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Effects of the incorporation of ensiled sugar beet pulp in the diet on lambs fattening performance

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Abstract. The objective of this study was to evaluate the effect of the incorporation of different levels of ensiled sugar beet pulp (ESBP) in the diet on lamb fattening performance. Eighteen Moroccan synthetic breed lambs "Dman*Boujaad" (20.2±1.35 kg initial body weight) were randomly assigned to three homogenous groups of six each. Three diets, depending on the ESBP incorporation level, were tested: $T_{0\%}$ (0% ESBP, 30% wheat straw (WS), 30% sunflower meal (SM), 25% maize grain (MG) and 15% barley grain), $T_{15\%}$ (15% ESBP,30% WS, 30% SM and 25% MG) and $T_{30\%}$ (30% ESBP,30% WS, 30% SM and 10% MG). The fattening trial was lasted for 70 days after 7-day of adaptation period. Lambs were weighed at the beginning and at the end of the trial and fortnightly. Average daily gain (ADG), Feed conversion ratio (FCR) and feeding cost were determined. The ADG of lambs consuming 15% of ESBP ($T_{15\%}$; 201.5 g/d) was higher (P=0.0085) than $T_{0\%}$ (132.7 g/d) and $T_{30\%}$ (173.5 g/d). The feed conversion ratio (Kg DMI/Kg ADG) was 8.67, 5.6 and 6.65 for diets containing 0%, 15% and 30 % of ESBP, respectively. The feeding cost (Moroccan dirham (MAD)/kg ADG) was 26.4, 17.7 and 20.5 for $T_{0\%}$, $T_{15\%}$ and $T_{30\%}$, respectively. An incorporation of ESBP at 15% of DM in fattening lambs' diets improves fattening performances.

Keywords. Ensiled sugar-beet pulp – Lamb – Fattening.

Effet de l'incorporation de la pulpe de betterave ensilée dans la ration sur les performances d'engraissement des agneaux

Résumé. *L'objectif de cette étude était d'évaluer l'effet de l'incorporation de la pulpe de betterave ensilée (PBE) à différents dans le régime alimentaire sur les performances d'engraissement des agneaux. Dix-huit agneaux marocains de race synthétique "Dman * Boujaad" (20,2 ± 1,35 kg de poids vif initial) ont été répartis aléatoirement en trois groupes homogènes de six chacun. Trois régimes alimentaires, selon le niveau d'incorporation du PBE, ont été testés : $T_{0\%}$ (0% PBE, 30% paille de blé, 30% tourteau de tournesol (TTS), 25% maïs et 15% orge), $T_{15\%}$ (15% PBE, 30% paille de blé, 30% TTS et 25% maïs) et $T_{30\%}$ (30% PBE, 30% paille de blé, 30% TTS et 10% maïs). L'essai d'engraissement a duré 70 jours après une période d'adaptation de 7 jours. Les agneaux ont été pesés au début et à la fin du procès et tous les quinze jours. Le gain quotidien moyen (GMQ), l'indice de conversion (IC) (Kg matière sèche ingérée/ kg de GMQ) et le coût alimentaire (CA ; dirham marocain (MAD) / kg de GMQ) ont été déterminés. Le régime alimentaire a affecté significativement le GMQ (P = 0,0085). Les agneaux du $T_{15\%}$ ont réalisé une GMQ de 201,5 g/j, par contre ceux du $T_{0\%}$ et $T_{30\%}$ ont réalisé un GMQ, respectivement, de 132,7 g/jet 173,5 g/j. L'Indice de conversion était de 8,67, 5,6 et 6,65 respectivement pour $T_{0\%}$, $T_{15\%}$ et $T_{30\%}$. Le coût alimentaire était respectivement de 26,4 ; 17,7 et 20,5 pour $T_{0\%}$; $T_{15\%}$ et $T_{30\%}$. L'incorporation de la PBE à un niveau de 15% de MS dans les rations d'engraissement des agneaux améliore les performances d'engraissement.*

Mots-clés. *Pulpe de betterave ensilée – Agneaux – Engraissement.*

I – Introduction

In Morocco, the activity of small ruminant production is affected by many factors such the succession of drought years, the rainfall irregularity, as well as the overuse of the pastoral areas. This situation leads to a significant reduction of forage availability and therefore an increasing of supplementary feeding prices mainly during feed shortages periods. Faced to this situation, small ruminant-holders are forced to look for other alternative feeding resources such beet pulp silage. The incorporation of this latter in ruminant diets may provide an opportunity to reduce feeding costs and also constitute an alternative to the high cost of producing dehydrated pulp beet. In this regards, studies have shown that beet pulp silage has a high nutritional value (Martelli *et al*., 1999) which is comparable to barley grain (Murphy, 1986) and also has a positive effect on ruminal fermentation (Formigoni *et al*., 1993). The objective of this work was to evaluate the effect of the incorporation of different levels of ensiled sugar-beet pulp in the diet on performance of Moroccan synthetic breed lambs' fattening.

