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Quantitative characteristics of carcass and meat quality of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast[1]

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ABSTRACT - Twenty-seven carcasses of non-castrated confined goat kids, (18 ¾ Boer + ¼ Saanen and nine Saanen) with slaughtered weight of 30.1 ± 0.27 kg were used to evaluate quantitative characteristics of the carcass and qualitative characteristics of the loin and shoulder. The animals were distributed in a completely randomized design in a 2 × 3 factorial arrangement (breed group × diet). The diets consisted of inclusion of dry yeast, as follows: soybean meal, soybean meal + dried yeast or dried yeast. The other ingredients of the diets were oat hay (30% DM), ground corn and mineral mixture. Hot carcass weight, cold carcass weight, weight loss by cooling, true carcass yield and carcass compactness index were not influenced by the inclusion of dry yeast nor by racial group. Saanen goats presented the highest carcass commercial yield of carcass, but they needed 15 days more to reach the slaughter weight. The cut yields were not affected, but a significant interaction for shoulder yield occurred. Dry yeast and breed group did not influence the measurements of the loin, the muscle:bone ratio, the cooking losses, the shear force and composition. There was a significant interaction between the inclusion of dry yeast in the diets and the breed group for the muscle proportion on loin, which was higher in the ¾ Boer + ¼ Saanen group. For the shoulder, inclusion of dry yeast and breed group did not alter the proportions of muscle, fat, protein and ash. However, in Saanen goats, the proportion of bone and moisture content were higher and total lipid content was lower. The ¾ Boer + ¼ Saanen groups showed higher precocity. Dry yeast is an alternative protein source that can be included in diets for goat kids.

Key Words: byproduct of sugar cane, genetic group, goat, meat quality, *Saccharomyces cerevisiae*

Características quantitativas de carcaça e de qualidade da carne de cabritos ¾ Boer + ¼ Saanen e Saanen alimentados com rações contendo levedura seca

RESUMO - Foram utilizadas 27 carcaças de cabritos machos não-castrados, confinados, sendo 18 ¾ Boer + ¼ Saanen e nove Saanen com peso de abate de 30,1 ± 0,27 kg, para avaliar as características quantitativas da carcaça e qualitativas do lombo e da paleta. Os animais foram distribuídos em delineamento inteiramente casualizado em arranjo fatorial 2 × 3 (grupo racial × rações). As rações foram constituídas pela inclusão de levedura seca, sendo: farelo de soja, farelo de soja + levedura seca ou levedura seca. Os demais ingredientes das rações foram o feno de aveia (30% da MS), milho moído e mistura mineral. Os pesos de carcaça quente e de carcaça fria, as perdas de peso por resfriamento, o rendimento verdadeiro de carcaça e o índice de compacidade de carcaça não foram influenciados pela inclusão da levedura seca nem pelo grupo racial. O grupo Saanen apresentou maior rendimento comercial de carcaça, porém 15 dias a mais de idade para atingir o peso de abate. Os rendimentos de cortes não foram influenciados, porém ocorreu interação significativa para rendimento de paleta. A levedura seca e o grupo racial não influenciaram as medidas do lombo, a razão músculo:osso, as perdas de peso por cocção, a força de cisalhamento e a composição centesimal. Houve interação significativa entre a inclusão da levedura seca nas rações e o grupo racial para a proporção de músculo do lombo, que foi maior no grupo ¾ Boer + ¼ Saanen. Na paleta, a inclusão de levedura seca e o grupo racial não alteraram as proporções de músculo, gordura, teor de proteína e cinzas. Entretanto, no grupo Saanen, a proporção de osso e o teor de umidade foram maiores e teor de lipídios totais menor. O grupo ¾ Boer + ¼ Saanen apresentou maior precocidade. A levedura seca é uma fonte proteica alternativa que pode ser incluída em rações para cabritos.

