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The effect of the incorporation of sorghum in the diet of fattening kids on performances, carcass characteristics and meat quality

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Abstract. The effect of including sorghum in the diet for fattening kids on growth performance, carcass characteristics and meat quality was studied. Three concentrate rations (Rm, R2 and R3) containing respectively 0%, 25% and 50% DM of sorghum grain completed with barley and faba beans, were distributed to 3 groups of 5 local kids for 3 months. The results showed that sorghum had no effect on ADG (47.9, 48.9, 44.5 g/day respectively for Rm, R2 and R3), while the intake and feed conversion showed a significant difference (12.35, 11.65, 13.20 kg DM/kg weight gain (P<0.001).This difference was positive with 25%DM of sorghum. As for carcass characteristics, sorghum had no effect on performance and weight of carcass, pluck, gastric pouch, perirenal and mesenteric fat. Bone tissue was not affected, as the length of the carcass and thigh did not differ significantly. No differences were observed with regards to the muscle tissue because thigh thickness, compactness, conformation and muscle index were similar. Sorghum did not affect carcass color indices. In terms of technological (pH and water retention) and organoleptic (color and tenderness) meat quality traits, no effect of sorghum inclusion was observed. Sorghum incorporation can reach 50% DM of kids concentrate without negatively affecting fattening performance, carcass characteristics and meat quality.

Keywords. Sorghum – Kids – Fattening performances – Carcass characteristics – Meat quality.

Effet de l'incorporation du sorgho dans la ration des chevreaux en engraissement sur les performances, les caractéristiques de la caracasse et la qualité de la viande

Résumé. *Pour déterminer l'effet de l'incorporation du sorgho grain dans la ration des chevreaux, les performances de croissance, les caractéristiques de la carcasse et la qualité de la viande ont été évaluées. Trois formules de concentré (Rm, R2 et R3) contenant 0%, 25% et 50% MS de sorgho grain associé à l'orge et la féverole, ont été distribuées à 3 lots de 5 chevreaux durant 3 mois. Les résultats montrent que le sorgho n'a pas d'effet sur le gain moyen quotidien (GMQ = 47,9, 48,9 et 44,5 g/jour respectivement pour Rm, R2 et R3. Cependant, la quantité ingérée et l'indice de conversion ont montré une différence significative (12,35, 11,65, 13,20 kg MS/kg gain de poids) (P<0,001). Quant aux caractéristiques de la carcasse, le sorgho n'affecte pas les performances de la carcasse. Les qualités technologique (acidité et taux de rétention d'eau) et organoleptique (couleur et tendreté) de la viande ne sont pas affectées par l'incorporation du sorgho. Le sorgho peut atteindre 50% MS du concentré des chevreaux sans affecter négativement les performances d'engraissement, les caractéristiques de la carcasse et la qualité de la viande.*

Mots-clés. *Sorgho – Chevreaux – Performances d'engraissement – Caractéristiques de la carcasse – Qualité de la viande.*

I – Introduction

In the north west of Morocco, goat is the dominant livestock species and its diet is based on the forest path which provides forage but it is subject to strong seasonality, conditions in which an adequate productivity of flocks is not guaranteed (Chentouf *et al.,* 2004). Thus, the improvement and diversification of food calendar appears to be necessary. Sorghum is adapted to the

northern region of Morocco where it expresses high levels of production and can be exploited in green or grain (Noutfia and Baya, 1997). High yields can contribute to satisfying the concentrates requirements of the goat herd. In this context, this work aims to analyze the effect of the incorporation of sorghum grain in the diet of kids on fattening performance and carcass characteristics and meat quality.

II – Material and methods

Fifteen kids from the local goat population aged 4 months were followed from weaning to 3 months until 7 months of age. The animals were assigned to 3 groups (Rm, R2 and R3) and received a food ration consisting of oat hay and 3 types of iso-energetic and iso-nitrogenous concentrate supplements. These supplements were composed of barley grain, faba bean, vitamin-mineral supplement and sorghum grain. The incorporation rate of sorghum was in the range of 0, 25 and 50% dry matter of concentrate respectively for groups Rm, R2 and R3. During the test, animals were weighed weekly to calculate average daily gain. After slaughter, measurement were conducted to evaluate the carcass, yield, color, importance of adipose, bone and muscle tissue. The color of the carcass was measured using a portable colorimeter (Chromameter Minolta CR410). To perform the analysis of meat quality, the samples were taken on the *Longissimus dorsi* (between 12th and 13th rib) and *Semimembranosus* muscle of the leg (on the back of the leg). On the *Longissimus dorsi*, the pH was measured using a pH meter HANNA HI99163 portable for this purpose. Tenderness was measured using a texture analyzer (Texture Analyzer – PRO-TMS) and color using the portable colorimeter. The *Semimembranosus* served to determine the water-holding capacity. The statistical analysis was performed by the Excel 2007 and SAS (2001).

