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Nutritional Enhancement of Meat Products with Dietary Fibres

The National Food Centre

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NUTRITIONAL ENHANCEMENT OF MEAT PRODUCTS WITH DIETARY FIBRES

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SUMMARY

Normal fat (about 23 %) and reduced fat (about 10%) pork sausages and beefburgers were nutritionally enhanced using dietary fibres from various plant sources: inulin, wheat, citrus, potato, oat and pea.

Reducing the fat level in sausages reduced the quality of the products particularly in terms of cook loss, flavour and acceptability. Reduced fat sausages formulated with inulin and oat fibre were rated similar in flavour to the normal fat control. Inulin improved the tenderness ($P<0.05$) at both fat levels while other fibres had a slight toughening effect. Sausages containing inulin were more juicy ($P<0.05$) than sausages containing the other fibres and similar ($P>0.05$) to the control.

Fibres (wheat, citrus, potato, oat and pea) were added to beefburger formulations containing both 10% and 23% fat. A reduction in the fat level reduced the textural quality of the control products and produced higher shear force ($P<0.05$) values. The addition of the fibres increased water-holding capacity and produced a more succulent product. However the citrus fibre produced a product with a mushy texture that was unacceptable. Of the fibres examined, both potato and pea fibres had the most beneficial effects. These fibres increased the overall acceptability of the reduced fat burgers to a level similar to that of the normal fat controls and significantly improved the textural and flavour properties of the reduced fat products. A follow on from this trial examined the addition of both pea and potato fibres at two levels, 1.5% and 3% w/w. The incorporation of both fibres at both levels improved tenderness and reduced shear force values of the reduced fat burgers. The most significant decrease was apparent with the addition of pea fibre at the 3% w/w level.

Flavour analysis by GC-MS showed that profiles from reduced fat products were less intense than from the normal fat products. Volatile concentrations in reduced fat burgers containing both pea and potato fibre at the 1.5% w/w addition rate were similar to those in the normal fat products for a number of important compounds. Time intensity (TI) studies showed that normal fat burgers produced an extended TI curve while the reduced fat burger produced

a curve that peaked early and decreased rapidly indicating that reduction in fat produces an initially intense but transient flavour. The addition of the fibres resulted in a prolonged flavour intensity. Tmax values were highest for burgers containing 1.5% w/w potato fibre (Tmax=22) and lowest for those beefburgers containing 3% w/w potato fibre (Tmax=13). This indicates that the flavour was released earlier in the beefburgers containing 3% w/w potato fibre.

INTRODUCTION

The demand for convenience foods has increased dramatically in recent years. However, consumers are not only interested in quality products that taste good and are convenient, but are also concerned with the nutritive value, safety and wholesomeness of the food they consume. The advent of such health conscious consumers has led to a growing preference for convenient meat products with reduced fat and cholesterol. Unfortunately, the removal of fat from traditional meat products affects their flavour, juiciness and mouthfeel, in addition to reducing satiety value. Meat processors have therefore had to develop alternative, natural, functional and cost-effective ingredients that can successfully replace the less desirable fat component, while maintaining product quality.

Reduced-fat and healthier meat products are one of the fastest growing food sectors in new product development in the United States. Adding value while increasing the nutritional wholesomeness of a food is of major benefit to the market. Research has shown that a range of fat replacers/substitutes, such as non-meat proteins, carbohydrates and other products can be used to improve the overall organoleptic qualities of reduced fat meat products (Colmenero, 1996; Lucca and Tepper, 1994 and Giese, 1992). However, further in-depth studies on the effects of specific fat replacers, such as dietary fibres, on the texture, and in particular the flavours, of healthier meat products are needed.

Nutritional scientists claim that there is a large deficiency in the intake of fibre in the diet. 'Second generation' fibres, which have neutral taste and colour, have been used to replace fat in meat products in recent years (Backers and Noll, 2001). Several years ago, dietary fibres were considered to have no nutritional value, but today consumers are aware of their positive effects, including their contribution to the prevention of colon cancer and the reduction of cholesterol levels in blood.

This project developed reduced-fat meat products, incorporating dietary fibres to increase their nutritional status whilst maintaining the quality attributes of the products.

APPLICATION OF DIETARY FIBRES TO CONVENIENCE MEAT PRODUCTS

Meat processors continue to search for the ideal fat replacer or substitute, which gives all the fat- related attributes without the accompanying health concerns. Dietary fibres from oat, sugar beet, soy, apple, pea and wheat have been included in the formulations of several meat products such as patties, sausages and bologna (Backers and Noll, 2001; Mansour and Khalil, 1999; Keeton, 1994 and Troutt *et al.*, 1992). In many instances, these dietary fibres not only have beneficial physiological effects, they also generate important technological properties that offset the effect of fat reduction.

