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Nutritional and production aspects of partially or totally replacing berseem hay by cassava in ewes feeding

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Abstract. Berseem (Trifolium Alexandrinum) is the traditional winter forage in the Mediterranean-Middle East regions. In Egypt, berseem has achieved the distinction of being a base for livestock production due to its high nutritive value and easy cultivation. However, the absence of berseem during summer season cause a limiting factor for livestock production. So the objectives of this study were to evaluate the nutritional and production aspects of partially or totally replacement of berseem hay by cassava in ewes diets on ruminal fermentation, milk production and lamb performance. Forty late pregnant Barki ewes were assigned to four experimental diets (n = 10 each): i.e. control [50% berseem hay and 50% concentrate mix] or [33, 66 and 100% replacement of berseem hay by leaves and thin twigs of cassava hay] plus 50% concentrate mix for a period of 4 weeks before the expected lambing date until 8 weeks of lactation. 100% replacement of cassava resulted in increasing (p < 0.05) individual (acetate and propionate) and total volatile fatty acid concentration compared with other treatments. Ruminal NH₃-N concentrations and total protozoa were decreased (p < 0.05) with 66 and 100% cassava replacement compared with control. Milk yield was improved (p < 0.05) by total replacing of cassava in addition milk fat, protein and lactose percentages were increased (p < 0.05) by 100% of cassaya rather than other treatments. Lamb growth rate and weaning weight were enhanced (p = 0.022) by 100% cassava compared with other diets. Thus, using 100% replacement of berseem by cassava provides a promising source of forages for sheep with positive impacts on fermentation and ewes productivity.

Keywords. Cassava - Rumen fermentation - Milk yield and composition - Lamb growth rate.

Aspects nutritionnels et de production liés au remplacement partiel ou total du foin de berseem par du manioc dans l'alimentation des brebis

Résumé. Le berseem (Trifolium alexandrinum) est le fourrage traditionnel d'hiver des régions de la Méditerranée et du Moyen-Orient. En Égypte, le berseem s'est distingué comme étant une base pour la production animale en raison de sa haute valeur nutritive et de sa facilité de culture. Cependant, l'absence du bersem pendant la saison d'été est un facteur limitant pour la production animale. Les objectifs de cette étude étaient donc d'évaluer les aspects nutritionnels et de production du remplacement partiel ou total du foin de berseem par du manioc dans l'alimentation des brebis sur la fermentation ruminale, la production de lait et les performances de l'agneau. Quarante brebis Barki en fin de gestation ont été affectés à quatre régimes expérimentaux (n = 10 chacun): c.-à-d. Témoin [50% de foin de berseem et 50% de concentré] ou [33, 66 et 100% de remplacement du foin de berseem par des feuilles et de minces brindilles de manioc foin] plus 50% de concentré pendant une période de 4 semaines avant la date prévue d'agnelage jusqu'à 8 semaines de lactation. Le remplacement à 100% du manioc a entraîné une augmentation (p <0,05) de la concentration individuelle (acétate et propionate) et totale d'acides gras volatils par rapport aux autres traitements. Les concentrations dans le rumen de NH₂-N et les protozoaires totaux ont diminué (p < 0.05) avec un remplacement de manioc de 66 et 100% par rapport au témoin. Le rendement laitier a été amélioré (p <0,05) par le remplacement total du manioc. De plus, les pourcentages de matière grasse, de protéines et de lactose ont été augmentés (p <0,05) de 100% de manioc plutôt que d'autres traitements. Le taux de croissance et le poids au sevrage ont été augmentés (p = 0,022) de 100% de manioc par rapport aux autres régimes. Ainsi, le remplacement à 100% de berseem par du manioc constitue une source prometteuse de fourrages pour les ovins, avec des effets positifs sur la fermentation et la productivité des brebis.

Mots-clés. Manioc – Fermentation dans le rumen – Rendement et composition en lait – Taux de croissance de l'agneau.

