P-12-24

Processing Of Beef Lungs As A Nutritious Protein Supplement And Evaluate The Processing Effect On *In Vitro* Digestibility (#604)

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Introduction

The countries with highest meat production often have a low demand for co-products while other parts of the world suffer from protein deficiency. Beef lungs are an underutilised co-product of the meat industry that has enormous potential as a protein supplement. The objective of this research is to evaluate the processing potential of beef lungs as a nutritious protein supplement and study the processing effect on *in vitro* protein digestibility.

Methods

Beef lungs without trachea were provided by a New Zealand meat processor. Beef lungs were minced and dried using an air oven drier at different time-temperature combinations viz. 50 ˚C for 23 hours, 70˚C for 10 hours and 100˚C for 6 hours to prepare a beef lung powder (BLP). Beef lung powder nutritional value and protein digestion kinetics were evaluated during *in vitro* gastrointestinal digestion according to [2]. The amino acid profile of dried beef lung powders and in vitro digesta were analysed by HPLC to calculate essential and nonessential amino acid portions. Protein profiles of raw and dried beef lung powder were observed with SDS-PAGE. Mineral profile of the BLP or digesta was determined by Inductively Coupled Plasma Optical Emission Spectrophotometry. Data was analysed by using one-way ANOVA with Tukey's comparison test for pairwise comparison of means.

Results

BLP had a protein content of 87% (dry weight basis), and ideal indispensable amino acid score, similar to previous results [1]. The amino acid profile of BLP did not change with drying temperature, however, a significant ($P<0.05$) decrease was observed in the release of free amino acids during *in vitro* gastrointestinal digestion as drying temperature increased (Table 1). Release of Cu, Fe, and S during *in vitro* gastrointestinal digestion also decreased with an increase in drying temperature (Table 1) but other minerals were not affected by the drying temperature (data not shown). These minerals are closely associated with the proteins and may be trapped within denatured proteins. *In vitro* protein digestibility of beef lung powder also decreased significantly with increasing temperature (96.4±0.1 %, 95.9±0.6 %, 95.6 ±0.4 % at 50 ˚C, 70˚C and 100˚C, respectively). This may be due to changes in the three-dimensional structure of proteins with high temperature which may reduce access by the digestive proteases. These changes in the protein profile of raw and dried beef lungs are illustrated in Figure 1. The protein profile of beef lungs was completely different from the pattern of muscle protein and protein bands at10 and 67 kDa were prominent in raw beef lungs. The 10 kDa protein band appeared to be heat labile and was completely lost at high temperatures. Based on these results it can be concluded that low temperature drying produced a better-quality beef lung powder as it released more nutrients during gastrointestinal digestion.

Conclusion

Beef lungs have the potential of being processed into a powdered lung stock. The nutritional quality of the beef lungs is by preserved at low drying temperature. The microbiological quality is currently being investigated.

References

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2. Kaur, L., Astruc, T., Vénien, A., Loison, O., Cui, J., Irastorza, M., & Boland, M. (2016). High pressure processing of meat: effects on ultrastructure and protein digestibility. *Food & function*, *7*(5), 2389-2397.

Notes

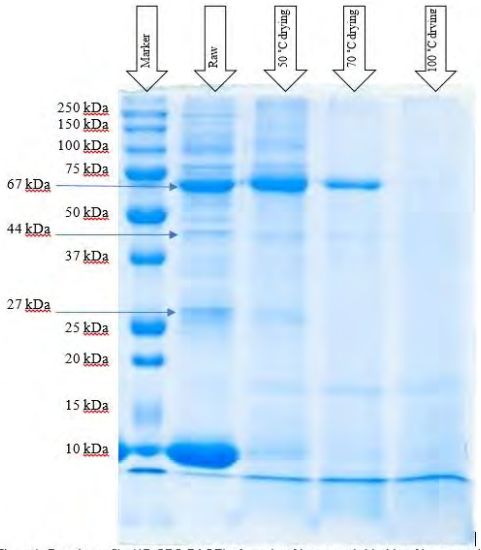

Figure1: Protein profile (1D-SDS-PAGE) of raw beef lungs and dried beef lung powder at 50 °C, 70 °C and 100 °C (15-µg samples were loaded in each lane).

Figure1:
Protein profile (1D-SDS-PAGE) of raw beef lungs and dried beef lung powder at 50 ˚C, 70 ˚C

Notes

Table 1: Amino acids and mineral comparison within the beef lung powder and *in vitro* digestion

BLP essential amino acid content relating to protein			
Drying temperature	**50°C BLP**	**70°C BLP**	**100°C BLP**
Total EAA mg/100mg protein	49.9±1.32	49.9±1.08	48.6±1.4
Release of free amino acids during *in vitro* digestion			
Drying temperature	**50°C BLP**	**70°C BLP**	**100°C BLP**
Total EAA (mM)	10.11±0.4[a]	5.6±0.44[b]	5.19±0.59[b]
Total non-EAA (mM)	11.2±0.38[a]	5.55±0.58[b]	3.87±0.28[c]
Mineral release during *in vitro* digestion			
Drying temperature	**50°C BLP**	**70°C BLP**	**100°C BLP**
Cu (mg/L)	0.10± 0.001[a]	0.04±0.01 [b]	0.01±0.001[c]
Fe (mg/L)	1.73±0.09[a]	0.73±0.26[b]	0.53±0.1[c]
S (mg/L)	98.39±1.28[a]	77.56±10.3[bc]	68.50±12.69[c]

*EAA, Essential amino acid
Results are means (± SD) of triplicate samples (n=3)
Different superscripts are significant (P < 0.05) along the row

Table 1:
Amino acids and mineral comparison within the beef lung powder and *in vitro* digestion

Notes