Palavras-chave: caprinos, grupo racial, qualidade da carne, *Saccharomyces cerevisiae*, subproduto da cana-de-açúcar

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Introduction

Goat meat has important nutritional characteristics, such as protein source of high biological value (Amaral et al., 2007), low cholesterol content (40 mg/100 g) lower than sheep (62 mg/100 g) and bovine meat (70 mg/100g), according to Souza & Visentainer (2006), and it is lower in fat, which results in a reduction proportion of saturated fat and calories when compared to other red meat (Madruga et al., 1999; Malan 2000). Silva Sobrinho & Osório (2008) reported that despite these characteristics of goat meat, the consumption is considered low (about 0.4 kg/capita/year) compared to beef (40 kg/capita/year).

The greatest challenge of goat meat producers should be the search for animals able to use the nutrient pool for production of muscle, which represents most of the carcass edible portion (Santos et al., 2001). However, some factors that influence the carcass traits should be considered, including the breed group, sex, age and/or weight, management and nutrition of animals (Gonzaga Neto et al., 2005).

The expansion of ethanol producers in Brazil increases the planting of sugar cane. This generates a large quantity of by-products, including, yeast *(Saccharomyces cerevisiae),* which are responsible for alcoholic fermentation of sugar cane soup and are obtained by the bleeding of the fermentation vats (Ghiraldini & Rossel, 1997; Machado, 1997; Butolo, 2002), and are subsequently dried by the process of spray-dry.

The high protein content, above 30% (Sgarbieri et al., 1999, Yamada et al., 2003), is one of the most important characteristics of dry yeast, but this by-product also stand out in its composition, the B vitamin group (B1 , B2, B6, pantothenic acid, niacin, folic acid and biotin) and good amino acids profile, especially lysine, threonine and methionine (Barbalho, 2005). Cell wall of dry yeast is consisted of carbohydrates (20-35%), mainly glucans and mannans, which have immune function (Ghiraldini & Rossel, 1997; Ezequiel et al., 2000; Butolo, 2002). Because of the chemical composition, the inclusion of dry yeast in animal diets has been studied.

Thus, this study was performed to evaluate the quantitative characteristics of carcass and meat quality of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast.

Material and Methods

The carcasses used in the experiment were obtained from a performance experiment conducted at the Universidade Estadual de Maringá, in Setor de Caprinocultura on Fazenda Experimental de Iguatemi (FEI). Twenty-seven carcasses of non-castrated male goats were used: 18 ¾ Boer + ¼ Saanen and nine Saanen. The animals were distributed in a completely randomized design in a 2×3 factorial arrangement (breed group × diet).

The diets were formulated by replacing protein sources: soybean meal (SB), soybean meal + dry yeast (SBDY) or dry yeast (DY, containing 42.88% CP) and the other ingredients were: ground corn, mineral mixture and oat hay with 91.01% of DM, 12.55% of CP and 64.12% NDF in DM. The diets were formulated to meet requirements of growing kids (± 25 kg and average daily gain of 200 g) according to AFRC (1995), corresponding to 2.50 Mcal/kg DM and 17.0% crude protein (Table 1).

When the animals reached 30.1 ± 0.27 kg of BW, which corresponded to aproximately 154 days of age, they were fasted for solids (18 hours) and weighed before

Table 1 - Chemical composition and percentage (% DM) of experimental diets

Ingredient	Diet		
	Soybean meal	Soybean meal + dry yeast	Dry yeast
Oat hay	30.00	30.00	30.00
Ground corn	49.51	47.36	44.59
Soybean meal	17.49	9.86	-
Dry yeast	-	9.78	22.41
Mineral mixture	3.00	3.00	3.00
Dry matter (%)	91.15	91.22	90.94
Organic matter (% DM)	94.89	95.25	95.38
Ash (% DM)	5.11	4.75	4.62
Crude protein (% DM)	17.28	17.35	17.38
Ether extract (% DM)	3.30	3.13	2.76
Neutral detergent fiber (% DM)	30.02	27.69	26.09
Acid detergent fiber (% DM)	13.86	12.95	12.08
Total carbohydrates (% DM)	74.31	74.77	75.23
Metabolizable energy (Mcal/kg DM)[1]	2.50	2.51	2.52

[1]ME = 0.82 × DE (NRC, 1996).

slaughter to get the body weight at slaughter. The animals were stunned by electric shock of 220 volts for 8 seconds later with bleeding sectioning of the jugular veins and carotid arteries.

