The nutrient content of meat sausages containing beef offal

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Abstract

The objective of this research was to develop acceptable, nutritious meat products using cheaper sources of protein, such as culturally-acceptable beef offal and trimmings. Initially 25 formulations of fresh meat sausages containing beef offal were developed and the best four selected, together with the control. Treatments 1 and 2 contained beef trimmings, beef hearts, intestines and spleen, whereas Treatments 3 and 4 contained beef trimmings, beef liver, stomachs and lungs. Spices, rusk and a soy concentrate were also added. The control sample only contained beef trimmings, rusk and spices. Proximate chemical analysis, amino acid and fatty acid profiles, B-vitamins (B_1, B_2, B_3, B_6 & B_{12}), cholesterol, micro-minerals (magnesium, calcium, phosphorous, potassium, iron & sodium) and trace elements (selenium, mercury, lead & cadmium), were determined. Results showed that Treatments 1 and 2 were good sources of protein, vitamin B_3, B_6, B_{12}, phosphorus, magnesium, iron, selenium, mono-unsaturated fatty acids, *cis*-fatty acids and omega-3 fatty acids. Treatments 3 and 4 were ranked second best including sensory, yet are excellent sources of iron and vitamin B_{12}. The control was generally ranked the lowest. The various culturally-acceptable beef offal parts and meat trimmings can be used successfully for making nutritious and affordable fresh sausages of acceptable quality.

Objective

The objective of this part of the study was to determine the proximate chemical composition and nutritional value of the raw control and four meat sausages containing beef offal.

Materials and methods

Initially, 25 formulations of fresh meat sausages containing beef offal were developed and the best four selected, together with the control. Formulations 1 and 2 contained beef trimmings (B), spleen (S), intestines (IN), heart (H) with rusk (R) or Multibase™ (MB) - i.e. "BSINHR" and "BSINHMB", whereas formulations 3 and 4 contained beef trimmings (B), liver (L), stomachs (ST) and lungs (L) with rusk or Multibase™ - i.e. "BLSTLR" and "BLSTLMB." A standard mixture of spices was also added to each formulation. The control sample only contained beef trimmings, rusk and spices. Five representative samples, consisting of a raw control and four meat sausages containing beef offal, were randomly selected from the 5 replications and analyzed for proximate chemical analysis and nutrient content [amino acid profiles, fatty acid profiles, B- vitamins (B_1, B_2, B_3, B_6 & B_{12}), cholesterol, micro-minerals (magnesium, calcium, phosphorous, potassium and sodium) and trace elements (iron, selenium, mercury, lead & cadmium)], using internationally recognized AOAC official methods (2005).

Results and discussion

Proximate Chemical Analysis

The proximate chemical analysis results are shown in Figure 1. All five sausages have comparable protein, ash and moisture contents. The control's fat content is higher than the other four.

Protein

The Dietary Reference Intakes (DRIs) are the most recent set of dietary recommendations established by the Food and Nutrition Board of the Institute of Medicine, 1997-2001. They replace previous Recommended Dietary Allowances (RDAs), and are the basis for eventually updating the RDIs.

A nutrient density (ND) value >1 indicates a good source of the nutrient (Figure 2) and all five sausages are therefore considered to be very good sources of protein.

The percentage dietary reference intake (% DRI) was calculated as follows:

$$\frac{\text{Nutrient value}}{\text{DRI value of a nutrient of females aged 31-50 years}} \times \frac{100}{1}$$

Similarly all five sausages make significant contributions (minimum of 35.43%) to the daily protein requirement (% DRI) (Figure 3).

