SENSORY ATTRIBUTES OF VEAL MEAT RECEIVING DIFFERENT LIQUID DIETS[1]

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ABSTRACT

This study aimed to evaluate the sensory quality of meat from crossbred calves slaughtered at 60 days old. We used 16 crossbred calves (Holstein x Zebu), distributed in a completely randomized design with four treatments and four replications: LI - Whole milk, LS - 50% whole milk + 50% cheese whey; LSO - LS added one whole egg ; LSOB - LSO added biotin. After slaughter at 60 days, samples of the *Longissimus dorsi* muscle were collected to perform the sensory analysis as the global acceptance, color acceptance and intensity of flavor, tenderness and succulence. Data were submitted to ANOVA and Tukey's test. The samples received scores averaging around 6.0, corresponding to "liked little" in hedonic scale, in relation to global acceptance and acceptance of color, no significant influence of liquid diets (P>0.05). The same occurred with respect to the quality attributes of beef, which was considered average intensity of flavor, very tender and slightly succulent. It was concluded that the diet offered to the animals did not influence the acceptability and quality of veal meat.

Keywords: color, flavor, global acceptance, succulence, tenderness.

ATRIBUTOS SENSORIAIS DA CARNE DE VITELO RECEBENDO DIFERENTES DIETAS LÍQUIDAS

RESUMO

Objetivou-se com este trabalho avaliar a qualidade sensorial da carne de bezerros leiteiros mestiços abatidos aos 60 dias. Foram utilizados 16 bezerros mestiços (holandês x zebu), distribuídos em delineamento inteiramente casualizado com quatro tratamentos e quatro repetições: LI - Leite integral; LS - 50% Leite integral + 50% de Soro de queijo fresco; LSO - LS adicionado de um ovo integral; LSOB - LSO adicionado de biotina. Após o abate aos 60 dias, foram coletadas amostras do músculo *Longissimus dorsi* para a realização da análise sensorial quanto à aceitação global, aceitação da cor e intensidade dos atributos sabor, maciez e suculência. Os dados foram submetidos à análise de variância e teste de Tukey. As amostras receberam escores com médias em torno de 6,0, correspondente a "gostei pouco" da escala hedônica, em relação à aceitação global e aceitação da cor, sem influência significativa da distas líquidas (P>0,05). O mesmo ocorreu com relação aos atributos de qualidade da carne, que foi considerada com sabor de média intensidade, bem macia e pouco suculenta. As dietas

testadas não influenciaram as características sensoriais da carne de bezerros mestiços abatidos aos 60 dias de idade.

Palavras-chave: aceitação global, cor, maciez, sabor, suculência.

ATRIBUTOS SENSORIALES DE CARNE DE TERNERA RECIBIENDO DIFERENTES DIETAS LIQUIDAS

RESÚMEN

El objetivo de este estudio fue evaluar la calidad de la carne sensorial de terneros mestizos sacrificadas a los 60 días. Utilizamos 16 terneros mestizos (Holstein x Cebú), distribuidos en un diseño completamente al azar con cuatro tratamientos y cuatro repeticiones: LI - leche; LS - 50% suero de queso + 50% leche; LSO - LS añade un huevo; LSOB - LSO añadió biotina. Después del masacre a los 60 días, se colectaron muestras de músculo Longissimus dorsi para llevar a cabo el análisis sensorial como la aceptación global, la aceptación del color y la intensidad de los atributos de sabor, tierneza y jugosidad. Los datos fueron sometidos a la prueba de ANOVA y Tukey. Las muestras recibieron calificaciones promedio de alrededor de 6,0, lo que corresponde a "como poco" la escala hedónica, en la aceptación general y la aceptación de color, ninguna influencia significativa de distas netos (P> 0,05). Lo mismo ocurrió con respecto a los atributos de calidad de la carne, que fue considerada mediana intensidad de sabor, muy tierna y ligeramente suculenta. Las dietas probadas no afectaron las características sensoriales de la carne de terneros cruzados sacrificados a los 60 días de edad.