During evisceration, the gastrointestinal tract was emptied to obtain empty body weight (body weight at slaughter minus the weight of the gastrointestinal tract content) to determine the carcass yield and carcass biological yield (ratio of hot carcass weight and empty body weight - Sañudo & Sierra, 1986). The blood, gastrointestinal tract and liver were collected and weighed to get the percentage in relation to body weight at slaughter.

At the end of evisceration, carcasses were weighed (hot carcass weight) and stored in a cold room at 4°C for 24 hours, the Achilles tendon hung on hooks appropriated for the maintenance of the tarsometatarsal joints spaced at 17 cm. After cooling for 24 hours, the carcasses were weighed to calculate percentage of weight loss by cooling (WLC) and carcass biological yield (CBY).

To determine the index of compactness, the following measures were performed on the carcass: leg length - distance between the anterior edge of the symphysis pubis, ischium and the inner edge of the tarsometatarsal joint surface, the inner side of the leg, internal length of the carcass - the maximum distance between the anterior edge of the symphysis pubis and the anterior edge of the first rib at its midpoint, and rump width - maximum width between the trochanters of both femurs, surrounded by a compass and tape measure. By using these measurements, it is possible to determine the carcass compactness index (CCI), the quotient of the cold carcass weight and internal carcass length, and leg compactness index (PCI), the ratio between the rump width and leg length.

Subsequently, the carcasses were cut longitudinally and the left half of each one was divided into seven anatomical regions, and weighed individually to determine cut percentages. The following carcass areas were recorded: lower leg - all of the gluteus region, femoral and leg, based on the tarsal bone, tibia, femur, ischium, pubis and ileum, separated by a perpendicular cut to the spine between the last lumbar vertebra and first tarsometatarsal joint and sacral, lumbar - formed by the vertebrae and the area corresponding to the incident perpendicular to the spine, between the 13th thoracic vertebra and the last lumbar vertebra; shoulder - consisting of the scapula, humerus, ulna, carpal and radio; ribs - formed by the last eight thoracic vertebrae, with the upper half of the corresponding ribs; ribs under the shoulder - based on the first five thoracic vertebrae, with the upper half of the corresponding ribs; breast and rib points - a straight line of the dorsal border of the abdomen to the sternum; and neck - the seven cervical vertebrae, and obtained by means of an oblique cut between the seventh cervical vertebra and first thoracic.

The *Longissimus dorsi* muscle was delineated (between the last thoracic vertebra and first lumbar vertebra, in the cut called loin) with the use of plastic blade of transparency and an appropriated pen. It was used a computer program (Autocad®) for determining the loin eye area.

Also on the *Longissimus dorsi* muscle, measurements were made by using a caliper rule for the four measures: Measure A – large length of the muscle perpendicular to the axis or Measure B; Measure B – short length, considered as maximum depth; Measure C – short fat thickness on the muscle, with the thickness of fat covering on the same cross section, Measure J – large fat thickness covering the loin in the profile (Figure 1).

The loin on the left side of each carcass was collected and divided into two samples: one for dissection and the analyses of cooking losses and shear force (performed at the Universidade Estadual de Maringá – Campus Regional de Umuarama, Laboratório de Qualidade de Carne) and the second for composition of the muscle. The samples were packed in polyethylene bags and stored at -18°C until the analysis. The shoulder on the left side of each carcass was collected and stored at -18°C for subsequent analysis and dissection.

