ANGUS AND WAGYU BEEF: ESSENTIAL MINERALS, FROM DIFFERENT CUTS

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1. INTRODUCTION

The skeletal muscles of animals have predetermined anatomical and structural characteristics, primarily related to their function and location in the animal's body [1]. Variations in the physicochemical composition of meats from the same animal can occur depending on the muscle groups from which they are obtained [2], potentially influencing the concentrations of elements available for absorption through the digestion process. Beef, an excellent food source, can provide most of the nutrients needed for maintaining good health, such as essential minerals like iron (Fe), zinc (Zn), magnesium (Mg), and selenium (Se), wich are easily absorbed during meat digestion [3]. Fluctuations in mineral levels can impact the sensory and nutritional quality of meats [4]. While existing literature covers discrepancies in breeds and cuts of beef, no studies have explored the racial impact and nutrient concentrations across different cuts from the same animal. Therefore, this study aimed to evaluate the protein and fat content, as well as the concentrations of iron, zinc, magnesium, and selenium in beef sourced from three cuts of meat from Angus and Wagyu breeds.

1. MATERIALS AND METHODS

A total of 10 animals were used in the experiment, all raised for beef in a geographical region characterized by a tropical savannah climate. When they reached 17 months of age, they were placed in confinement and given special feed for periods of between 105 and 266 days to fatten them up until slaughter. 5 Angus and 5 Wagyu animals were used, weighing an average of 639kg and 755kg respectively. The carcasses were identified individually until boning, so that the cuts removed could be related to their respective animals of origin. The three commercial cuts were outside flat (Biceps femoris), knuckle (Vastus intermedius, lateralis, medialis and Rectus femoris), and the shank (digital flexors and extensors). The minerals iron, zinc and magnesium were quantified by Flame Atomic Absorption Spectrophotometry (FAAS - Perkin Elmer, USA, model AAnalyst-200), following the method described by Rebellato et al [5]. To assess selenium, the samples were subjected to acid digestion and incineration at 450°C, to detect the mineral by Hydride Generation Atomic Absorption Spectrometry (HG-AAS), following the method described by Orlando et al. [6]. Protein and intramuscular fat were assessed using the Kjeldahl and Bligh & Dyer methods, respectively. The data obtained was analyzed with one-way ANOVA and Tukey's test ($P<0.05$), using Statistica v.10 software (StatSoft, USA).

1. RESULTS AND DISCUSSION

The concentrations of the four minerals examined in the three cuts are presented in Table 1, alongside the reference values for the corresponding cuts from the Brazilian Table of Food Composition - TBCA [7]. Iron levels in the knuckle and selenium levels in the outside flat and shank were notably higher in Wagyu meat ($P<0.05$). In terms of zinc and magnesium values across the three cuts, there was no distinction between Angus and Wagyu breeds ($P<0.05$). The concentrations of all four minerals in the two breeds were observed to surpass the TBCA averages, except for iron in Angus knuckle and shank ($P<0.05$). The quantities of protein and intramuscular fat are detailed in Table 2. These results were derived from the centesimal composition analyses conducted on the samples. Protein content was higher in Angus for the hard loin and rear muscle, while there was no major contrast in protein levels for the knuckle samples of the two breeds. Wagyu exhibited higher amounts of intramuscular fat in the outside flat and shank ($P<0.05$).

Table 1 – Means* ± standard deviation of the iron, zinc, magnesium, and selenium concentrations determined in beef from outside flat, knuckle and shank of the Angus and Wagyu breeds.

Cut	Breed	Iron (mg/100g)	Zinc (mg/100g)	Magnesium (mg/100g)	Selenium (µg/100g)
Outside Flat	Angus	$2.01^{a} \pm 1.65$	$3.61^{a} \pm 0.67$	$23.78^{a} \pm 8.77$	$8.16^{b} \pm 5.60$
	Wagyu	$2.38^{a} \pm 2.05$	$3.8^{a} \pm 3.11$	$21.93^{a} \pm 11.21$	$10.27^{a} \pm 3.39$
	Ref.**	1.89	2.81	21.1	2.87
Knuckle	Angus	$1.71^{b} \pm 0.57$	$5.55^{a} \pm 3.88$	$22.96^{a} \pm 4.70$	$10.53^{a} \pm 3.99$
	Wagyu	$2.71^{a} \pm 0.10$	$5.38^{a} \pm 2.67$	$21.4^{a} \pm 10.99$	$11.52^{a} \pm 3.67$
	Ref.**	1.78	4.31	21.2	2.22
Shank	Angus	$1.67^{a} \pm 0.80$	$4.87^{a} \pm 0.44$	$22.26^{a} \pm 4.73$	$3.73^{b} \pm 2.92$
	Wagyu	$2.29^{a} \pm 2.98$	$5.09^{a} \pm 3.66$	$21.85^{a} \pm 10.84$	$5.14^{a} \pm 2.15$
	Ref.**	1.86	3.65	17.5	2.24

*Means with equal letters in the same column for the same cut do not differ significantly according to Tukey's test of means ($P<0.05$). **Concentrations of Fe, Zn, Mg and Se for the same cut, available from TBCA [7].

Table 2 – Means* ± standard deviation of protein and intramuscular fat determined in beef from knuckle, outside flat and shank of the Angus and Wagyu breeds.

Cut	Breed	Protein (%)	I.M. Fat (%)
Outside Flat	Angus	$20.97^{a} \pm 0.51$	$6.39^{b} \pm 1.20$
	Wagyu	$18.25^{b} \pm 0.46$	$14.99^{a} \pm 2.03$
Knuckle	Angus	$20.77^{a} \pm 0.04$	$4.51^{a} \pm 0.55$
	Wagyu	$20.03^{a} \pm 0.70$	$7.20^{a} \pm 1.64$
Shank	Angus	$22.73^{a} \pm 0.13$	$4.06^{b} \pm 0.47$
	Wagyu	$21.08^{b} \pm 0.57$	$8.03^{a} \pm 1.06$

*Means with equal letters in the same column for the same cut do not differ significantly according to the ANOVA test ($P<0.05$).

1. CONCLUSION

The results are of significant relevance to the fields of meat research, production, and technology. These data also appeal to consumers, given their interest in nutritional matters, and can be utilized on packaging and within the specialized meat market.

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