Palabras clave: aceptación global, color, jugosidad, sabor, ternura.

INTRODUCTION

In countries with developed dairy farming, such as in Europe and North America, the use of calves from dairy herd for beef production is a reality, which represents a significant portion of the meat consumed by the population. In the last 30 to 40 years, the abundance of male calves from dairy herds in these countries has encouraged dairy farmers to produce veal meat (1). The calf can be characterized according to the feeding system, that is, exclusively from milk and milk substitute to slaughter, for the production of white meat or milk feeding and thereafter the concentrate and hay, containing minimum amounts of iron in the diet, for the production of pink meat calf (2).Veal meat presents a good choice, as it meets the requirement of quality and healthy products, beyond the new standards of creation within the standards of animal welfare (3). Veal meat is practically free from fat cover, and is soft, with moderate marbling (4), which classifies it as a meat "light", noble and healthy (5). However, there is little research with the aim of demonstrating this potential, in particular that related to meat quality.

Meat quality is a combination of elements, such as flavor, succulence, texture, softness and appearance, which contribute to the assessment of the product by the consumer, whose satisfaction depends on the psychological and sensory responses related to each individual (6). Sensory analysis is a powerful tool to evaluate attributes that cannot be measured objectively with instrumental analyzes, such as acceptance and flavor, and aspects related to texture, such as softness and succulence, in which human perception is more complete. Several techniques can be used for sensory analysis, including those that measure the acceptance by the consumer, or others that are only descriptive in nature (7).

Although much of the Brazilian herd consists of crossbred animals, with a potential for the production of calves, few are utilized for this purpose in order to reduce spending. According to Lima et al. (8) one of the ways to reduce the cost of the feeding system on milk production is monitoring the age at weaning and reducing the amount of milk supplied, or by partial or total substitution of whole milk by a milk substitute (milk replacer), which is generally a byproduct of the dairy industry.

Few studies have reported aspects of the quality characteristics of veal meat. Thus, the present study aimed to evaluate the sensory quality of meat from crossbred calves slaughtered at 60 days old.

MATERIAL AND METHODS

For the purpose of this study, 16 crossbred calves (Holstein x Zebu) from the dairy herds in the region were selected. The selected calves belonged to the zebu breed, which originated from crosses of breeds such as Guzerat, Red Sindhi and Gir, whose composition is unknown. The animals were distributed in a completely randomized design with four treatments (diets) and four repetitions: LI: Whole milk (control); LS: 50% whole milk + 50% whey cheese; LSO: LS added one whole egg; LSOB: LSO added the biotin (0.5 mg/animal/day).

At 60 days of age, the calves were slaughtered, and the *Longissimus dorsi* muscle was collected, and subsequently, this material was frozen for about 45 days until the analyzes were performed. The sensory tests were performed in the Sensory Analysis Laboratory of Embrapa Tropical, in Fortaleza - CE - Brasil, in individual booths, under conditions of controlled temperature and lighting, according to the methodology proposed by Nassu (9).

The samples were then carefully removed from the *Longissimus dorsi* muscle in the direction parallel to the orientation of the muscle fibers, using a circular cutter of 1.27 cm diameter. Each sample measured approximately 1.0 x 1.0 x 2.5 cm. The samples were subjected to a heat treatment in an electric furnace at a temperature of 180 ° C, 71 ° C up to the geometrical center, controlled by a thermometer (Delta ohm, model HD9218). The samples, after removal from the oven, were kept in a heater at a temperature of 50 ° C until assessment. Each judge received a sample of each diet, a total of four samples on paper plates, coded with three digit random numbers. Further, each judge was also served water and a slice of bread, which was used as a neutralizer between the samples for cleaning the taste buds. The order of presentation of samples was balanced to avoid changes in the results (10). The team of judges, which consisted of 48 individuals, was recruited for the present study on the basis of their liking and eating habits of beef.

The overall acceptance and acceptance of color of the samples were evaluated using the hedonic scale of nine points (11), ranging from like extremely to dislike extremely. Further, the intensity of flavor, softness and succulence were also included in the same evaluation form (12) using structured linear scales of 7 (seven) points. Herein, the amateur judges marked scores for these quality parameters of beef, which were converted into numerical values for the purpose of statistical analysis.