For dissection, the samples were thawed at 4ºC for 24 hours and analyzed to determine the proportions of muscle, fat and bone, using methods described by Sañudo & Sierra (1986). After dissection, it was determined muscle cooking losses. For this, the samples were weighed and individually covered with aluminum foil and roasted in preheated plate

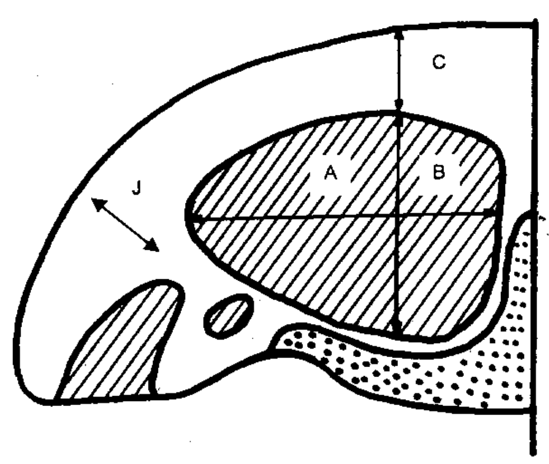

Figure 1 - Measurements taken in the *Longissimus dorsi:* Measure A, Measure B, Measure C and measure J. (Garcia et al., 2003).

(170°C) until 70°C at the geometric center (temperature was monitored by a skewer thermometer). When the temperature reached 70ºC, the samples were removed from the plate, dried in absorbent paper, cooled to room temperature and weighed again. The calculation of the weight difference of samples before and after cooking resulted in the percentage of cooking losses.

Samples of cooked *Longissimus dorsi* were taken for determination of shear force, according to the methodology of Wheeler et al. (2007). Samples were longitudinally cut in the form of cubes (1.5 × 2.0 × 3.0 cm), with three subsamples for determination of texture. The analysis was performed on a Texture Stable Micro System TA-XT2i, coupled with the probe Warner-Bratzler Shear Force, at a speed of 20 cm/minute, which measures the shear force of the sample in kilograms-force (kgf).

The shoulder dissections were performed at Universidade Estadual de Maringá - Campus Sede, at Laboratório de Análise de Alimentos e Nutrição Animal. The thaw process of the samples was the same used for the loin. After dissection, the muscles of the shoulders were ground in processor, homogenized and stored at -18°C for subsequent chemical analysis.

In the second loin sample, it was removed only the *Longissimus dorsi,* which was ground and stored following the same procedure of the muscles of the shoulders.

For the moisture, ash, protein and lipid samples were thawed at 4ºC for 24 hours. Moisture and ash analysis were carried out in an oven and furnace, respectively, and the determination of crude protein, by Kjedahl semimicro method, as described by Silva (2002). Analyses were performed in triplicate using samples of fresh meat. For the analysis of ether extract, raw samples were dried at 105°C for 24 hours and ground in ball type mill. The extraction of lipids was also in triplicate, following the methodology described by Silva (2002).

The data obtained were analyzed by using analysis of variance by utilizing SAEG system performed by Universidade Federal de Viçosa (2007) with the following general model: $Y_{ijk} = \mu + D_i + B_j + DB_{ij} + e_{ijk}$; where: Y_{ijk} = the dependent variable, μ = overall mean; D_i = effect of diet *i, i* = SB (Soybean meal) SBDY (soybean meal + dry yeast) and DY (Dry Yeast); B_j = effect of breed group j, j = 1 for ¾ Boer + ¼ Saanen and j = 2 for Saanen; DB_{ij} = interaction between diet i and breed group j; e_{ijk} = random residual error.

Results and Discussion

The evaluated carcass characteristics of ¾ Boer + ¼ Saanen and Saanen goats fed diets with dry yeast instead of soybean meal (Table 2) showed no differences on slaughter weight, hot carcass weight, cold carcass weight, weight loss by cooling, carcass yield and carcass compactness index.

The inclusion of dry yeast in the diets did not influence age at slaughter, however, differences were observed according to breed group. To reach 30 kg of BW at slaughter, it took on average 146.17 days of feedlot for crossbred animals (¾ Boer + ¼ Saanen), but Saanen animals spent 161.18 days to reach the same weight. The heterosis obtained from crossing between these breeds resulted in early animals to slaughter with a consequent reduction of days of feedlot.