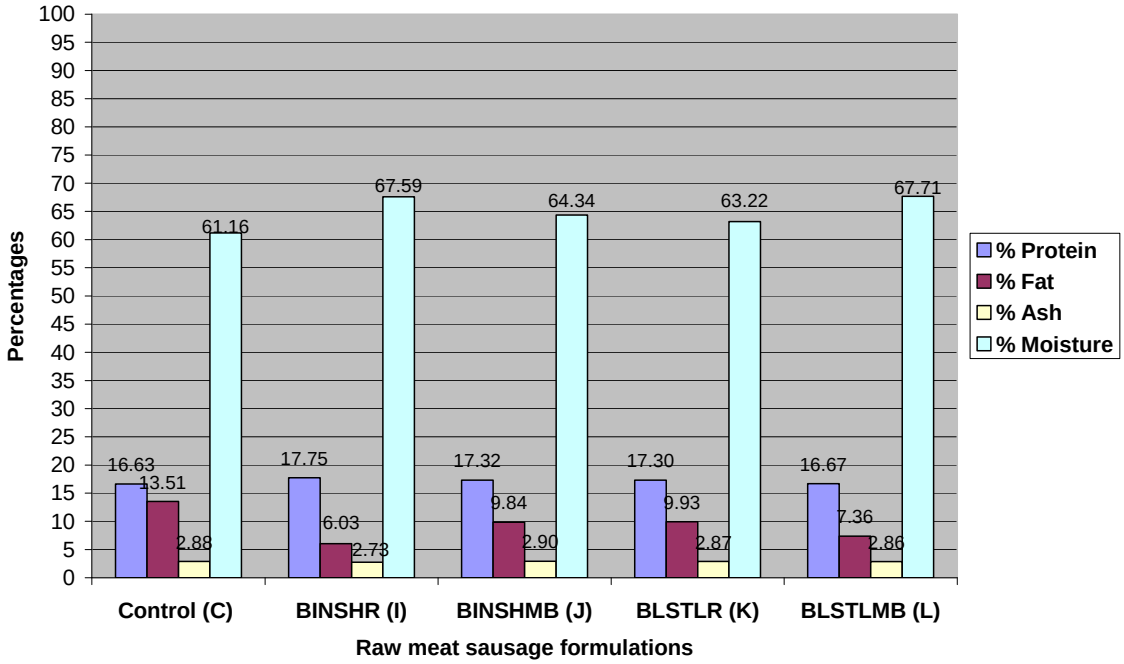

Figure 1. Proximate chemical analysis results for the raw control and four meat sausages containing beef offal

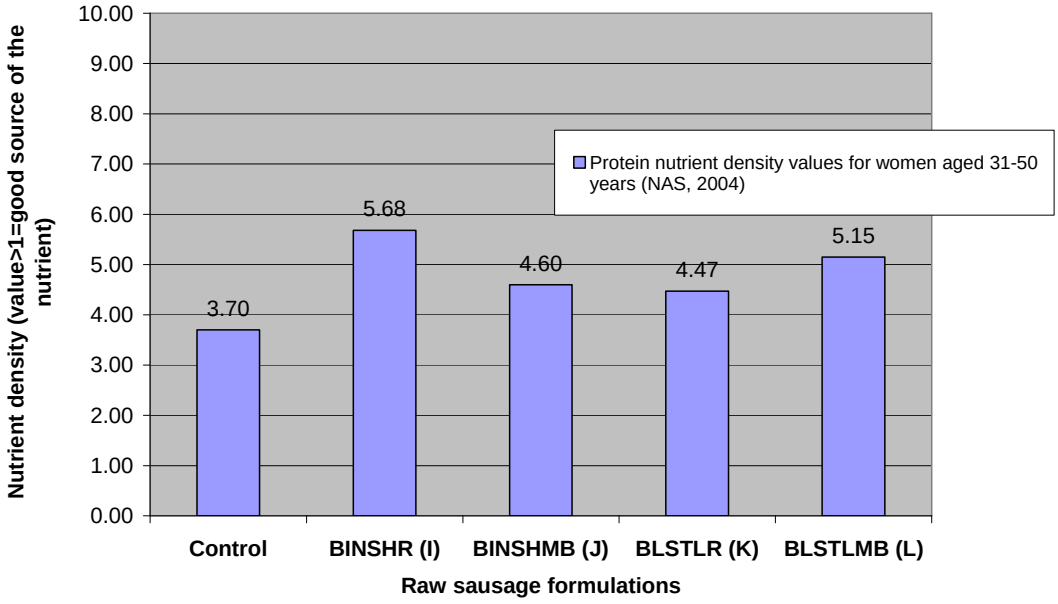

Figure 2. Protein nutrient density values for the raw control and four meat sausages containing beef offal.

