements. Furthermore, management and use of range plants in camel feeding systems require a good knowledge of seasonal variation on their intake.

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The aim of the study was to determine the impact of seasonal variation on intake in female camels to satisfy its dry matter and nutrient requirements and for better management of the animal and its habitat.

MATERIALS AND METHODS

Study area

The study was conducted in the area of El Alia (32°41′51″ N, 5°25′32″E), El Hedjira town, a major rangeland in northern Algerian Sahara (Fig 1). The area experiences hot arid climatic conditions, characterized by such as high temperatures, salinity and drought (Trabelsi *et al.,* 2020) The main plant species of the site are, *Anabasis articulata*, *Salsola tetragona*, *Retama retam*, *Moltkiopsis ciliata*, *Tamarix galica*, *Limoniastrum guyonianum* and *Traganum nudatum*, these species are widely available and highly preferred by ruminants (sheep, goats and camels) in its natural habitat (Lakhdari *et al*., 2015). So the energy productivity of El-Alia

rangeland remains appreciable. This gives it an important pastoral interest (Mayouf *et al*., 2017).

Monitoring of animals and estimating forage intake

The experimental study was conducted throughout the two seasons (dray and wait). During each season, sixteen female camels were randomly selected and marked from the two categories, youngs (2-4 years) and adults (≥4 years). So that 01 animal / day / category/ season was selected. Thus, 64 animals were observed from October 2015 to July 2016.

Forage intake for each preferred plant species was estimated by multiplying bite counts by the average mass per bite, after cutting and weighing simulated bites that represent bite ingested (Cook, 1963; Meuret *et al*., 1985; Dumont *et al*., 1995). Forage consumption was quantified by the bite count technique (Wallmo and Neff, 1970; Gauthier-Pilters and Dagg, 1981). In this technique, an animal was closely followed for 20 min each one hour during feeding throughout the day, the number of bites made on the preferred plant species (Lakhdari *et al*., 2015) were recorded when the observers were close enough (3-5 m) to ensure accurate identification of the plant and parts diets consumed.

The dry matter intake (DMI) is given by the formula:

$$DMI = \frac{GT}{R^* \Sigma (TNBi^*WBi)}$$

DMI: Dry matter intake.
GT: Total grazing time.
R: Total counting time.
TNBi: Total number of bites made on species i.
WBi: Weight of the bite made on species i.

This study was carried out by the Scientific and Technical Research Centre for Arid Areas (CRSTRA), Biskra, Algeria.

Statistical analysis

Different experimental groups (the number of bites on each preferred plant species by each category of female camels and Intake) were compared with the Univariate ANOVA followed by Bonferroni's test for comparisons post hoc. A probability level of P≤0.05 was considered to be statistically significant. The SPSS software package (SPSS Ver. 15.0, SPSS Inc., Chicago, Illinois) was used for all tests.

RESULTS AND DISCUSSIONS

For adult females, the number of bite counts was in the range of 6 to 43 (average= 26.5±19.8) bite counts in the wet season and 32 to 87 (average= 63.3±23.5) bite counts in the dry season. For young females, the number of bite counts was in the range of 4 to 35 (average= 16.8±12.5) bite counts in the wet season and 12 to 67 (average= 29.7±20.9) bite counts in the dry season.

During the wet season, for adult females, bite weight ranged from 0.7 g recorded for *Salsola longifolia* to 3.2 g recorded for *Traganum nudatum*, while for young females, bite weight ranged from 0.66 g recorded for *Anabasis articulata* to 1.62 g recorded for *Traganum nudatum*. During the dry season, the bite weight ranged from 0.72 g recorded for *Anabasis articulata* to 2.67 g recorded for *Traganum nudatum* and 0.65 g recorded for *Anabasis articulata* to 1.55 g recorded for *Limoniastrum guyonianum* for adult and young females respectively.

The monitoring individual feeding behavior and direct observation method used has permitted the recording of bite counts, bite weight and the evaluation of the female camels' intake. The results revealed that the preferred species show a variability in the number of bits ($p<0.05$), so it is clear that in the dry season, *Anabasis articulata* is very grazed as it occupies the second position for adult and young female camels categories with a number of bites (84) and (39) respectively. While in the wet season, the number of bites made on *Anabasis articulata* decreases to the half for both categories. The study conducted by Benseddik (2011), in the Ouargla region confirmed that the palatability of this species is very strong only in winter.

