INCORPORATION OF APPLE FIBRE TO LOW- AND HIGH-FAT BEEF BURGERS

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INTRODUCTION

Although numerous non-meat ingredients (soy protein, potato starch, corn germ meals, carrageenan, xantan, locus bean gun, pea flour, etc.) and some dietary fiber (sugarbeet, oat and pea) have been used to limit the effect of fat reduction on the characteristics of low-fat meat products (Egbert et al., 1991; Keeton, 1992; Trout et al., 1992; Berry and Wergin, 1993; Bullock et al., 1995), there are no references to the use of apple fibre in the formulation of low-fat ground meat.

The aim of this research was to ascertain the characteristics (water and fat binding properties and texture) of beef burgers as a function of fat content (8%, 15% and 20%) and different proportions (0%, 1% and 2%) of added apple fibre.

MATERIALS AND METHODS

Lean beef with all visible fat trimmed off and pork back fat were coarsely ground through a 1.2 cm plate then frozen to -25°C, in a plate freezer (plate temperature -40°C) (SMC 465, Sabroe Aarhus, Denmark) and stored (-20 °C) until use. Proximate analyses of both raw materials were determined (AOAC, 1984). Apple fibre was supplied by Indulerida (Lérida, Spain).

After thawing (18-20 hours, 2°C), meat and fat were mixed with salt, water and wheat flour to make up a number of different target formulations (8 kg each) as set forth in Table 1. Protein content was targeted at 16.5% for all formulations and 1.5% salt was added. After mixing the components, each sample was ground (0.45 cm plate) and burgers made up (about 90-100 g) on a Formatic Standard Machine (Deighton Engineering, England). Batter temperature never exceeded 0°C. Burgers were frozen to -20 °C in an air-blast freezer (air temperature -37°C) (Frigoscandia, Helsingborg, Sweden), vacuum-packed and stored at -20°C (±2°C) until use.

Moisture, protein and ash of uncooked burgers were determined in triplicate by AOAC (1984) methods. Fat content was evaluated by difference. The pH was assessed using a pH-meter (Radiometer PHM 93, Copenhagen, Denmark) on a homogenate of 5g of uncooked sample in 50 ml of distilled water.

Water and fat holding capacity was determined in five replicates on 12-15 g frozen sample (5 cores, diam 0.17 cm), as described Jiménez Colmenero et al. (1995). Frozen burgers were cooked on preheated (190°C) electric griddles (Plactronic 6156100, Selecta. Spain). Burgers of all formulations were cooked for 9 min, turning over every minute, and every 30 seconds for the last minute. Cooking loss (three hamburgers per formulation) was determined as per cent weight loss during cooking procedure. Reduction in burger surface area (before and after cooking, SR, %) was quantified densitometrically on three hamburgers per formulation, using Videoplan (Software Release 2.1, Kontron Bildanalyse GmbH). Kramer shear force (N/g, KSF) was determined as described Jiménez Colmenero et al. (1995)

Two-way analysis of variance with an F test, and least squares differences in means between pairs were used to obtain confidence intervals.

RESULTS AND DISCUSSION

Proximate composition of the nine formulations analysed is shown in Table 1. As proposed in the experimental design, three fat levels were observed (roughly 8%, 15% and 20%). Protein percentage (16.7 ± 0.3) and ash content (2.3 ± 0.1) were similar in all samples (P>0.05). Neither fat content nor presence of apple fibre caused any significant differences (P>0.05) in the pH (5.78 ± 0.04) of burgers.

Binding properties and retention of burger's area.

The highest (P<0.05) values of total cooked-out fluid and released water were found in the lower-fat burgers (Table 1). Addition of AF increased binding properties, an effect that was chiefly apparent as a decrease in released water (Table 1). Divergent results have been reported on the relationship between fat content and binding properties, a fact that has been attributed to differences in composition and/or degree of cooking (Fernández et al., 1996). Other authors have pointed out that cooking times need to be varied in accordance with fat level in order to achieve similar degrees of cooking (Trout et al., 1992; Berry, 1992).

The change in area of burgers as a result of cooking was not dependent on fat content (Table 2). A direct relationship was however identified between the presence of AF and retention of burger's area during cooking (Table 1).