Data were submitted for analysis by ANOVA and the Tukey's test to compare the means, using the procedures available in the statistical package SAS, and presented in the form of histograms.

RESULTS AND DISCUSSION

Table 1 presents the mean values converted from the hedonic structured scale assigned by the judges to the samples of meat from crossbred calves slaughtered at 60 days old. It is

observed that all samples received scores averaging around 6.0, corresponding to "liked little" on the hedonic scale, in relation to global acceptance and color.

Table 1. Average values converted from the hedonic scale given by the panelists for the sensory attributes of veal calves.

Variable	Liquid diets				SE
	LI	LS	LSO	LSOB	
Global Acceptance	6.2a	5.8a	6.0a	6.8a	± 0.12
Color Acceptance	5.9a	5.8a	5.7a	5.7a	± 0.12

Means followed by different letters in the same line differ ($P < 0.05$) by the Tukey test; SE: Standard error; LI: Whole milk; LS: 50% whole milk + 50% whey cheese; LSO: LS added one whole egg; LSOB: LSO added biotin.

The above response of the judges may be justified by the likely comparison of veal with meat of adult bovine animals fit for slaughter (about 450 to 500kg), as the consumption of veal is not part of the eating habits of Brazilians. It is worth noting, with regards to the color, that the slaughter of calves at 60 days of age resulted in a light-colored meat (classified in Europe as white veal meat), not showing the characteristic color of beef obtained from adult animals generally consumed by the population.

Although no statistically significant difference was detected between the mean values converted from the hedonic scale (Table 1), minor differences in the distribution of frequencies in each category of the scale hedonic were observed by analyzing the histograms (Figures 1 and 2). Figure 2 depicts that about 70% of the judges have given values 6 and 7 to all the samples of veal meat, which corresponded to "like little" and "like". However, if an imaginary line is drawn on the bars for each sample, it can be observed that the frequency distribution of responses for the sample LSOB (added dietary biotin) differs slightly from others, being shifted to the lower region of acceptability of the scale.
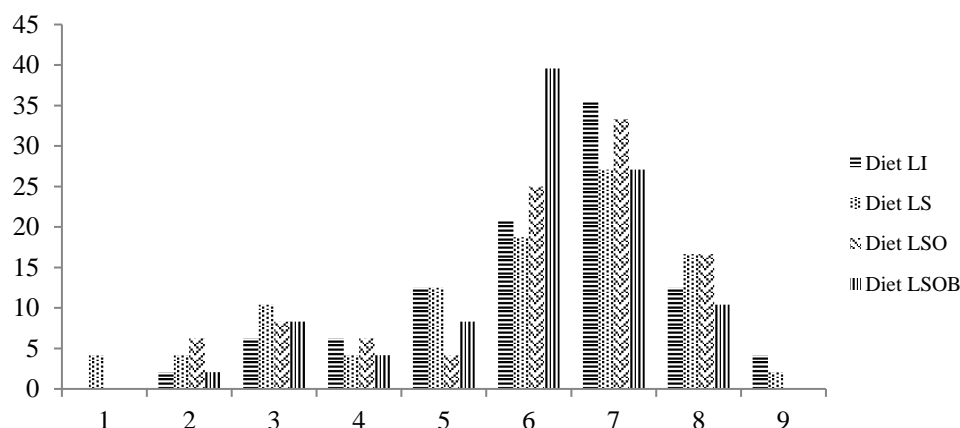

Figure 1. Histograms of the frequency of hedonic values assigned to the overall acceptance of samples from different treatments (LI, LS, LSO and LSOB) of meat from calves slaughtered at 60 days of age (1 = dislike extremely and 9 = like extremely).