According to Silva Sobrinho & Osório (2008), the use of specialized breeds for meat production, such as Boer, is a way to optimize growth, because the animals reach slaughter weight faster. Madruga et al. (2009) reported that the crossbreeding can increase growth and provide better performance and carcass conformation. Moreover, the excellent characteristics of the Boer breed as for example hardiness, fertility, high growth potential and good carcass quality are transmitted when these animals are used in crossbreeding systems.

Table 2 - Carcass characteristics of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast

	Breed group		Diet			CV (%)
Item	¾ Boer + ¼ Saanen	Saanen	Soybean meal	Soybean meal + dry yeast	Dryyeast	
Slaughter weight (kg)	30.49	29.51	29.98	29.95	30.07	5.23
Age at slaughter (days)	146.17b	161.18a	153.00	151.75	157.17	7.52
Hot carcass weight (kg)	13.84	13.73	13.81	13.66	13.88	7.50
Cold carcass weight (kg)	13.64	13.58	13.63	13.49	13.73	7.67
Weight loss by cooling (%)	1.43	1.02	1.27	1.30	1.11	53.11
Carcass yield (%)	52.74	53.73	53.15	53.26	53.31	2.80
Carcass biological yield (%)	44.69b	46.03a	45.44	44.99	45.65	2.96
Carcass compactness index (kg/cm)	0.22	0.21	0.22	0.21	0.21	8.54
Leg compactness index	0.42a	0.40b	0.40	0.42	0.40	5.38

Means followed by letters in the same row differ (P<0.05) by Tukey test.

Mattos et al. (2006) highlighted the importance for body weight and age at slaughter as one of the most important items to valorize a carcass, whose main goal should be to obtain higher final weight in shorter time in feedlot, in order to meet the demands of the consumer.

For hot and cold carcass weight, the averages 13.78 kg and 13.61 kg were obtained, respectively. These values are similar to those described by Fernandes et al. (2008), who used ¾ Boer + ¼ Saanen with 28.2 kg of BW at slaughter and obtained 13.7 kg of hot carcass weight.

The dry yeast and breed group did not influence the weight loss by cooling, which averaged 1.23%, a result similar to those reported by Oliveira et al. (2008) in a study with goat kids of several breeds and similar slaughter weight (1.92%) but lower than the results obtained by Grande et al. (2003) with Saanen goats (3.10%) and by Hashimoto et al. (2007) with Boer + Saanen goat (5.44%). Silva Sobrinho & Osório (2008) reported that the loss of moisture from the muscle surface during the cooling of the carcass mostly depend on fat cover, due to the greater protection given to the carcass.

Carcass yield was not affected (P>0.05) by the breed group either by diet, averaging 53.24%. Dhanda et al. (2003) and Hashimoto et al. (2007) reported yields of 51.7% and 56.91%, respectively, on animals of similar physiological age.

For the carcass biological yield, Saanen animals showed the highest value (46.03%) compared to crossbred animals (44.69%), however, to reach the established slaughter weight, these animals remained 15 days more in feedlot receiving rations.

Grande et al. (2003) reported that Saanen animals slaughtered at 25 kg of BW at 145 days of age showed 43.54% of carcass biological yield. However, Grande et al. (2009) observed 44.35% of carcass biological yield in ¾ Boer + ¼ Saanen with age and body weight similar to animals of this experiment. The results are support by Yáñez et al. (2007), who reported that the carcass biological yield is influenced by several factors such as breed group, fat deposition, conformation, muscularity, age and physiological and nutritional state of the animal.

The carcass compactness index (CCI) was not influenced by the inclusion of dry yeast or by breed group. The average was 0.22 kg/cm, similar to 0.21 kg/cm reported by Dhanda et al. (2003) and 0.25 kg/cm by Hashimoto et al. (2007) and higher than 0.16 kg /cm by Grande et al.(2003). It is important to note that the CCI estimates the carcass muscularity, thus it is interesting to improve these values.