I – Introduction

In the developing countries there is a serious need of searching for alternative feed resources because of the limited area for agriculture and the competition between animals and humans for some crops. In addition, these alternative feeds should be friendly to the environment and have good impacts on animal production and quality, which will reflect on consumer's acceptance. Vast areas of Mediterranean-Middle East are characterized by high salinity arid and semi-arid zones, where halophyte forages are the most common plant species naturally grown (Ahmed *et al.*, 2015). Many of these plant species yield high volumes of green biomass and contain substantial amounts of digestible protein (Morsy *et al.*, 2018). In addition, they contain bioactive phytofactors, such as tannins and cyanogenic glycosides which have shown to possess antimicrobial, antimethanogenic, antioxidant, and immunomodulatory properties (Soltan *et al.*, 2012, 2017; Morsy *et al.*, 2018). Thus, we suggested that feeding ewes on these forages may affect animal performance. The objectives of this study were to evaluate cassava (*Manihot esculenta*) dried leaves and thin twigs to partially or totally replace berseem hay in the diet of late pregnant Barki ewes, on nutritional and production aspects in addition to the performance of their offspring.

II – Materials and methods

1. Animals

Forty late pregnant Barki ewes similar in total account of parity, milk yield to previous lactation and body weight (42.5 ± 1.25 kg SE) were randomly assigned to one of 4 dietary treatments for a period of 4 weeks before the expected lambing date until 8 weeks of lactation. The ewes were grouped (10 ewes/group) for treatments into: group 1 (control): received a diet consisting of berseem hay (50%), corn (27%), cotton seed meal (24%), wheat bran (10.5%), molasses (5.5%), NaCl (0.5%), NaHCO3 (2%) and vitamin mix (0.5%) on DM basis; and groups 2, 3 and 4: receiving the same diets as the control, but after partial or total replacement of berseem hay with 33, 66 and 100% cassava hay, respectively. These diets were formulated according to NRC requirements (NRC, 2007). Ewes were kept in semi-open sheds and fed the corresponding diets as a total mixed ration at 4% of BW twice daily while had free access to fresh water. After birth, all lambs were allowed to suckle colostrum for about two hours. Lamb birth weight was recorded 24 h after birth and weaning weight at the eighth week of lamb age. Lambs were reared with their dams with free access to water but had no reach to dams feed.

2. Sampling and analyses

Representative samples of all diets were analyzed according to AOAC (1995) for dry matter, organic matter, and crude protein (CP). Contents of neutral detergent fiber, acid detergent fiber and lignin were measured following Van Soest *et al.* (1991). Determinations of total phenols, condensed tannin (CT) and total tannin were according to Makkar (2003). Cyanide was measured colorimetrically following Orjiekwe *et al.* (2013). The ruminal fluid was collected biweekly from the begin of the experiment. Samples were collected via the stomach tube at 1.0, 3.0 and 6.0 h after feeding. The rumen fluid was taken for protozoa counts, while the rest was stored at –20°C for later analysis of NH₃-N and

VFA's. Milk samples and yield was recorded twice weekly, animals were milked at 07:00 and 16:00 h as described by Morsy *et al.*, 2016. Milk samples were analyzed as described by Morsy *et al.* (2016) for fat, protein, lactose and total solids using infrared method (EKOMILK-M ultrasonic milk analyzer, EON Trading INC, Bulgaria, 2000). Lamb birth weight was recorded 24 h after birth and weaning weight at the eighth week of lamb age. Data were statistically analyzed according to a completely randomized design using GLM procedure of SAS software 2002 (Version 9.2).

III – Results and discussion

The effects of partially or totally replacing berseem hay by cassava in ewe's diets on ruminal fermentation parameters are shown in Table 1. The total (100%) replacement of berseem by cassava resulted in increasing (p < 0.05) individual (acetate and propionate) and total volatile fatty acids concentration compared with control treatments. Ruminal NH3-N concentration and total protozoa were decreased (p < 0.02) with 66 and 100% cassava replacement compared with control. The presence of plant bioactive phytofactors like tannins and / or cyanogenic glycosides present in cassava might have a positive effect on animal productivity by affecting the ruminal microbial ecosystem (Soltan *et al.*,2012 and 2017). Our results are in agreement with Oni *et al.* (2010) who concluded that inclusion of dried cassava leaves at 60% promotes good growth performance, nutrient digestibility, nitrogen utilization in West African dwarf goats and reduces feeding costs.