The study exhibited that in wet season, *Traganum nudatum*, is the most grazed by adult and young females with a maximum of 57 and 35 bites respectively, also in the dry season it is very appetizing, this result is confirmed by Benseddik (2011), who reported that the palatability

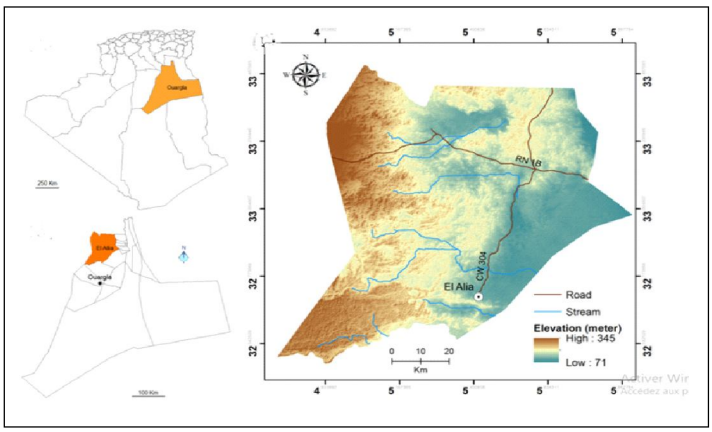


Fig 1: The map of study area.

of *Traganum nudatum* remains high even if the plant is desiccate. *Limoniastrum guyonianum* grazed very little in winter with 6 bites for adult females and 4 bites for young females, but in the dry season, it becomes the most grazed with 87 and 67 bites respectively for adult and young females.

Our results fall within the broad range of the study conducted by Benguessoum and Bouhamed (2006), on the number of bites per species, reported that the number ranging from 60 to 100 for *Stipagrostis plumosa*, from 20 to 29 for *Savignia longistila* and from 20 to 30 bites for *Helianthemum lippiias,* well our observations concurred with the reports of Kuria *et al.* (2012). Slimani *et al.* (2013), reported a maximum 2 to 5 bites for each species. Generally, the difference in bite counts may be attributed to forage abundance, where camels concentrated on browsing and the movement was minimal (Kassily, 2002).

Overall, there is a significant difference ($p<0.05$) in the average number of bites between seasons, it is higher in the dry season, 63.3±23.47 whereas 26.5±19.78 in the wet season for adult females, while it is 29.7±20.92 in the dry season and 16.8±12.47.

The season significantly influences the number of bites, which is a maximum in the dry in the wet season for young females. The season significantly influences the number of bites, which is a maximum in the dry season. Penning (1986) and Distel *et al.* (1995) suggest that the animals try to compensate the small quantity taken by bite by increasing the frequency of bite in order to maintain their intake. Mebirouk (2014), reports that the average number of bites is changed inversely proportional to the weight of the bite: the number of bite increases when the weight of the bite decreases. The seasonal influence on chemical composition and digestibility of the most selected forage species.

Regarding the intake quantity for adult females (Fig 2), in the wet season, *Traganum nudatum* recorded the highest amount with 182.4 g/day, followed by *Salsola tetragona* and *Anabasis articulata* with an estimated intake 63.8 and 53.7 g/day respectively. The lowest intakes were recorded in *Limoniastrum guyonianum*, *Moltkiopsis ciliata* and *Salsola longifolia* 19.3, 14 and 11.9 g/day respectively. In the dry season, the highest intake is estimated in *Traganum nudatum* 216.3 g/day followed by *Limoniastrum guyonianum* with 106.1 g/day, while the *Moltkiopsis ciliata* recorded the lowest ingested amount 35.5 g/day.