In a similar manner, it can be observed in Figure 2 that the samples of meat from calves fed on diets LI and LSO had frequency distributions more displaced to the region of greater acceptance of the scale, indicating that these samples were more acceptable in relation to color.
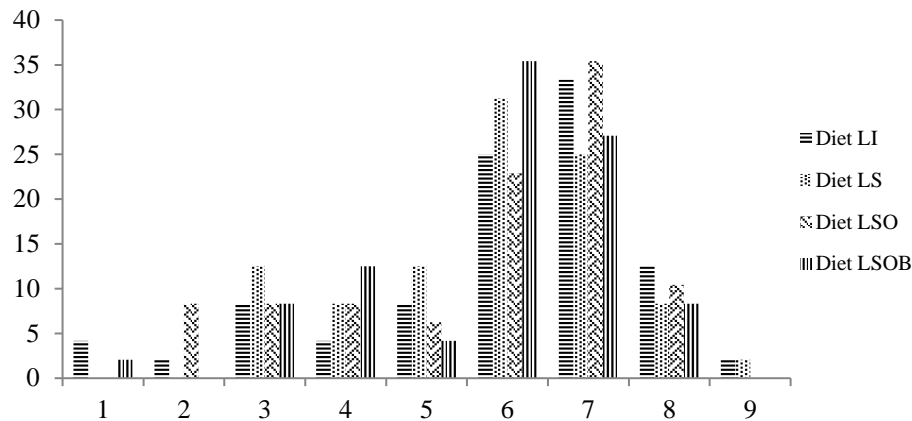
Figure 2. Histograms of the frequency of hedonic values assigned to the acceptance of color samples of different treatments (LI, LS, LSO and LSOB) of meat from calves slaughtered at 60 days of age (1 = dislike extremely and 9 = like extremely).

Table 2 presents the average values of the responses to the intensity of the flavor of meat, succulence and softness. It can be observed that there were no significant differences (P> 0.05) between the diets for any of the attributes of meat quality. According to these averages, the calf meat of all the treatments were considered of medium intensity on a scale of the meat flavor (near the middle of the scale, neither weak nor strong), very soft and a bit succulent.

Table 2. Averages assigned by the judges for flavor, softness and succulence of meat from calves slaughtered at 60 days.

Variable	Liquid Diets				SE
	LI	LS	LSO	LSOB	
Flavor	3.6a	3.3a	3.5a	3.4a	0.14
Softness	5.4a	5.2a	5.2a	4.9a	0.13
Succulence	3.7a	3.3a	3.5a	3.6a	0.14

Means followed by different letters in the same line differ (P < 0.05) by the Tukey test; SE: Standard error; LI: Whole milk; LS: 50% whole milk + 50% whey cheese; LSO: LS added one whole egg; LSOB: LSO added biotin.

The frequency distribution of responses on a scale of intensity of flavor of the meat is shown in Figure 3. It can be seen that there was a segmentation of the sensory panel, as about 50% of the consumers responded in the categories on the "weak" in scale (categories 1-3) and an average of 18% replied in the middle of the scale (category 4), corresponding to "neither weak nor strong" and another 25 to 36% found the taste of meat to be a bit too strong (categories 5-7).
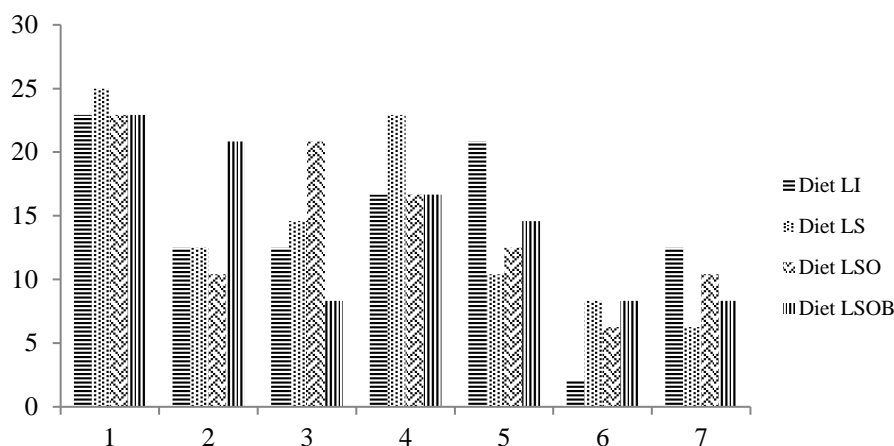
Figure 3. Histograms of the frequency of values attributed to the intensity of the flavor of the meat samples of different treatments (LI, LS, LSO and LSOB) of meat from calves slaughtered at 60 days of age (1 = very low, 7 = very strong).