This work examined the effect of the incorporation of a number of dietary fibres on the quality characteristics of reduced- and normal fat meat products. Two popular convenience type products were selected for this purpose: sausages and beefburgers.

Sausages:

Approach: Pork sausages were manufactured containing 8% and 23% fat. Inulin (Raftiline®, oat fibre (Opta oat fibre), enhanced oat fibre (Hesco) and pea fibre (Swelite®) were added separately to these sausage formulations at a rate of 3% w/w. Control products (normal- and reduced-fat), without the functional fibres were also prepared. For each product, moisture, fat and protein were determined. Cook loss, water-holding capacity and textural properties (using Kramer shear force and texture profile analysis) were also measured. Sensory analysis was carried out on each product using a trained in-house panel.

Table 1: The effects of dietary fibres on the physicochemical, sensory and instrumental texture values of both reduced-fat and normal fat pork sausages.

	Cook loss	WHC	Tenderness	Overall flavour	Overall acceptability	Hardness
A: Fat level						
Reduced fat	14.8	41.5	5.9	3.9	3.8	37.4
Normal fat	7.8	53.6	5.6	4.0	4.1	53.6
Significance level	***	***	***	ns	***	***
B: Fibre type						
Control	10.9	50.5	6.0	4.1	4.1	44.6
Oat fibre	11.4	45.9	5.5	3.9	3.9	51.1
Inulin	10.8	50.0	6.1	4.1	4.2	40.9
Pea fibre	11.9	47.7	5.7	3.9	3.9	45.0
Enhanced oat fibre	11.5	43.6	5.4	3.6	3.6	45.8
Significance level	ns	***	***	***	***	***
Interaction A x B	ns	***	ns	*	*	**
Samples:						
Reduced Fat						
Control	14.5	39.2	6.1	3.9	3.9	36.6
Oat fibre	14.9	40.2	5.5	3.8	3.8	39.2
Inulin	13.3	40.3	6.3	4.3	4.3	36.1
Pea fibre	15.9	44.2	5.8	3.8	3.8	37.5
Enhanced oat fibre	15.5	437	5.6	3.5	3.4	37.5
Normal fat						
Control	7.4	61.9	5.9	4.2	4.3	52.6
Oat fibre	7.9	51.7	5.4	4.1	4.0	63.1
Inulin	8.4	59.6	5.9	3.9	4.1	45.7
Pea fibre	7.9	51.2	5.5	4.0	4.1	52.6
Enhanced oat fibre	7.4	43.4	5.1	3.6	3.8	54.2

Level of significance ***P<0.001, **P<0.01, *P<0.05, ns = not significant.

Outcome: Reducing the fat content of sausages decreased the quality of the products, particularly in terms of cook loss, flavour and acceptability (Table 1). Inulin functioned more favourably than the other fibres examined. Sausages formulated with inulin were comparable to control sausages in terms of water-holding capacity, tenderness, flavour and overall acceptability. Inulin improved the tenderness at both fat levels while other fibres had a slight toughening effect. A number of interactive effects were also observed between inulin and fat level for flavour, acceptability and hardness.

Beefburgers:

Approach: Beefburgers were formulated containing 10 and 23% fat. Pea fibre (Swelite®, wheat fibre (Vitacel®), potato fibre (Potex), oat fibre (Whitestar AOF 200) and citrus fibre (Herbacel AQ plus citrus fibre) were added separately to both the reduced and normal fat beefburgers at a rate of 1.5% w/w. Control products (normal and reduced-fat), were also manufactured without the use of the fibres. The composition (moisture, fat, protein), cook loss, colour and water-holding capacity of the beefburgers was determined. The textual properties of the products were measured using Kramer shear force and texture profile analysis (TPA). A trained in-house panel was used to determine the sensory qualities of the products.

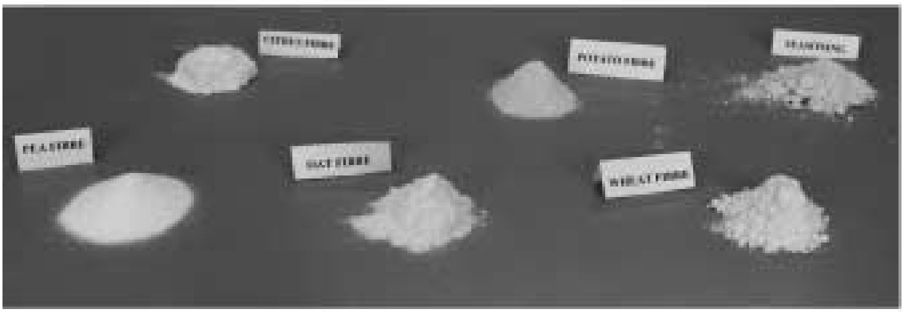

Figure 1: Fibres and seasoning used in beefburger manufacture.

