Meat quality of cattle raised on pastures with pigeon pea intercropping as a strategy for mitigating greenhouse gases: preliminary results

Carvalho, S. C. S.*[1]; Francisco, V. C.[2]; Silva, K. F.[1]; Chamilete, S. A. M.[1]; Silva, G. V.[3]; Rodrigues, P. H. M.[3]; Oliveira, P. P. A.[2]; Barioni Júnior, W[2]; Nassu, R. T[2].

*[1]Universidade Estadual Paulista, São José do Rio Preto, SP, Departamento de Alimentos, Nutrição e Engenharia de Alimentos; [2]Embrapa Pecuária Sudeste, São Carlos, SP; [3]Universidade de São Paulo, Pirassununga, SP, Faculdade de Medicina Veterinária e Zootecnia

Abstract - Pigeon pea (*Cajanus cajan* (L.) Mill sp.) intercropped with *Brachiaria* acts as a protein bank and green fertilizer, as well as having the potential to reduce greenhouse gas (GHG) emissions in the production system. This study aimed to evaluate meat quality by physicochemical analysis (pH, water holding capacity, cooking loss, shear force, and instrumental color); metabolomics analysis, by high-resolution nuclear magnetic resonance (NMR); fatty acids composition; volatile compounds; and sensory acceptance of meat from Nellore cattle grazing in three different pasture systems: degraded pasture; recovered pasture, and pasture intercropped with pigeon pea + *Brachiaria*. Steaks 2.5 cm thick were removed from the *Longissimus thoracis* muscle, aged for 0, 7, and 14 days at 0 to 2ºC. Steaks aged for seven days at 0 - 2ºC were cooked until they reached an internal temperature of 75ºC in an oven at 180ºC. The acceptance test was carried out in two locations: at the University of São Paulo (USP) in Pirassununga, SP (n=119) and Embrapa Pecuária Sudeste, São Carlos, SP (n=52), in a total of 171 consumers. Samples were evaluated by a 9-point structured hedonic scale (1=dislike extremely; 9=like extremely) for flavor, texture (tenderness), and overall acceptability. No differences ($p>0.05$) were found between the treatments for all attributes. The association between the different places of evaluation of the meat sensory attributes was also verified. The attributes were categorized as 1 = low (1 to 4), 2 = medium (5 to 7), and 3 = high (8 to 9). Samples evaluated as category 1 (low) presented the same category for all attributes, the same occurring for the other categories, regardless of the production system, meaning that all attributes were associated. This tendency was observed in the two places where the analyses were conducted. In conclusion, beef from the different production systems were equally accepted by consumers, and the attribute scores were associated with each other, regardless of the place where the analyses were carried out.

Keywords: beef cattle, enteric methane, sensory acceptance, sustainability

Introduction

Brazil is one of the world's most important beef producers, resulting from decades of investment in technology that has increased both productivity and the quality of the Brazilian product, making it competitive and reaching the market of more than 150 countries. The increase in the emission of greenhouse gases has been considered one of the main causes of global warming, and the animal production sector has been criticized for being responsible for the emission of these gases, the most important of which is methane (CH_4) and nitrous oxide (N_2O), from enteric fermentation. When intercropping pigeon pea with grasses, it acts as a protein bank (providing a high-quality diet during the dry season) and as a green manure (the remaining in the pasture is cut at the end of the dry season and left to decompose on the soil surface. These two aspects of introducing legumes have great potential to reduce GHG emissions in the production system. This study aims to evaluate meat quality and sensory acceptance from the intercropped production system between pigeon pea and pasture, which aims to mitigate greenhouse gases.

Methods

Twenty-seven Nelore young bulls (approximately 280 kg of live weight; between 15 and 16 months old) were randomly distributed in three treatments with different levels of intensification: degraded pasture; recovered pasture; and intercropped pasture (pigeon pea + *Brachiaria*). Animals remained on-site during one year. The animals were randomly allocated to nine grazing units, with each treatment assigned to one grazing unit in a

randomized block design. After the period in the field, the animals were slaughtered in a certified commercial abattoir. After 24 h of cooling, samples of the *Longissimus thoracis* muscle from the left carcass of each animal were removed and taken to the meat analysis laboratory at Embrapa Pecuária Sudeste, São Carlos, SP. Steaks of 2.5 cm thick, aged 0, 7, and 14 days at 0 to 2ºC, were used for meat quality analysis: pH; instrumental color; water holding capacity; cooking loss; and shear force. In addition, steaks aged seven days at 0 to 2ºC were kept for sensory analysis; metabolomic analysis; fatty acid composition; and volatile compounds. For sensory analysis, the samples were prepared with 1g of salt and cooked to an internal temperature of 75ºC in an oven at 180ºC. The acceptance test was carried out at the University of São Paulo (USP) in Pirassununga, SP, and Embrapa Pecuária Sudeste, São Carlos, SP. A questionnaire was applied to verify the profile of consumers, and the samples were evaluated using a 9-point structured hedonic scale (1 = dislike extremely; 9 = like extremely) for flavor, texture (tenderness), and overall acceptance. The data obtained from the sensory acceptance test were analyzed using analysis of variance (ANOVA), and when there was a difference, Tukey's test was applied at a 5% significance level. The association between the different analysis sites used in the evaluation of meat sensory attributes was also verified. The acceptance attribute scores were categorized into 1 = low (1 to 4), 2 = medium (5 to 7), and 3 = high (8 to 9) and analyzed using the chi-square test and multiple factorial correspondence analysis.

Results and Discussion

Of the 171 consumers, 70% participated in the study at USP and 30% at Embrapa; of the total, 67% were women, and 33% were men; aged 21 to 35 years (51%) and had incomplete higher education (53%). Consumers mentioned that they are concerned about the GHG generated by beef production (83%) and would pay more for a product resulting from more sustainable agricultural practices (92%). No differences ($p>0.05$) were found between treatments for all analyzed attributes in the two locations. The averages obtained for global acceptance were 7.1 for the meat from degraded pasture and recovered pasture and 7.0 for the meat from pigeon pea + *Brachiaria* intercropped pasture, equivalent to "I liked it moderately." Meat samples evaluated in category 1 (low acceptance) for flavor showed the same category for texture and global acceptance attributes, regardless of the production system. Similar results were observed for categories 2 (medium) and 3 (high) for all studied attributes meaning they were associated. This trend was similar between the two locations where the analyses were carried out.

Partial Conclusions

In conclusion, consumers equally accepted beef from different production systems, and sensory acceptance attribute scores were associated and independent of the analysis location and production systems.

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