It can be noted that in Brazil there is no significant consumption of white meat calves, slaughtered as in the present study, owing to little or no market demand, possibly due to cultural issues. Thus, only a few studies related to the characteristics of the meat calves have been conducted, there by making it difficult to establish a standard for such product. However, since then, a vast field of research has been opened up.

There was no statistically significant difference between the averages, with regards to the softness. However, minor differences were observed between treatments in the frequency distribution of responses on the scale of intensity (Figure 4). The meat sample LI diet showed 77% of responses in categories 5-7, corresponding to the positive reaction of softness of the sample, against 67% of there maining samples. In addition, the diet LSOB showed only 23% of responses in category 7 ("very soft"), while samples from the other diets showed 33 to 37% of responses in this category.
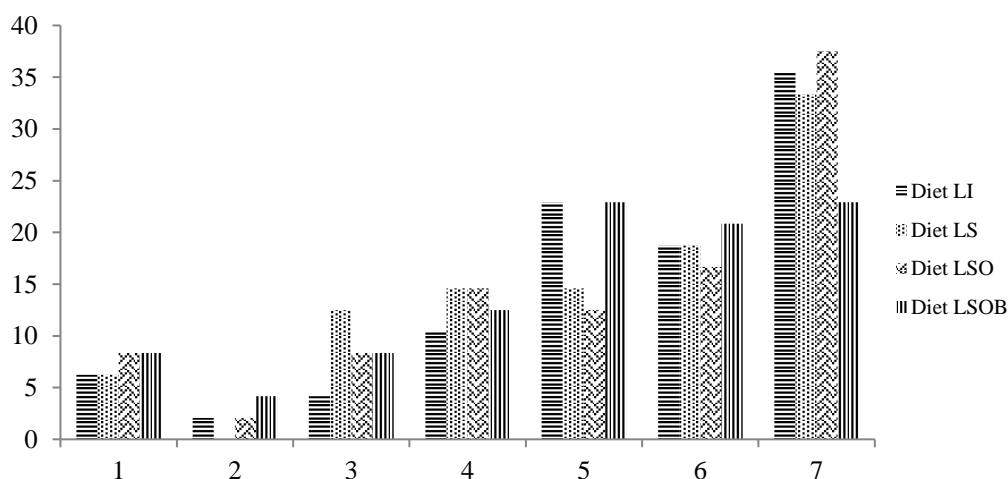

Figure 4. Histograms of the frequency of values attributed to the intensity of the softness of the meat samples from different treatments (LI, LS, LSO and LSOB) of calves slaughtered at 60 days of age (1 = not soft, 7 = very soft).

Arboitte et al. (13) studied the physical carcass composition, meat quality and cholesterol content in the *Longissimus dorsi* muscle of steers 5/8 Nellore - 3/8 Charolais steers feed lot that were finished and slaughtered at different maturity stages. The results

established that certain softness of the meat shear force obtained by the method of Warner-Bratzler, was not influenced by the slaughter age (mean of 3.78 kgf), which was similar to that seen in the tenderness evaluated by the judges, being ranked among above average (6 points) and very soft (8 dots) on the same scale used in this study. The highest score in terms of softness was obtained for the meat of animals slaughtered at 425 kg, 7.17 points, which was considered as soft meat.

Lawrie (14) demonstrated that under the same conditions of cooking the meat of young cattle was more tender than the meat of adult animals. The reason for the tenderness was that the collagenin the young beef of animals solubilizes quickly, forming a gel on cooling, while the collagen of adult animals becomes sparingly soluble and hardens the meat.