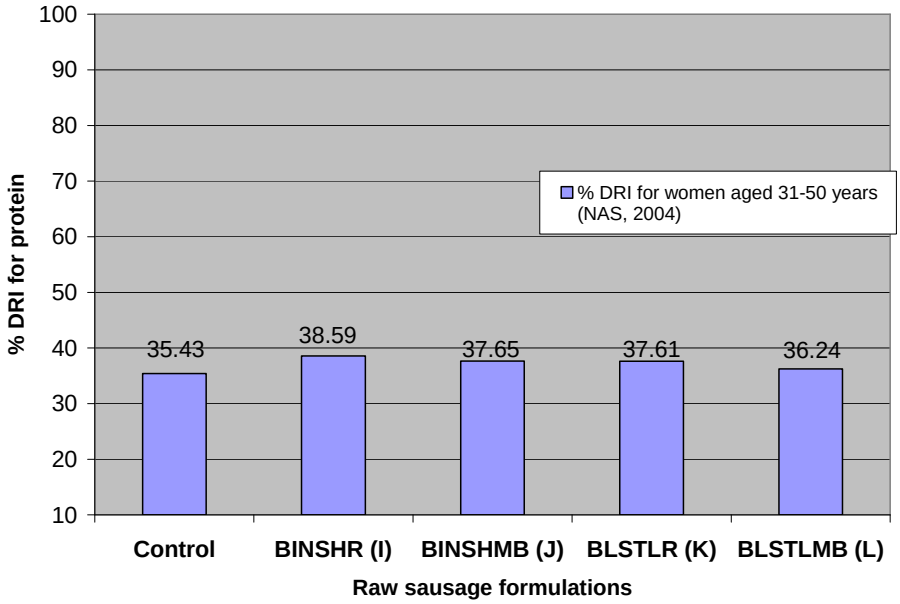

Figure 3. Percentage DRI values for protein for the raw control and four meat sausages containing beef offal.

Vitamins and minerals

Only nutrients with recognized Dietary Reference Intakes (DRI's) (NAS, 2004) were initially calculated and only nutrients with ND>1 were selected for Table 1.

Table 1. Nutrient density values for the protein, vitamin and mineral contents of the raw control and four meat sausages containing beef offal, for females aged 31-50 years

	Nutrient density*				
Nutrients	**Control (C)**	**BINSHR (I)**	**BINSHMB (J)**	**BLSTLR (K)**	**BLSTLMB (L)**
Protein	3.70	5.68	4.60	4.47	5.15
Niacin	2.86	3.47	3.18	3.05	4.32
Pyridoxine	2.73	3.51	3.94	4.20	6.34
Cyanocobalamin	7.44	30.01	18.92	64.04	73.63
Magnesium	1.08	1.36	1.44	1.28	1.31
Phosphorus	2.28	3.70	3.51	3.40	3.96
Sodium	5.40	6.71	6.13	6.07	6.87
Iron	1.80	5.18	3.73	2.90	4.12
Selenium	10.06	10.44	6.88	6.69	8.52

*Nutrient Density ≥1.00 indicates a good source of the specific nutrient

The raw control and meat sausages containing beef offal were found to be good sources of protein, vitamins B_3 (Niacin), B_6 (Pyridoxine) and B_{12} (cyanocobalamin) and minerals (magnesium, phosphorus, iron and selenium). The sausages all have an especially high vitamin B_{12} content (Table 1).

Conclusions

It can be concluded that raw meat sausages containing beef offal are especially good sources of protein, energy, Vitamin B_{12} (Cyanocobalamin), B_6 (Pyridoxine), B_3 (Niacin), selenium, sodium, iron, phosphorus and *cis*-fatty acids. These sausages were also found to be culturally acceptable by the sensory trained panel. Furthermore, they are affordable sausage products at < R20/kg.

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