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GROWTH AND DEVELOPMENT OF PRE-RUMINANT KID GOATS OF THE GRANADINA BREED. USE OF A MILK REPLACER DETERMINING MAXIMUM FEED INTAKE

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SUMMARY

An experiment was conducted in an attempt to produce kid goats of the Granadina breed with appropriate growth and development. They were fed during their first two months of life on a milk replacer whose nutritional composition and dry matter concentration had been selected to maximize feed intake. The utilization of the milk replacer was determined by balance trials. The experimental animals were slaughtered on the day following the end of the experimental period.

There were not significant effect of age on component digestibilities. The mean growth rates (g/day) and feed conversion ratios (kg dry matter/kg bodyweight gain) of the animals were: 162.2 and 1.18 and, 197.0 and 1.59 in the first and second months of life, respectively. The metabolizable energy intakes obtained during the same first two months of life were: 1244 and 1050 kJ/kg$^{0.75}$ per day. The percentages of dry matter, fat, protein and ash in the empty bodyweight and in the carcass of the animals were: 37.91 and 38.56; 45.20 and 43.24; 48.88 and 45.77 and, 8.41 and 11.32, respectively. The growth and fattening obtained resulted superior to those obtained for similar animals fed on either a milk replacer with a different composition to that used here or a milk replacer with a lower dry matter concentration. The results obtained seem to confirm that in 0-2 months old Granadina kid goats, the achievement of relatively high energy intake can produce high growth rates and excellent body composition, especially as far as the degree of fattening is concerned.
Keywords: kid goats, growth, development, feed intake.

INTRODUCTION

The low voluntary feed intakes of pre-ruminant animals has been considered to cause the lack of relationship between the feed intake and the body composition of these animals. In these early stages the body composition is fundamentally related to live weight (Walker 1986). For older or heavier animals in order to obtain more fatty carcasses, different breeds of goat, or milk replacers with increasing fat concentrations have been used. This has given rise to changes in body composition, but the resulting changes are less than expected (Lara 1991). At the same time and in general terms, the size of the abomasum may represent the primary factor limiting voluntary feed intake of the pre-ruminant animal (Stobo *et al.* 1979). Sanz Sampelayo *et al.* (1995) feeding Granadina kid goats with different milk replacers, established how the feed composition, especially in function of its digestible protein concentration, can determine both the feed intake and the body composition. This indicated that there is some relationship between these two variables. The same authors estimated the protein concentration which gives maximum energy intake indicating at the same time, that the value exceeded the maximum concentration studied in their experiment and therefore required futher verification. Allegretti (1995) also working with Granadina kid goats, verified the hypothesis that the size of the abomasum is the primary factor limiting feed intake and showed that by increasing the dry matter concentration of a milk replacer, this limiting effect could be decreased and eventually annulled. This author estimated the minimum dry matter concentration necessary to annul this effect. With this in mind, the results presented here refer to the nutritional utilization and to the growth and body composition of Granadina kid goats fed on a milk replacer whose composition and dry matter concentration was chosen so as to achieve a maximum feed intake.

MATERIAL AND METHODS

Six male kid goats of the Granadina breed were maintained from birth to two months of age in individual cages under controlled conditions. They were fed on a milk replacer with 34.5% protein (50% from a skimmed milk powder, 25% from micronized soya and 25% from casein) and 30.0% fat (pork lard), being the gross energy content equal to 24.7 MJ/kg. The replacer was prepared at 200 g fresh powder/kg and was offered in containers fitted with teats. The containers were placer over a device designed to maintain the replacer temperature at 39±2°C and to keep it satisfactorily mixed. In order to assess the voluntary feed intake, animals had ad lib. access daily from 09.00 until 18.99 hours. Feed intakes were determined daily and the bodyweights twice a week. Two balance trials of 8 days duration were performed, staring when the animals were aged 23 and 53 days respectively. During these trials total faeces and urine collections were made and samples were stored frozen. From the bulked samples, subsamples were taken for the

determination of DM, N and energy contents of the urine, and DM, N, fat and energy contents of the faeces. The protein, fat and energy digestibilities were calculated for each balance period and for each animal. The digestible protein (DP; g/kg DM), digestible energy (DE; MJ/kg DM) and metabolizable energy (ME; MJ/kg DM) contents of the diet were also calculated as were the ME intakes (MEI; kJ/kg$^{0.75}$ per day), growth rates (g/day) and the feed conversion ratios (FCR; kg DM/kg bodyweight gain).

The day after the end of the experimental period, when the animals were aged 61 days, they were slaughtered by carotid section after anaesthetization using an intramuscular injection of Xylacine (Rompun, Bayer). Once the animals were dead and completely bled, the skin, limbs, internal organs and head were removed. The rumen, reticulum, omasum and abomasum were washed of their contents. The blood, skin, alimentary canal, all internal organs and the carcass were considered as distinct body parts and were minced separately. Empty bodyweight and carcass composition, i.e., percentages of DM, fat, protein and ash were calculated.

DM and N analyses were performed on samples of the freshly minced parts. All other determinations were carried out on lyophylized samples. N was determined by the Kjeldahl method, energy using an adiabatic bomb calorimeter. The fat concentration of the milk replacer was analysed by the Garber method, that of the faeces by extraction with petroleum ether after HCL hydrolysis and that of the different body parts by extraction with chloroform-methanol (2:1, v/v) and finally, ash contents by incineration of fat-free portions in an electric muffle furnace at 550°C.