III – Results and discussion

The incorporation of sorghum had no effect on final live weight and average daily gain. The ADG obtained was between 40.0 and 47.9 g/d. This gain is higher than that recorded by Sen *et al.* (2004) with goats in semi arid conditions. Contrary to the previous parameters, feed intake and feed conversion showed a significant difference. The best results were recorded in animals in the control group (Table 1).

Table 1. Effect of sorghum on growth performance of kids

	Final live weight (kg)	ADG (g/d)	feed intake (kg DM/day)	Feed conversion (kg DM/kg weight gain)
Rm	15.6	47.9	0.592[a]	12.3[c]
R2	15.3	43.5	0.570[c]	13.1[b]
R3	14.2	40.0	0.587[b]	14.7[a]

a, b, c: in a same line, followed by the letters distinguished values are statistically different than 5%.

The dietary treatment had no effect on carcass characteristics including yield and carcass weight. The carcass yield obtained ranged from 39.7 to 42.3%. Keli *et al. (*2008) obtained similar yields of about 40.8% and 41.4% respectively with animals fed flax and control. The absence of diet effect was also observed for the weight of pluck and gastric pouch full and empty (Table 2).

Table 2. Effect of sorghum on carcass weight, yield, pluck and gastric pouch

	Carcass weight (kg)	Carcass yield (%)	Pluck† (g)	Gastric pouch full (kg)	Gastric pouch empty (kg)
Rm	6.4	41.4	636.3	3.8	1.5
R2	6.2	42.3	614.3	3.7	1.3
R3	5.5	39.7	565.6	3.7	1.2

†Includes all liver, lung, heart, spleen and trachea.

After evaluation of adipose tissue, the diet did not affect significantly the weight of the mesenteric and perirenal fat (Table 3). Regarding the importance of bone tissue, there was no significant difference between batches because the carcass length and thigh were not affected by the sorghum incorporation (Table 3).

Table 3. Effect of sorghum on adipose and bone tissue

	Mesenteric fat (kg)	Perirenal fat (kg)	carcass length (cm)	thigh length (cm)
Rm	421.35	165.08	57.50	26.5
R2	289.28	174.14	55.20	25.8
R3	282.2	143.65	55.17	25

Regarding the importance of muscle tissue, no differences were found between treatments with regards to the thickness of the thigh, the index of compactness of muscle and conformation (Table 4).

Table 4. Effect of diet on muscle tissue

	Thickness thigh (cm)	Compactness Index	Index muscle	Index conformation
Rm	10.55	0.11	0.40	0.51
R2	11.28	0.11	0.44	0.55
R3	10.37	0.10	0.42	0.52

Also the incorporation of sorghum did not affect the color indices of carcass at saddle, tail and back (Table 5).

Table 5. Effect of diet on carcass color

	L* saddle	a* saddle	b* saddle	L* tail	a* tail	b* tail	L* back	a* back	b* back
Rm	52.62	14.76	9.40	51.82	12.38	4.60	60.30	7.54	4.67
R2	52.20	14.37	9.15	49.6	14.99	5.86	59.70	8.22	4.83
R3	50.64	14.64	10.13	49.57	15.28	5.75	55.80	9.92	5.90

L* Lightness, a * Redness , b *yellowness

In terms of parameters of technological meat quality, the incorporation of sorghum had no effect

on the pH measured at 0 and 24 hours post mortem and on the water-holding capacity. The values of pH at 24 hours were higher than those found by Werdi Pratiwi *et al.* (2007) reporting pH values of 5.7 and 5.6 respectively for goats from Australia of 10 kg and 70 kg live weight, and those reported by Sen *et al.* (2004) who obtained an average pH of 5.48. Our results are similar to those found by Ding *et al.* (2010) with pH ranging from 6.05 to 6.38 for goats and Boer cross Guanzhong Dairy. The water-holding capacity varied between 17.7% for the group receiving 50% of sorghum and 19.8% for those who received 20% (Table 6).

Table 6. Effect of diet on parameters of meat quality

	pH 0h	pH 24	Water holding capacity (%)	Tenderness (N)	*Longissimus dorsi* color		
					L*	a*	b*
Rm	6.95	6.05	19.7	102.05	52.62	14.76	9.40
R2	6.97	6.13	19.8	78.33	52.20	14.37	9.15
R3	6.80	6.12	17.7	87.6	50.64	14.64	10.13

Regarding the organoleptic quality, these parameters were not affected by diet. The tenderness ranged between 78 and 102 N (Newton). The values obtained for the groups receiving sorghum were similar to those found by El Otmani *et al*. (2011) reporting values ranging from 75.77 and 89.36 N for kids receiving lupin or a control diet. Color indices of *Longissimus dorsi* were not affected by diet. The yellow index obtained is similar to that obtained by El Otmani et al. (2011), while the red index is less and the luminance is higher than that found by the same authors (Table 6).

IV – Conclusions

Sorghum grain can be incorporated in the diet of kids at rates that can reach 50% of the concentrate ration without adversely affecting fattening performance, carcass characteristics and meat quality.

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