II – Material and methods

Eighteen Moroccan synthetic breed lambs "Dman*Boujaad" with initial weight of 20.2 ± 1.35 and age 120 ± 20.4 days were randomly assigned to three diets (Table 1), depending on the ensiled sugar beet pulp (ESBP) incorporation level: $T_{0\%}$ (0% ESBP, 30% wheat straw (WS), 30% sunflower meal (SM), 25% maize grain (MG) and 15% barley grain), $T_{15\%}$ (15% ESBP,30% WS, 30% SM and 25% MG) and $T_{30\%}$ (30% ESBP,30% WS, 30% SM and 10% MG). Diets are distributed as total mixed ration (TMR) twice daily (at 9h and 12h). All used diets are iso-energetic and iso-nitrogenous. The trial lasted 77 days including 7 days of adaptation.

Table 1. Ingredients and chemical composition of used diets

	Diet		
	$T_{0\%}$	$T_{15\%}$	$T_{30\%}$
Ingredients (%, Dry matter weight basis)			
Ensiled sugar beet pulp (ESBP)	0	15	30
Wheat straw	30	30	30
Barley grain	15	0	0
Maize grain	25	25	10
Sunflower meal	30	30	30
Chemical composition (% Dry matter)			
Dry matter	89.4	78.9	68.7
Organic matter	95.1	95.1	94.7
Ash	4.9	4.9	5.3
Crude protein	13.4	13.2	13.3
Neutral detergent fiber	41.8	45.1	50.3
Acid detergent fiber	30.5	33.1	36.7
Lignin	8.1	8.2	8.6
Fat	1.8	1.8	1.7

$T_{0\%}$: Diet containing 0% ESBP; $T_{15\%}$: Diet containing 15% ESBP; $T_{30\%}$: Diet containing 30% ESBP.

The intake amounts were determined daily. Animals were weighed before morning feeding, at the beginning and the end of the trial and every 15 days during the trial.

Free clean water and mineral block were available all the time.

The effect of incorporation of ESBP in the diet on final weight and average daily gain (ADG) was analyzed was analyzed by means of a one-way analysis of variance according to the model:

$Y_{ij} = \mu + a_i + \varepsilon_{ij}$ where a_i represents the diet effect and ε_{ij} the experimental error. The PROC GLM procedure of the SAS statistical package was used for the analysis. Comparisons among mean values were tested using the LSD test.

III – Results and discussion

1. Fattening performances

Initial and final live weights as well as ADG are presented in Table 2. The highest ADG (P=0.0085) was recorded in the lambs receiving the $T_{15\%}$ and $T_{30\%}$ diet. This superiority of ADG in lambs consuming ESBP diet may be explained by a good digestive utilization of the diet due mainly to high content of ESBP in digestible fibers (Cuvelier and Dufrasne, 2015).

The results obtained for both live weight and ADG are lower than those reported by Benbati *et al*. (2017) using dry beet pulp in the diet. This difference may be to the polysaccharides fermentation loss of energy during the ensiling process (Martelli *et al*., 1999).

Table 2. Fattening performance of lambs fed diets containing different levels of ensiled sugar beet pulp incorporation

	Diets			SEM	P
	$T_{0\%}$	$T_{15\%}$	$T_{30\%}$		
Initial body weight (kg)	19.6	19.8	21.1	–	–
Initial body weight (kg)	28.8	33.7	33.1	1.89	0.1683
Average daily gain (g/d)	132.7[b]	201.7[a]	173.5[a]	13.47	0.0085

$T_{0\%}$: Diet containing 0% ESBP; $T_{15\%}$: Diet containing 15% ESBP; $T_{30\%}$: Diet containing 30% ESBP; SEM: standard error of the mean; P: probability of the differences;
[a, b] Means with different superscripts are significantly different (P<0.05).

2. Intake, feed conversion and feeding cost

The intake, feed conversion ratio and feeding cost are shown in Table 3. The feed conversion ratio was 8.67, 5.6 and 6.65 kg DMI/ kg ADG for $T_{0\%}$, $T_{15\%}$ and $T_{30\%}$, respectively. This result can be explained by the fact that the ESBP inclusion in the diet improves the organic matter digestibility (Richardson *et al*., 2003) and therefore reduces the feed conversion and feeding cost. This latter was 26.36, 17.73 and 20.52 MAD/kg ADG for $T_{0\%}$, $T_{15\%}$ and $T_{30\%}$, respectively.

The feed conversion and feeding cost obtained in this experiment are superior to those reported by Benbati *et al*., (2017) using dry beet pulp incorporated at 0%, 30% and 60% of dry matter for fattening lambs with 5.5, 4.8 and 5.2, respectively.

Table 3. Intake, feed conversion and feeding cost of used diets containing different levels of ensiled sugar beet pulp

	Diet		
	$T_{0\%}$	$T_{15\%}$	$T_{30\%}$
Intake (kg DM/d)	1.13	1.11	1.13
Feed conversion (kg DMI/kg ADG)	8.67	5.60	6.65
Feeding cost (MAD/kg ADG)	26.36	17.73	20.52

$T_{0\%}$: Diet containing 0% ESBP; $T_{15\%}$: Diet containing 15% ESBP; $T_{30\%}$: Diet containing 30% ESBP; DMI: Dry matter intake; ADG: Average daily gain; MAD: Moroccan dirham (1 MAD = 0.09 €).

IV – Conclusions

The results of this work showed that the incorporation of ensiled sugar beet pulp at 15% in the fattening diets of lambs improves the fattening performance. However, further trials should be carried out increasing the proportion of ESBP inclusion in the diet and involving aspects related to carcass characteristics and meat quality in order to complete the obtained results of this study.

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