In the present study, the softness revealed in the meat was expected as it was obtained from animals slaughtered at 60 days. Therefore, the individuals were still in the growth stage and were physiologically immature. In addition, the animals were raised in confinement, in individual shelters, which limited the movements, thereby reducing the physical activity and resulting in greater rigidity to the muscles.

Figure 5 shows the results for the succulence. The histogram confirms the results presented in Table 2, where it was observed that the meat samples of all the treatments showed little succulence. There is a higher percentage of responses on a point scale ("no juicy"). However, the sample of the diet LI had frequency distributions more displaced to the region of higher succulence of the scale, indicating that this sample had slightly more succulence in comparison to others.
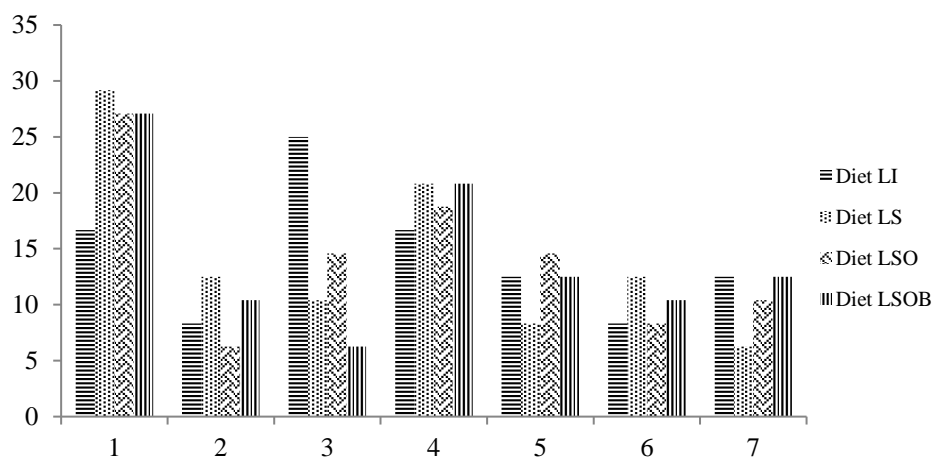

Figure 5. Histograms of the frequency of values assigned to the intensity of succulence of the meat samples of different treatments (LI, LS, LSO and LSOB) of calves slaughtered at 60 days of age (1 = not succulent, 7 = very succulent).

Pacheco et al. (15) evaluated the characteristic of succulence and established that the meat of steers slaughtered at 15 months and ranked among "succulent" and "very succulent" (7.34 points) was significantly higher in comparison to the flesh of young animals slaughtered at 22 months and ranked among "slightly above average" and "succulent" (6.83 points). The main causes of succulence are the water and fat released during chewing, which have a stimulating effect on the salivation.

During the growth phase of the animal, the fat tissue, which has delayed development but is deposited at all ages owing to the intake of nutrients, in particular energy, exceeds the requirement for maintenance and growth (16).

The fat marbling is the last to be deposited in the muscle and is affected by the dietary energy level as well as the weight of the animal. In general, the sensory characteristics of the

meat were found to be correlated positively among themselves, there by indicating that the meat was also considered soft, succulent and palatable, as reported by Arboitte et al. (13).

Owing to the age of slaughter adopted in the present study as 60 days old, the carcasses had obtained virtually no fat, marbling or subcutaneous, as the animals had not completed their growth, there by resulting in poorly developed muscle bundles. Thus, the responses of the panelists were mostly (65% in LI, 71% in LS, 60% and 61% in the LSO LSOB) less than four grades in the intensity scale for succulence, corresponding to "neither dry nor succulent".

CONCLUSIONS

The meat of the crossbred calves slaughtered at 60 days olds showed good acceptability in relation to its color and global aspects, and is considered by consumers as being a product of average meat flavor, soft but somewhat succulent.

It was concluded that the diet offered to the animals did not influence the acceptability and quality of veal meat.

ETHICS COMMITTEE AND BIOSAFETY

Protocol n. 147/2009 – CEUA/UNESP.

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