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EATING QUALITY OF LOW FAT BEEFBURGERS CONTAINING FAT REPLACING FUNCTIONAL BLENDS

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BACKGROUND

Many consumers are currently limiting the amount of fat and calories in their diets. As a result, in recent years there has been a trend towards low fat products. This has been encouraged by some members of the medical profession and the media. The aim in producing low fat meat products is to give consumers products similar to full fat meat products while maintaining a healthy diet.

Fat plays an important role in determining the quality of meat products. It has a significant effect on the rheological and structural properties of meat products. Fat also effects flavour, it is a known precursor of a large number of flavour compounds that can contribute to desirable as well as undesirable tastes and aromas (Goutefongea and Dumont, 1990). Also, many volatile aroma compounds are fat soluble rather than water soluble and the relative amounts of these two media in the food will affect the way the volatiles are released, both before eating (odour) and during chewing. Several studies (Egbert *et al.*, 1991; Berry, 1994; Troutt *et al.*, 1992; Millar *et al.*, 1993) have shown that production of low fat beefburgers through simple reduction of fat would substantially decrease product palatability, flavour intensity, juiciness and tenderness. Most low fat meat products, therefore, contain fat replacers which act as water binding and texture modifying agents. These typically fall into three categories: (a) Non-meat proteins e.g. soya and milk proteins (b) Carbohydrate based e.g. carrageenans, maltodextrins, starches and oat fibre and (c) Functional blends.

A number of studies (Egbert *et al.*,1991; Troutt *et al.*, 1992; Berry and Wergin, 1993) have shown that some of these fat replacers have improved the sensory quality of low fat beefburgers.

OBJECTIVE

From an initial survey of twenty three ingredients (Desmond *et al.*, 1994), six were chosen on the basis of their overall acceptability in terms of texture, flavour and physical characteristics, these included tapioca starch, carrageenan, oat fibre, pectin whey protein and a commercial mixture of carrageenan and locust bean gum. Thirteen functional blends were formulated from these ingredients so that each ingredient imparted a number of quality attributes in a complementary manner to the finished product. The low fat beefburgers were tested for cook yield, water holding capacity (WHC), sensory and mechanical texture analysis. These blends were;

(1) Tapioca starch/Oat fibre/whey protein
(2) Tapioca starch/Pectin/Whey Protein
(3) Pectin/Whey Protein
(4) Carrageenan and Locust Bean Gum/Oat Fibre/Whey Protein
(5) Carrageenan and Locust Bean Gum/Pectin/Whey protein
(6) Carrageenan/Oat Fibre/Whey Protein
(7) Carrageenan/Pectin/Whey Protein
(8) Tapioca Starch/Oat Fibre
(9) Tapioca Starch/Pectin
(10) Carrageenan and Locust Bean Gum/Oat Fibre
(11) Carrageenan and Locust Bean Gum/Pectin
(12) Carrageenan/Oat Fibre
(13) Carrageenan/Pectin

METHODS

Beefburger Manufacture: Lean beef (95% VL) forequarter and fat from Hereford cross heifers was coarsely ground in a ASEA mincer through a 10mm plate. Appropriate amounts of lean beef and fat were then mixed to obtain 90% lean beef. Water, salt and the blends of ingredients were added to the meat. The resulting mixture was finely ground using a 5mm plate. Beefburgers (113g) were formed using a MANCA burger maker set and frozen in a blast freezer at -20°C. When frozen the burgers were stacked two high in plastic vac-pack bags. A total of four burgers were placed in each bag and then vac-packed. The burgers were stored at -20°C until required.
Water Holding Capacity: The WHC was determined using centrifugation (9000×g at 4°C for 10 min) using a modification of the method of Liangi and Chen (1991).
Cooking Protocol: Beefburgers were cooked from a frozen state in a preheated (setting 5) electric Tricity grill for 12 min being turned over every 2 mins until an internal temperature of 71°C was reached.
% Cook Yield: This was determined by calculating weight differences in beefburgers before and after cooking (Berry, 1994)
Sensory Analysis: Beefburgers were cooked as previously described. A ten member in-house taste panel evaluated the beefburgers for of textural, flavour and overall quality attributes as described by Jeffery and Lewis (1983).
Mechanical Texture Analysis: (a) Warner-Bratzler Shear: Two 2.5cm wide sections were removed from each beefburger. Each section was sheared in five separate locations with a Warner-Bratzler V-shaped blade attached to a Instron Universal Testing Machine (Model 4464) with a 500 N load cell using modifications of the method of Berry (1994).
(b) Kramer Shear: Two 2.5cm × 6.0cm long strips were removed from each beefburger, weighed and then sheared using a multi-bladed Kramer shearing device attached to a Instron Universal Testing Machine (Model 4464) with a 2 KN load cell (Millar *et al.,* 1993).