For young females (Fig 3), the highest quantity intake in the wet season recorded in *Traganum nudatum* 56.7 g/day, the lowest intakes are estimated for *Moltkiopsis ciliata*

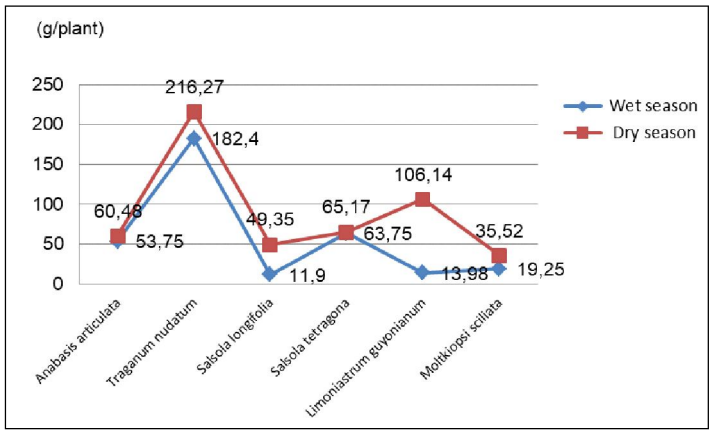


Fig 2: Intake quantity (IQ) by adult females.

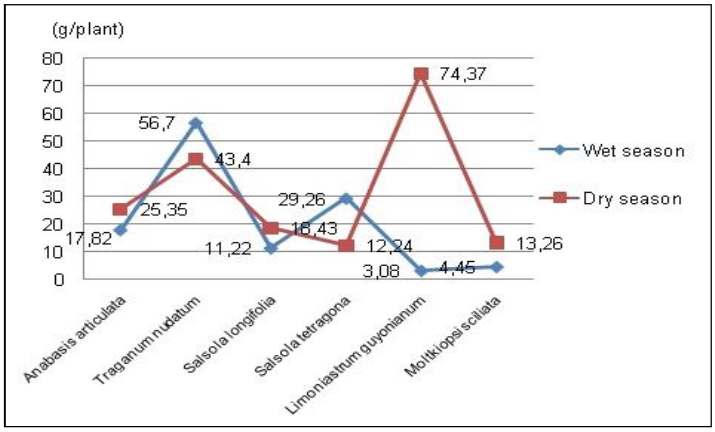


Fig 3: Intake quantity (IQ) by young females.

and *Limoniastrum guyonianum* 4.5 and 3.1 g/d respectively. In the dry season, the highest intakes were estimated for the species *Moltkiopsis ciliata* and *Salsola tetragona* 13.3 and 12.3 g/day respectively.

The results obtained for adult females showed that during the wet season the highest daily dry matter intake recorded for *Traganum nudatum* 1.9 kg DM followed by *Salsola tetragona* with 0.38 kg DM then *Anabasis articulata* with 0.32 kg DM (Fig 4).

The lowest quantities were recorded for *Limoniastrum guyonianum* and *Salsola longifolia* 0.08 and 0.07 kg DM respectively. However, in the dry season, *Traganum nudatum* precedes with an estimated quantity of 1.3 kg DM, followed by *Limoniastrum guyonianum* with 0.64 kg DM. Very similar quantities were recorded for *Salsola tetragona* and *Anabasis articulata* 0.38 and 0.36 kg DM respectively, the lowest quantity was recorded for *Moltkiopsis ciliate* with 0.21 kg DM. Species *Anabasis articulata* and *Salsola tetragona* do not showed significant seasonal variability in the amount of dry matter intake.

Concerning young females, in the wet season, the highest daily dry matter intake recorded for *Traganum nudatum* 0.34 kg DM, the lowest dry matter intake was recorded for *Limoniastrum guyonianum* 0.02 kg DM.0.018 and 0.11 kg DM were recorded for *Salsola tetragona* and *Anabasis articulata* respectively. In the dry season, the highest daily dry matter intake recorded for *Limoniastrum guyonianum* 0.45 kg DM. *Traganum nudatum* recorded only 0.26 kg DM followed by *Anabasis articulata* and *Salsola longifolia*, with 0.15 and 0.11 kg DM respectively, while *Salsola tetragona* recorded the lowest quantity with 0.07 kg DM (Fig 5).

Regarding the quantity of dry matter intake (DMI), the study showed a difference in the amount of dry matter intake between seasons ($p<0.05$). According to Cross (1977), the dromedary intake at pasture varied from 4.8 to 11.4 kg DM/day, this seasonal variation was also mentioned by Lechner-Doll *et al.* (1990); Migongo-Bake (1992) and Longo *et al.* (2007), they reported that the quantity of dry matter intake at the pasture is affected by the season.