For the leg compactness, index differences were observed between breed groups: ¾ Boer + ¼ Saanen animals showed 0.42 and the Saanen showed 0.40. The compactness indices are directly related to the age of the animals, body weight and production ability of the breed groups (meat or milk). Meat breeds are more compact, robust and heavier, while dairy breeds have more developed and longilign bone structure.

The carcass division in cuts allows the qualitative analysis, because it determines the participation of edible tissues, especially muscle (Yáñez et al., 2007). Yields from the commercial cuts were not influenced by the inclusion of dry yeast or by breed group (Table 3).

There was interaction between breed and feed on the shoulder yield (Table 4), whose average was higher for Saanen goats fed the soybean meal diet.

Measures of lower length and, lower and higher fat thicknesses of the loin did not change with the inclusion of dry yeast and did not differ between breed groups and averaged 24.56, 0.55 and 1.28 mm, respectively (Table 5).

Hashimoto et al. (2007) evaluated Boer + Saanen goats slaughtered at 33.82 ± 4.40 kg of BW and observed the following measures: short length, 24.75 mm; short fat thickness, 1.45 mm; and large fat thickness, 2.76 mm. Compared to this research, the values presented by the authors are high and are related to the greater age (188 days) and weight (33.82 kg) of animals. The increase in measures of fat thickness is due to the higher growth of fat tissue at older ages (Santos et al., 2001).

Table 3 - Yield of commercial cuts of the carcasses of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast

	Breed group		Diet			CV (%)
Item	¾ Boer + ¼ Saanen	Saanen	Soybean meal	Soybean meal + dry yeast	Dryyeast	
Leg	32.33	32.95	33.08	32.11	32.75	4.26
Loin	9.62	10.01	9.66	10.03	9.76	12.91
Shoulder	*	*	*	*	*	5.73
Rib	7.43	7.49	7.40	7.82	7.16	8.83
Rib under the shoulder	11,76	11.45	11.92	11.27	11.64	12.81
Breast and rib points	11,55	11.63	11.68	11.94	11.17	8.04
Neck	6.26	6.66	6.52	6.54	6.32	21.55

* Interaction between breed group and diet.

Table 4 - Shoulder yield of ¾ Boer + ¼ Saanen and Saanen goat kids for interaction between racial group and diet

	Diet		
Breed group	Soybean meal	Soybean meal + dry yeast	Dry yeast
¾ Boer + ¼ Saanen	20.32Ab	20.22Aa	21.37Aa
Saanen	22.31Aa	20.10Aa	20.30Aa

Means followed by capital letters in one row and lowercase letters in the same column differ (P <0.05) by Tukey test.

Table 5 - Measurements of loin ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast

	Breed group		Diet			CV (%)
Item	¾ Boer + ¼ Saanen	Saanen	Soybean meal	Soybean meal + dry yeast	Dry yeast	
Loin eye area (cm^2)	*	*	*	*	*	17.09
Large length (mm)	48.84a	44.49b	46.60	46.35	47.05	8.86
Short length (mm)	25.56	23.56	24.35	24.99	24.33	12.79
Short fat thickness (mm)	0.61	0.49	0.62	0.52	0.51	46.72
Large fat thickness (mm)	1.37	1.19	1.34	1.27	1.22	18.77

* Interaction between breed group and diet.
Means followed by letters in the same row differ (P<0.05) by Tukey test.

The large length differed between breed groups and was higher in ¾ Boer + ¼ Saanen animals. This measure represents the large length of the *Longissimus dorsi,* considered with later maturation and an indicator of development and size of muscle tissue (Silva Sobrinho et al., 2008). The crossbred allowed higher growth rate of animals and it reflected on the size of the *Longissimus dorsi*.

A significant interaction between breed groups and diets for the loin eye area was observed (Table 6), which was higher in ¾ Boer + ¼ Saanen fed soybean meal ration. The value for this group was similar to that presented by Hashimoto et al. (2007), 13.96 cm² for Boer + Saanen goats. However, the lowest value was observed in Saanen breed fed soybean meal ration, which is consistent with results reported by Grande et al. (2003), 9.21 cm² for Saanen goats. Thus, the difference between breed groups may be related to the precocity of crossbred animals resulting from heterosis.