RESULTS AND DISCUSSION

The cooking yields showed a significant difference (p<0.05) between the blends. The lowest cook yield (58.2%) was obtained from the low fat control. Beefburgers containing blends of carrageenan + locust bean gum/pectin/whey protein and carrageenan/oat fibre/whey protein had the highest cook yields of 69.0% and 68.3% respectively. The majority of beefburgers had cook yields of between 61.3-66.9%. The results for water holding capacity (WHC) also showed a significant difference (p<0.05) between blends. The blends increased the WHC, compared with the low fat control (31.99%). Burgers containing blends of tapioca starch/oat fibre/whey protein and tapioca starch/oat fibre had the highest WHC values of 42.07% and 40.28% respectively. The majority of burgers had a WHC value of between 36-40%.

Sensory panel ratings showed no differences (p>0.05) for fattiness and overall appearance. However, panelists found a significant difference (p<0.05) for tenderness, moistness/juiciness, crumbliness, meaty flavour, non-burger flavour, amount of residual connective tissue, overall flavour, texture and acceptability. Beefburgers containing tapioca starch, oat fibre and pectin were found to be the most tender and juicy. Beefburgers containing the pectin/whey protein blend were also ranked low in tenderness and juiciness. Burgers containing blends of carrageenan + locust bean gum/pectin/whey protein and carrageenan/oat fibre were ranked the lowest in overall flavour having a slight non-burger flavour. Burgers containing tapioca starch/oat fibre, carrageenan/oat fibre/whey protein, tapioca starch/pectin and carrageenan + locust bean gum/oat fibre were ranked the best by panelists for overall quality attributes. The low fat control was ranked the lowest in overall texture. Similar results were obtained for overall acceptability.

Warner-Bratzler (W/B) values were significantly different (p<0.05) for the blends used. Most blends resulted in lower W/B peak forces compared to the low fat control (25.4N). Some blends such as those containing tapioca, oat fibre and whey protein substantially decreased the peak force to 13 - 15N. Kramer shear values showed similar results. The low fat control had the highest Kramer peak force (54.67 N/g) and one of the highest peak energies (0.316 J/g). Burgers with blends containing tapioca starch, oat fibre and whey protein gave the lowest Kramer peak forces (31-32 N/g) and peak energies (0.165-0.207 J/g).

Troutt *et al*, 1992, reported similar results in that added ingredients such as dietary fibers, starches and polydextrose have the potential for improving the palatability of low fat ground beef. Ingredient combinations reduced cooking losses and significantly (p<0.05) reduced W/B and Kramer shear values to be similar to those for 20 and 30% fat controls.

CONCLUSIONS

Low fat beefburgers containing blends of tapioca starch, oat fibre and whey protein were superior in overall quality. These low fat beefburgers were acceptable in terms of flavour and texture. Sensory results showed that flavour and texture were the most important in deciding overall acceptability. Some blends containing pectin and a mixture of carrageenan and locust bean gum were found to be the lowest in overall quality.

The mechanical texture measurements were significantly different from the full fat control. Some of these measurements such as Kramer shear peak force and peak energy correlated well with the sensory texture traits. The different mechanical measurements were consistent with each other in that burgers with blends containing tapioca starch, oat fibre whey protein and pectin were found to be the most tender by each mechanical test.

REFERENCES

Berry, B.W. (1994). Fat level, high temperature cooking and degree of doneness affect sensory, chemical and physical properties of beef patties. J. Food Sci. 59 (1): 10-14, 19.

Berry, B.W. and Wergin, W.P. (1993). Modified pregelatinized potato starch in low fat ground beef patties. J. Muscle Foods (4) 305-320.

Desmond, E.M., Troy, D.J. and Buckley, D.J. (1994). Proceedings: 40th International Congress of Meat Science and Technology, The Hague, The Netherlands, W-3.22.

Egbert, W.R., Huffman, D.L., Chen, C.M. and Dylewski, D.P. (1991). Developments in low fat ground beef. Food Technology 45 (6): 64, 66-68, 70-71, 73.

Goutefongea, R. and Dumont, J.P. (1990). Developments in low-fat meat and meat products. In: Reducing fat in animals, ed. J.D. Wood and A.V. Fisher. Elievier Applied Science, London, p. 398.

Jeffery, A.B. and Lewis, D.F. (1983). Studies on beefburgers II. Effect of mincing plate size and temperature of the meat in the production of beefburgers. Leatherhead Food R.A. Research Report No. 439. December 1983.

Liangi, M. and Chen, N. (1991). Proceedings: 37th International Congress of Meat Science and Technology, Copenhagen, Denmark. pp 781-786.

Millar, M.F., Anderson, M.K., Ramsey C.B. and Reagan, J.O. (1993). Physical and sensory characteristics of low fat ground beef patties. J. Food Sci. 58(3) 461-463.

Troutt,E.S., Hunt, M.C., Johnson, D.E., Claus, J.R., Kastner, C.L. and Kropf, D.H. (1992). Characteristics of low fat ground beef containing texture-modifying ingredients. J. Food Sci. 57 (1) 19-24.