Parameters	Treatments				CEM.	Drehehilitur
	Control	33%	66%	100%	SEIVI	Probability
Total VFA (mM)	70.01 ^b	89.31 ^{ab}	89.01 ^{ab}	94.00 ^a	5.18	0.055
Acetate % of total	43.38 ^b	58.31 ^a	60.58 ^a	63.23 ^a	2.550	0.050
Propionate % of total	11.28 ^b	12.00 ^{ab}	10.26 ^b	15.68 ^a	1.140	0.051
Butarate % of total	15.74 ^{ab}	19.19 ^a	18.64 ^a	14.35 ^{ab}	0.900	0.031
NH ₃ -N (mg/100ml)	19.81 ^a	18.74 ^a	16.12 ^b	15.11 ^b	0.670	0.023
Protozoa (105/ml)	7.01 ^c	6.51 ^b	6.6 ^b	4.8 ^b	0.447	0.021

Table 1. Effect of partiality or totally replacement of berseem hay by cassava in ewe's diets on ruminal fermentation parameters

^{a,b,c} Means with different letters within the row are significant different P<0.05.

Table 2 presents the effect of cassava replacement on milk yield and composition of Barki ewes. Milk yield was improved (p < 0.02) by total replacing of berseem hay by cassava. In addition milk fat, protein and lactose percentages were increased significantly by the 100% cassava replacement compared to the other treatments. The enhancement of milk production by cassava inclusion could be attributed to the better fermentation and suitable condition in the rumen for better nutrient utilization, resulting in higher levels of individual and total VFAs witch then reflected on milk production.

Table 2.	Effect of partiality or totally replacement of berseem hay by cassava in ewe's diets on milk yield
	and composition

Parameters	Treatments				0EM	Drohohilitu
	Control	33%	66%	100%	SEIVI	Frobability
Milk yield (kg)	1008 ^b	1143 ^b	1138 ^{ab}	1261 ^a	32.1	0.026
Fat %	6.60 ^c	7.07 ^b	7.12 ^b	7.79 ^a	0.084	0.001
Protein %	3.71 ^a	3.56 ^b	3.62 ^{ab}	3.66 ^{ab}	0.018	0.025
Lactose%	5.33 ^b	5.36 ^b	5.38 ^b	5.64 ^a	0.040	0.024
Total solids%	9.09	8.68	8.91	9.09	0.083	ns

^{a,b,c} Means with different letters within the row are significant different P<0.05.

Regarding lamb performance, cassava replacement resulted in increasing lamb growth rate and weaning weight as presented in Table 3.

Parameters	Treatments				SEM	Brobobility
	Control	33%	66%	100%	SEIN	Probability
Birth weight (kg)	3.20	3.53	3.22	3.22	0.185	ns
Weaning weight (kg)	12.40 ^b	14.00 ^{ab}	13.75 ^{ab}	15.00 ^a	0.823	0.030
Growth rate (g / day)	164 ^b	186 ^{ab}	187 ^{ab}	212 ^a	0.014	0.024

Table 3. Effect of partiality or totally replacement of berseem hay by cassava in ewe's diets on ruminal fermentation parameters

^{a,b} Means with different letters within the row are significant different P<0.05.

The increase of milk yield and enhancement of milk quality as presented previously could explain the superior weaning weight and growth rate of lambs produced from ewes fed on diets in which cassava replaced partiality or totally the berseem hay.

IV – Conclusions

Using 100% replacement of berseem by cassava provides a promising source of forages for sheep with positive impacts on fermentation and ewe's productivity.

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