THE IMPACT OF DIETARY ANSERINE ON LIPID OXIDATION DURING IN VITRO DIGESTION OF COOKED GROUND CHICKEN MEAT

Yi Yao Li[1], Varoujan Yaylayan[1], Simon Cliche[2], Claude Gariépy[2], Tania M. Ngapo[2*]

[1] McGill University, Ste Anne de Bellevue, QC, Canada.

[3] Agriculture and Agri-Food Canada, Saint Hyacinthe, QC, Canada

*Corresponding author email: tania.ngapo@agr.gc.ca

I. INTRODUCTION

Imidazole dipeptides are naturally occurring in skeletal muscles of vertebrates, of which two of the most common are carnosine (β-alanyl-L-histidine) and its derivative, anserine (β-alanyl-1-methylhistidine) [1]. Studies using the isolated molecule have demonstrated that carnosine could play a protective role in a wide range of oxidative stress-related diseases, including neurodegenerative, cardiovascular, diabetes and cancer [1,2,3,]. Recently, carnosine benefits have also been demonstrated through its ingestion in red meat-based meal models [5,6,7], showing concentration dependent protein and lipid antioxidant effects during digestion of pork. Given that anserine is found in higher concentrations in white than red meat, the objective of this study was to determine the effect of anserine on malonaldehyde, a lipid oxidation indicator, during the digestion of chicken.

II. MATERIALS AND METHODS

Meat preparation: Three levels of anserine (control, LAns; intermediate, MAns; high, HAns) were achieved by adding 300 or 600 mg anserine/100g meat to commercial ground lean chicken. The chicken was stuffed into polypropylene wide-mouth screw-top containers (60 ml), individually vacuum packaged and cooked in a water bath (core temperature 74°C). The cooked meat was vacuum packaged and stored at -80°C. Just prior to digestion, the meats were thawed at room temperature (approximately 15 min).

In vitro digestion: In vitro digestion was undertaken according to Li et al. [4]. Tubes containing cooked meat samples (6.0 g) were sequentially incubated for 5 min with saliva (6 ml), 2 h with gastric juice (12 ml), and 2 h with 1 M bicarbonate buffer (pH 8.0, 2 ml), duodenal juice (12 ml) and bile (6 ml). Enzymatic incubation was performed in quadruplicate. Digests were homogenized using a Polytron homogenizer (10,000 rpm for 1 min), transferred to Eppendorf tubes and stored at -80°C until analyses.

Lipid oxidation: Malondialdehyde (MDA) was measured by GC-MS [5] using an Agilent 7890B gas chromatograph coupled to a 5977B quadrupole mass spectrometer (Agilent Technologies, Santa Clara, CA, USA) with Ultimate Plus deactivated fused silica tubing and HP-5MS columns (30 m × 0.25 mm × 0.25 µm). Selected-ion monitoring (SIM) was used (187 and 203 m/z, retention time (RT) 12.20 and 12.33 min, internal standard, HHE-d3; 250 m/z, RT 13.76 and 13.79 min, MDA) for quantification.

Statistical analyses: Results were analyzed by the MIXED model of SAS.

III. RESULTS AND DISCUSSION

Anserine showed anti-oxidant properties in gastric digests, but no significant differences were observed in the duodenal phase. In the gastric phase, anserine-enriching treatments (MAns and HAns)

resulted in significantly less MDA in digests, than the control (LAns) digests (P>0.05; Table 1). In addition, concentrations of MDA in the HAns digests were significantly lower than in the MAns digests (P>0.05) showing a progressive decrease in lipid oxidation with increased anserine concentration.

Similarly, high levels of carnosine enrichment of pork resulted in significantly lower MDA concentrations in gastric digests than at intrinsic levels of carnosine, while no effects were observed in the duodenal digests [7]. Given the range of antioxidant effects reported for carnosine, this glimpse into the potential of anserine ingestion as an antioxidant demonstrates that further research on the impact of anserine as an antioxidant is merited.

Table 1. Effects of anserine on MDA during in vitro digestion of chicken (LS Means with SEM in parentheses)

	MDA[1] (ng/ml digest)	
Treatments	Gastric	Duodenal
LAns	2727[a] (124)	2274 (86)
MAns	2218[b] (124)	2236 (86)
HAns	1826[c] (124)	2261 (86)
P values	**0.0003**	0.9476

[1] Different superscripts within the same column denote significant differences (P≤0.05).

IV. CONCLUSION

In this study, dietary anserine, which is relatively abundant in white meat, demonstrated antioxidant capacity during the digestion of chicken. These findings suggest that dietary anserine may bring similar health benefits through its ingestion in a meal as carnosine, from which it is derived, imparted in red meat-based meal models.

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