AitHamou (1993) reported that the female camels intake decreases from 3.2 kg DM/day/animal in the dry season to 2.06 kg DM/day/animal in the wet season. Ben Arfa *et al.* (2004) reported that the female camels' intake decreases remarkably in winter, which confirms our results (3.2 kg DMI /d/animal in the dry season and 2.06 kg DMI/d/animal in the wet season). Ben Arfa *et al.* (2004) reported that mean intake in adult female camels are 6 kg DM/d/animal for all

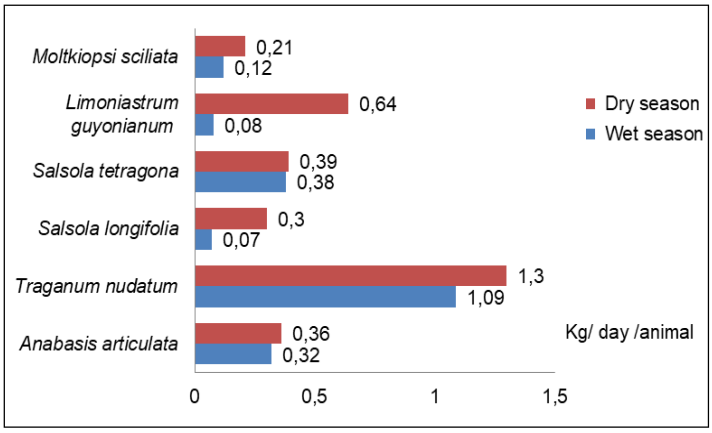


Fig 4: Dry mater intake (DMI) by adult females.

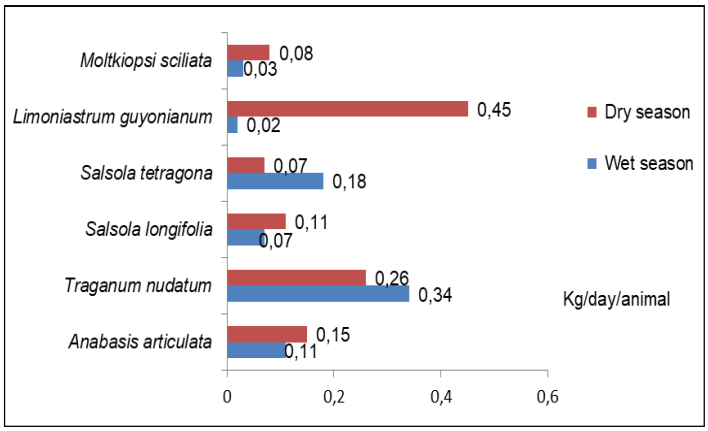


Fig 5: Dry mater intake (DMI) by young females.

grazed species. In order to adequately cover its needs, the she-camel should consume a large amount of DM (Laameche *et al*., 2019).

Our results remain in the intake range of the vegetation at pasture since they represent only the preferred species: *Traganum nudatum, Limoniastrum guyonianum, Anabasis articulata, Moltkiopsis ciliata*, *Salsola tetragona* and *Salsola longifolia*. In the wet season, the decrease in the dry matter intake of the preferred species is linked to the existence of ephemeral species that allow the camels to eat better and to diversify their food rations. Sagala *et al.* (2020) reported that that there were species and seasonal differences in forage preferences and that the preferred species were high in crude protein content and *in-vitro* dry matter digestibility. On the other hand, these ephemeral species disappear during the dry season, which makes the food choice of camels limited. Thus they try to compensate for this lack by increasing the intake of the preferred species available. According to Salamula *et al.* (2017) camels could have adequate forage even in the face of climate change. Dumont (1996) reported that the herbivores food choices are at least partly dictated by the desire to maximize their energy balance.

CONCLUSION

The major conclusion of this study is that for the female camels, there are seasonal variations in the amount of dry matter intake and the intake of plants is not always directed by the nutritive instinct. Forage offer, availability of each species and vegetative stage are also factors that determine the amounts intake by plants.

Conflict of interest

The authors declare that they have no competing interests.