Textural Analysis

Increasing fat content (from 8% to 20%) produced burgers with lower ($P<0.05$) Kramer shear force values. These results are consistent with the findings of other authors (Egbert et al., 1991; Berry, 1992; Trout et al., 1992). Addition of apple fibre caused KSF to decrease, the extent of the reduction depending on fat level (Table 1). This softening, possibly the result of dilution of meat protein, has also been detected on addition of other non-meat ingredients like dry-milled corn germ flour (Reitmeyer and Prusa, 1991), modified pregelatinized potato starch (Berry and Wergin, 1993) and sugarbeet fiber or potato starch with fibres of various plants (Trout et al., 1992).

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REFERENCES

AOAC. (1984). *Official Methods of Analysis of the Association of Official Analytical Chemists*. Washington, D C.
Berry, B.W. (1992). J. Food Sci. 57, 537-540, 574.
Berry, B. W. & Wergin, W.P. (1993). J. Muscle Food 4, 305-320.
Bullock, K. B.; Huffman, D. L.; Egbert, W. R.;, Mikel, W. B.; Bradford D. D. & W. R. Jones, (1995). J. Muscle Food 6, 37-46.
Egbert, W. R.; Huffman, D. L.; Chen, C. M. & Dylewski, D. P. (1991). Food Technol., 45, 64-73.
Fernández, P., Jiménez Colmenero, F., Carballo, J. & Solas, M.T. (1996). J. Food Sci., submitted.
Jiménez Colmenero, F., Carballo, J. & Solas, M.T. (1995). Int. J. Food Sci. Technol., 30, 335-345.
Keeton, J. T. (1992). *38th International Congress of Meat Science and Technology*, Clermont-Ferrand. France. Vol 1, 175-182.
Reitmeyer, C.A. & Prusa, K.J. (1991). J. Food Sci., 56, 216-219.
Trout, E. S.; Hunt M. C.; Johnson, D. E.; Claus, J. R.; Kanstner, C. L. & Kropf, D. H. (1992). J. Food Sci., 57, 19-24.

Table 1. Moisture (M, %), protein (P, %), fat (F, %), total cooked-out fluid (TCOF, %), released water (RW, %), released fat (RF, %), surface reduction (SR, %) and Kramer shear force (KSF, N/g) of beef burgers[1]

Sample	M	P	F	TCOF	RW	RF	SR	KSF
8/0	73.8_{a}	16.8	7.1_{a}	23.9_{a}	22.0_{a}	1.9_{a}	29.3_{a}	25.8_{a}
8/1	72.8_{ab}	16.8	8.2_{ab}	19.6_{b}	17.5_{b}	2.1_{ab}	27.5_{abd}	20.7_{bd}
8/2	72.0_{b}	16.9	8.9_{b}	21.3_{d}	19.3_{c}	2.0_{ab}	21.9_{c}	23.4_{c}
15/0	66.0_{c}	16.4	15.3_{c}	16.7_{d}	13.8_{d}	2.8_{c}	30.7_{a}	21.5_{b}
15/1	66.5_{c}	17.0	14.2_{c}	15.6_{de}	13.2_{de}	2.4_{bd}	28.6_{ab}	19.9_{de}
15/2	65.4_{c}	16.9	15.2_{c}	14.9_{ef}	12.2_{e}	2.7_{cd}	24.5_{bcd}	19.0_{ef}
20/0	60.0_{d}	16.4	21.3_{d}	15.5_{de}	12.6_{de}	2.9_{c}	29.1_{ab}	18.9_{ef}
20/1	60.6_{d}	16.8	20.5_{d}	13.9_{f}	10.8_{f}	3.0_{c}	23.6_{cd}	18.0_{fg}
20/2	60.2_{d}	16.7	20.8_{d}	11.2_{g}	8.9_{g}	2.3_{bd}	22.0_{c}	17.4_{g}
SEM	0.42	0.40	0.38	0.48	0.46	0.15	0.16	0.40

[1] The first number of the sample nomenclature indicates fat level, and the second indicates per cent added apple fibre.