RESULTS AND DISCUSSION

Feeding trials

Growth rates of the animals and FCRs in the first and second months of life, as well as the bodyweights achieved at the end of these periods are shown on Table 1. The live weight gains were the highest so far achieved in Granadina kid goats fed on milk replacers. Ruiz Mariscal (1991) using the same breed of kid goats and a milk replacer somewhat similar in composition to that used here but with only 17% dry matter concentration, observed a mean growth rate of 120 g/day during the first two months of life. The rate obtained in the present study was also greater than the 155 g/day achieved in Granadina kid goats maintained in identical conditions on goat's milk (Sanz Sampelayo *et al.* 1987a). Irrespective of the breed, the index of feed utilization for growth in the pre-ruminant kid goats is almost invariable estimated at 1.3 (Fehr and Sauvant 1974; Simiane and Miossec 1976 and Lanza and Lanza 1978). In the present study, this index was somewhat lower during the first month of life and somewhat higher during the second month. Most of the values published in the literature refer to kids younger than 60 days old, values between 1.3 and 1.9 being deduced for animals of the breed and age considered here (Lara 1991; Ruiz Mariscal 1991).

Balance trials

In accordance with the balance trials, the protein, fat and energy digestibility coefficients as well as the DP, DE and ME contents of the milk replacer were calculated. Table 2 shows these values which resulted high ones and at the same time not different according to animals age. As in these animals the digestive and metabolic utilization increases with the protein content of the milk replacer (Sanz Sampelayo *et al.* 1995) as well as with the animal age (Sanz Sampelayo *et al.* 1990b), from the results obtained here we can infer that under the milk replacer used, together with a maximum feed intake it was probably obtained a maximum digestive and metabolic utilization even at an early age. In this way it was possible to overcome the limit that according to the composition of the feed the animal age determines on the nutritional utilization of the milk replacers, having been this aspect also found in lambs (Aurousseau *et al.* 1983). Ruiz Mariscal (1991) feeding Granadina kid goats with a milk replacer containing 17% dry matter concentration, 28% protein and 28% fat, obtained lower values of the digestibility coefficients as well as of the DP, DE and ME contents. These differences can be explained on the basis of the effect that the protein content of the feed has on the digestive and metabolic utilization of the milk replacers (Sanz Sampelayo et al. 1995). The metabolizable energy intakes obtained in the present study during the first and the second moths of life were 1244±21 and 1050±27 kJ/kg$^{0.75}$ per day, respectively. Such levels have not previously been achieved in numerous trials performed to design an optimum system of artificial milk feeding for these animals (Sanz Sampelayo *et al.* 1990a, 1994, 1995).

Slaughter trials

Table 3 shows the percentages of dry matter, fat, protein and ash in the empty bodyweight (EBW) and carcass. The carcass composition was very similar to that of the EBW, both in terms of the dry matter content and of the proportion of fat. The amount of ash was higher, and the proportion of protein lower, in the carcass, as is to be expected. In different trials carried out previously on Granadina kid goats, the body

composition of the animals was calculated and analysed in function of the dietary regime (Sanz Sampelayo et al. 1990a, 1994; Lara 1991 and Ruiz Mariscal 1991). In these studies the values for the dry matter and fat contents of the EBW (maximum values: 27.9 and 35.9%, respectively) and of the carcass (maximum values: 36.5 and 35.5%, respectively) were lower than those obtained here, indicating different degrees of fattening. In all meat animals, the carcass composition is ideally defined in function of its tissue composition, due to the relationship that exists between this parameter and the so-called eating quality. In the present study the tissue composition of the carcasses of the experimental animals was not determined, although the fat that could have been obtained by dissection was estimated from the relationship established for these animals between the dissected fat and that extracted from the corresponding dry matter (Ruiz Mariscal 1991). In this way the dissectible fat was estimated to be 12.51±0.39%, a value superior to those obtained for similar animals fed on either a milk replacer with a different composition to that used here (10.6%) or a milk replacer with a lower dry matter content (10.9%) (Sanz Sampelayo *et al.* 1987b; Ruiz Mariscal 1991 and Allegretti 1995). The results obtained would seem to confirm the findings of Sanz Sampelayo *et al.* (1995). These authors found that in Granadina kid goats, the level of feed intake achieved establishes the body composition of the animals. Thus, the achievement of relatively high energy intakes can produce not only high growth rates, but also an excellent body composition, especially as far as the degree of fattening is concerned.

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Table 1. Feed utilization for growth (growth rate, g/day; FCR, kg DM/kg bodyweight gain; final bodyweight, kg) of kid goats fed on a milk replacer determining maximum feed intake

	Period of life	
	First month	Second month
Growth rate	162.2±14.2	174.0±13.9
FCR	1.18±0.10	1.59±0.10
Final bodyweight	7.0±0.3	12.2±0.6

Table 2. Protein, fat and energy digestibilities, digestible protein (DP), digestible energy (DE) and metabolizable energy (ME) contents of a milk replacer fed to kid goats determining maximum feed intake

	Period of life (days)			
	23 - 30	53 - 60	SE	Level of significance
Digestibility				
Protein	94.2±0.3	92.9±1.2	0.88	NS
Fat	96.4±0.4	95.4±1.4	1.05	NS
Energy	95.0±0.3	94.3±1.1	0.78	NS
DP (g/kg DM)	325.2±1.2	320.6±4.1	45.82	NS
DE (MJ/kg DM)	23.4±0.1	23.3±0.3	0.18	NS
ME (MJ/kg DM)	22.4±0.1	22.2±0.3	0.18	NS

Table 3. Empty bodyweight (EBW) and carcass composition (% in DM) of kid goats fed on a milk replacers determining maximum feed intake

	DM	Fat	Protein	Ash
EBW	37.91±0.40	45.20±1.79	48.88±3.04	8.41±1.08
Carcass	38.56±0.59	43.24±1.64	45.77±1.72	11.32±1.49