REFERENCES

AitHamou, A. (1993). Characterisation of Camel Breeding in the Province of Ouarzazate, End of study thesis IAV Hassan II, Rabat, Maroc.

Ben Arfa, A., Khorchani, T., Hammadi, M., Chammem, M., El-Hatmi, H., El-Jeni, H., Abdouli, H. and Cheniti, T.L. (2004). Digestibilité et ingestion de la végétation d'un parcours d'halophytes par le dromadaire dans le Sud tunisien. Cahiers Options Méditerranéennes. 62: 301-305.

Benguessoum, S., Bouhamed, D. (2006). Contribution to the study of the effect of dromedary feeding behaviour on rangeland degradation in the northern Sahara (Ouargla). Saharan agronomy engineering thesis. Kasdi Merbah University, Ouargla, Algérie. 79p.

Benseddik, I. (2011). Classification of plants grazed by dromedaries: the case of the Touggourt region, Master thesis, KasdiMerbah University, Ouargla. 62p.

Cook, W.C. (1963). Collecting Forage Samples Representative of Ingested Material of Grazing Animals for Nutritional Studies, SEI Meeting of the American Society of Animal Sciences. August 13.

Cross, H.E. (1977). Some camel feeding experiments. Agricultural Research Institute. Pusa. (77): 8.

Distel, R.A., Laca, E.A., Griggs, T.C. Demment MW. (1995). Patch selection by cattle: Maximization of intake rate in horizontally heterogeneous pastures. Applied Animal Behaviour Science. 45(1-2): 11-21.

Dumont, B., Meuret, M., Prud'Hon, M. (1995). Direct observation of biting for studying grazing behavior of goats and llamas on garrigue rangelands. Small Ruminant Research. 16(1): 27-35. https://doi.org/10.1016/0921-4488(94)00036-7.

Dumont, B. (1996). Feed preferences and selection on pasture INRA. Animal Production. 9(5): 359-366.

Faye, B., Senoussi, H. and Jaouad, M. (2017). The dromedary and the oasis: From caravanserai to periurban farm. Cahiers Agricultures. 26(1): 8. https://doi.org/10.1051/cagri/2017005.

Gauthier-Pilters, H., Dagg, A.I. (1981). The camel. Its evolution, ecology, behavior and relationship to man. The University of Chicago Press.

Hamad, B., Aggad, H., Hadef, L., Adaika, A. (2018). Effect of seasons on blood biochemical parameters in male dromedary camels in Algeria. Indian Journal of Animal Research. 52(5): 678-682.

Ikanya, L.W., Maina, J.G., Gachuiri, C.K., Owino, W.O. and Dubeux Jr, J.C.B. (2021). Chemical composition and digestibility of preferred forage species by lactating somali camels in kenya. Rangeland Ecology and Management. 80: 61-67.

Julien, L., Moutik, F. E., Haloui, C., Huguenin, J. and Sraïri, M.T. (2021). Paramètres démographiques et économie de l'élevage camelin: une étude au Maroc. Cahiers Agricultures. 30(1): 1-9.

Kassily, F.N. (2002). Forage quality and camel feeding patterns in Central Baringo, Kenya. Livestock Production Science. 78(2): 175-182.

Khenfer, B., Chehma, A., Huguenin, J. (2019). Importance of a soil seed bank to regenerate Algerian camel rangeland. Livestock Research for Rural Development. 31(10): 11 p. http://www.lrrd.org/public-lrrd/proofs/lrrd3111/khenf31178.html.

Kuraz, B., Tesfaye, M., Mekonenn, S. (2021). Climate change impacts on animal production and contribution of animal production sector to global climate change: A review. Agricultural Science Digest. 41(4): 523-530. doi: 10.18805/ag.D-344.

Kuria, S.G., Tura, I.A., Amboga. S., Walaga, H.K. (2012). Forage species preferred by camels (*Camelus dromedarius*) and their nutritional composition in North Eastern Kenya. Livestock Research for Rural Development. 24(8). http://www.lrrd.org/lrrd24/8/kuri24145.htm.

Laameche, F., Chehma, A., Faye, B. (2019). Effect of diet composition on dry matter intake of dairy she-camels. Tropical Animal Health and Production. 51(8): 2513-2519. doi: 10.1007/s11250-019-01960-9.