The highest proportion of fat was observed in animals fed soybean meal diet (Table 7), showing the influence of the diet on the proportions of fat and bone of the loin. Reduction on the proportion of fat in animals fed diets containing dry yeast is probably because of the characteristic composition of the dry yeast, which has a thick cell wall, resulting in lower energy value and lower fat deposition (Yamada et al., 2003).

For the proportion of bone in the loin, the diets containing soybean meal and dried yeast differed, with averages of 10.38% and 15.79% respectively. However, despite of this difference in the proportion of bone, the muscle:bone ratio suffered no differences with the inclusion of dry yeast or between breed groups. There was, however, a high coefficient of variation of data, which may have compromised the identification of differences between diets and breed groups.

Table 6 - Loin eye area of ¾ Boer + ¼ Saanen and Saanen goat kids for interaction between breed group and diet

	Diet		
Breed group	Soybean meal	Soybean meal + dry yeast	Dry yeast
¾ Boer + ¼ Saanen	14.91Aa	11.08Ba	11.04Ba
Saanen	10.86Ab	12.31Aa	12.12Aa

Means followed by capital letters in a row and lowercase letters in the same column differ (P<0.05) by Tukey test.

Table 7 - Percentage of muscle, fat and bone in the of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast

	Breed group		Diet			CV (%)
Item	¾ Boer + ¼ Saanen	Saanen	Soybean meal	Soybean meal + dry yeast	Dry yeast	
Muscle (%)	*	*	*	*	*	6.17
Fat (%)	15.61	16.80	18.73a	15.19b	14.69b	17.45
Bone (%)	11.53	13.40	10.38a	11.22ab	15.79b	32.52
Muscle:bone	7.40	6.13	6.83	6.55	4.40	46.01

* Interaction between breed group and diet.

It was observed a significant interaction between breed groups and diets. Saanen goats fed the diet dry yeast had lower proportion of the muscle in the loin (Table 8). This result indicates that the source of protein can interfere with formation of muscle tissue of these breed groups, in other words, in the pool of nutrients that are used in metabolism.

For the cooking losses and shear force on the loin, no changes were observed with the addition of dry yeast or between breed groups (Table 9). The values obtained for the cooking losses (27.12%) are similar to those observed by Monte et al. (2007), from 25.55% in ¾ Boer + ¼ unknown genetic composition.

For shear force, it was obtained an average of 5.8 kgf, which allows classifying the meat as tender. According to Souza et al. (2004), values lower than 8 kgf indicate soft flesh, from 8 to 11 kgf, acceptable, and above 11 kgf, tough meat. Values of this study were similar to those reported by Monte et al. (2007), 4.39 kgf, for ¾ Boer + ¼ unknown genetic composition animals, weighing 30 kg and at 10 months of age.

The composition of the *Longissimus dorsi muscle* was not affected (P>0.05) by the inclusion of dry yeast or by breed group (Table 10). The observed results are similar to those presented by Grande et al. (2009) in an extensive review of literature, of 70.80% to 80.25% for moisture, 18.50% and 23.82% for protein and 0.79% to 1.6% for ash. However, for the total lipid content, the literature reports range from 0.5% to 7.2% (Madruga et al. 1999; Dhanda et al. 2003; Silva, 2005), which may be related to the sex , slaughter weight (Mahgoub et al., 2004), age, food, breed types and the method of lipid extraction.

For the percentage of muscle and fat from the shoulder (Table 11) there was no difference according to the inclusion of dry yeast and breed group. However, significant differences in the percentage of bone and muscle:bone ratio of the shoulder between breed groups

Table 8 - Percentage of muscle in the loin of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast

Breed group	Diet		
	Soybean meal	Soybean meal + dry yeast	Dry yeast
¾ Boer + ¼ Saanen	69.52Aa	74.86Aa	74.20Aa
Saanen	72.27Aa	72.31Aa	64.84Ab

Means followed by capital letters in a row and lowercase letters in the same column differ (P<0.05) by Tukey test.