Lakhdari, K., Belhamra, M., Mayouf, R. (2015). Forage species preferred by dromedaries and their chemical composition in arid rangelands of Algeria. Livestock Research for Rural Development. 27(10): 1-10. from http://www.lrrd.org/lrrd27/10/lakh27205.html.

Lechner-Doll, M., Rutagwenda, T., Schwartz, H.J., Schultka, W., Engelhardt. W.V. (1990). Seasonal changes of ingesta mean retention time and forestomach fluid volume in indigenous camels, cattle, sheep and goats grazing a thornbush savannah pasture in Kenya. The Journal of Agricultural Science. 115(3): 409-420. doi: 10.1017/S0021859600075869.

Longo, H.F., Siboukeur, O,. Chehma, A. (2007). Aspects nutritionnels des pâturages les plus appréciés par camelus dromedarius en algérie Cahiers Agriculture. 16(6): 477-483.

Mayouf, R., Lakhdari, K., Belhamra, M. (2017). Assessment of the energy value of camel's rangelands, Ouargla-Algeria. Livestock Research for Rural Development. 29(11). https://www.lrrd.cipav.org.co/lrrd29/11/kaou29209.html.

Mebirouk-Boudechiche, L., Boudechiche, L., Ferhat, R., Tahar, A. (2014). Relationship between grass availability, intake and feeding activities of grazing rams. Archivos de Zootecnia. 63: 277-287. http://dx.doi.org/10.4321/S0004-05922014000200006.

Meradi, S., Benguigua, Z., Chekkal, F., Aouachria, M., Ziad, M.S., Mansori, F. and Halis, Y. (2016). Breeding of the small ruminants in the zones oasiennes: Case of the wilaya of Biskra (Algeria). Journal Algérien des Régions Arides. 13: 90-96.

Meuret, M., Bartiaux-Thill, N., Bourbouze, A., Rosenberger, S., Vernerey, M., Sourbier, Y. (1985). Assessment of the Consumption of a Herd of Dairy Goats on Forest Rangelands. Method of Direct Observation of Tooth Impact. Chromium Oxide Marker Method. In: Annales de Zootechnie. EDP Sciences. Pp: 159-180.

Migongo-Bake, W. (1992). Rumen Dry-matter Digestive Efficiency of Camels, Cattle, Sheep and Goats in a Semi-arid Environment in Eastern Africa. In Joint Feed Resources Network Workshop on the Complementarity of Feed Resources for Animal Production in Africa. Gaborone (Botswana). 4-8 Mar 1991. ILCA.

Penning, P.D. (1986). Some effects of sward conditions on grazing behaviour and intake by sheep. NATO advanced science institutes series: Series A: Life sciences (USA).

Sagala, J.I., Gachuiri, C.K., Kuria, S.G., Wanyoike, M.M. (2020). Nutritive value of selected preferred forage species by lactating camels in the peri-urban area of Marsabit town, Kenya. Indian Journal of Animal Nutrition. 37(3): 218-226.

Salamula, J.B., Egeru, A., Aleper, D.K. and Namaalwa, J.J., (2017). Camel forage variety in the Karamoja sub-region, Uganda. Pastoralism: Research, Policy and Practice. 7: 8. doi: 10.1186/s13570-017-0080-6.

Senoussi, A. (2012). Camel breeding in Algeria: myth or reality. Rencontres autour des Recherches sur les Ruminants. 1: 318. http://www.journees3r.fr/spip.php?article3541.

Slimani, S., Chehma, A., Faye, B. and Huguenin, J. (2013). Diet and feeding behaviour of the dromedary in its natural desert environment in Algeria. Livestock Research for Rural Development. 25(12): 1-8. from http://www.lrrd.org/lrrd25/12/slim25213.htm.

Trabelsi, H. and Kherraze, M.E. (2020). Effects of Abiotic Stress on Seed Germination of Some Algerian Sahara Psammo halophyte Species. Handbook of Halophytes: From Molecules to Ecosystems towards Biosaline Agriculture. 1-22.

Wallmo, O.C. (1970). Direct observations of tamed deer to measure their consumption of natural forage. Miscellaneous Publication. 1147: 110.