Table 9 - Cooking losses and shear force of loin of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast

	Breed group		Diet			CV (%)
Item	¾ Boer + ¼ Saanen	Saanen	Soybean meal	Soybean meal + dry yeast	Dry yeast	
Weight loss (%)	28.66	25.59	27.17	27.81	26.39	15.70
Shear force (kgf)	6.71	4.88	5.45	5.06	6.88	36.76

Table 10 - Composition of the *Longissimus dorsi* of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast

	Breed group		Diet			CV (%)
Item	¾ Boer + ¼ Saanen	Saanen	Soybean meal	Soybean meal + dry yeast	Dry yeast	
Moisture (%)	76.58	76.88	76.69	76.81	76.69	0.86
Protein (%)	21.63	21.87	21.62	21.93	21.71	3.96
Ash (%)	1.04	1.05	1.03	1.05	1.06	3.47
Total lipids (%)	1.34	1.50	1.15	1.62	1.48	26.26

Table 11 - Percentage of muscle, fat, bone and composition of shoulder of ¾ Boer + ¼ Saanen and Saanen goat kids fed diets with dry yeast

	Breed group		Diet			CV (%)
Item	¾ Boer + ¼ Saanen	Saanen	Soybean meal	Soybean meal + dry yeast	Dry yeast	
Muscle (%)	69.12	68.27	69.35	68.48	68.26	2.18
Fat (%)	11.92	11.15	11.18	11.27	12.14	9.09
Bone (%)	18.96b	20.58a	19.46	20.25	19.60	6.12
Muscle:bone	3.67a	3.33b	3.60	3.39	3.51	7.98
Moisture (%)	75.91b	76.85a	76.55	76.45	76.15	0.80
Protein (%)	21.37	21.14	21.09	21.41	21.27	3.10
Ash (%)	1.06	1.04	1.04	1.05	1.05	3.92
Total lipids (%)	2.19a	1.60b	1.97	1.85	1.88	14.62

Means followed by letters in the same row differ (P<0.05) by Tukey test.

were found. The ¾ Boer + ¼ Saanen animals showed less bone and more muscle:bone ratio compared to Saanen animals, due to the greater muscularity of carcasses resulting from heterosis. This fact confirms that the slaughter age, weight, physiological stage and genotype of the animals can express the distribution of different tissues in the carcass.

Values similar to those observed in this study for the proportion of muscle in the shoulder (67.58%) and higher for the bone proportion (25.73%) were reported by Costa et al. (2008), who evaluated carcasses of Saanen goats slaughtered at 203 days of age and 23 kg of BW fed different forage:concentrate ratio. However, for the proportion of fat and muscle:bone ratio, the values reported by the authors were lower (6.76% and 2.62% respectively).

For the shoulder composition (Table 11), protein and ash were not influenced by the inclusion of dry yeast or by breed group, averaging 21.26% of protein and 1.05% of ash. Madruga et al. (2005) characterized the shoulder for Boer crossbred goats and described similar values: 21.05% of protein and 1.09% of ash, showing little variation on the composition of this anatomical region.

Between the breed groups, there were differences in the moisture and total lipid present in the shoulder: on ¾ Boer + ¼ Saanen, it was observed lower moisture content and higher total lipids. Assessing the composition of the shoulder of goat kids without defined breed, Madruga et al. (2005) also reported similar values of moisture (74.79%), but higher total lipid content (4.39%), attributed to the higher age at slaughter (228 days).

Conclusions

The ¾ Boer + ¼ Saanen goat kids show higher early production and significant reduction on slaughter age, which supports the positive results obtained of the heterosis from crossbreeds. Dry yeast is an alternative protein source that can be included in diets for goat kids, without changing quantitative characteristics of the carcass and quality characteristics of loin and shoulder.

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