Outcome: Normal fat beefburgers had lower water-holding capacity and therefore experienced higher cook losses (Table 2). However, reducing the fat content decreased the textural quality of the products and produced significantly higher shear force and hardness values. Colour differences were also observed and reduced fat products were darker (lower CIE L* values) due to the higher lean meat percentage. The addition of fibres increased the water holding ability of the beefburgers and produced a concomitant decrease in cookloss values. No significant colour changes were observed with the inclusion of dietary fibres. However, the textural properties (instrumental and sensory) of reduced-fat beefburgers containing fibres were comparable to those of the control normal fat products. The addition of both pea and potato fibres to reduced-fat products increased their overall acceptability (4.0 and 3.8 respectively) to a level similar to that of the normal fat beefburgers (3.9).

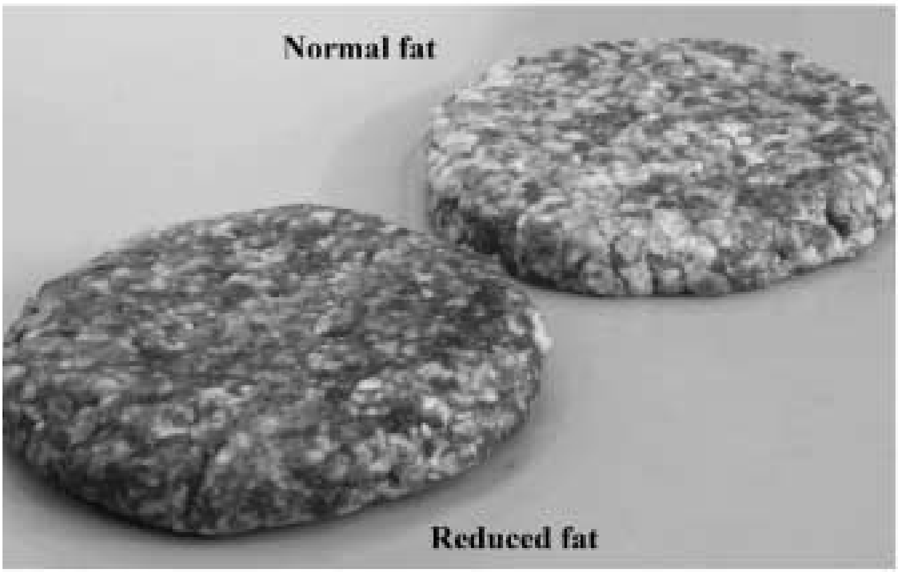

Figure 2: Beefburgers produced using low and normal fat formulations.

Table 2: The influence of dietary fibres on the physicochemical, visual and instrumental texture values of both reduced-fat and normal fat beefburgers.

	Cook loss	WHC	Tender-ness	Hardness	Kramer shear	Cohesive-ness	CIE L*
A: Fat level							
Reduced lat	29.1	52.1	4.3	146	35.1	0.39	45.3
Normal fat	31.3	46.5	4.6	115	27.0	0.30	51.5
Signif. level	***	***	***	***	***	***	***
B: Fibre Type							
Control	37.0	34.5	4.0	148	34.2	0.38	48.1
Citrus	27.6	53.9	4.8	112	25.1	0.26	49.0
Pea	25.8	57.8	4.8	119	25.0	0.32	48.1
Potato	28.9	57.5	4.7	130	29.8	0.33	47.8
Wheat	32.3	47.4	4.2	137	36.0	0.38	49.1
Oat	29.7	44.7	4.0	138	36.3	0.39	48.2
Signif. level	***	***	***	**	***	***	ns
Interaction A x B	***	***	*	ns	***	*	ns
Samples:							
Reduced fat							
Control	38.2	40.7	3.6	163	39.9	0.41	45.1
Citrus	27.1	59.8	4.8	135	29.9	0.31	44.8
Pea	23.6	55.3	4.6	139	26.6	0.37	44.7
Potato	25.8	57.3	4.8	147	32.6	0.36	45.5
Wheat	30.3	48.3	4.0	145	39.5	0.41	46.3
Oat	29.6	51.3	3.8	150	42.3	0.45	45.6
Normal fat							
Control	35.8	28.3	4.5	133	28.5	0.35	51.1
Citrus	28.1	48.0	4.7	89	20.3	0.21	53.2
Pea	28.0	60.2	5.0	98	23.5	0.28	51.5
Potato	32.0	57.7	4.6	113	26.9	0.31	50.2
Wheat	34.3	46.5	4.4	130	32.4	0.35	51.9
Oat	30.0	38.1	4.2	126	30.4	0.32	50.9

Level of significance ***P<0.001, **P<0.01, *P<0.05, ns = not significant.

INCORPORATING PEA AND POTATO FIBRES INTO REDUCED-FAT BEEFBURGERS

Pea and potato fibre have both been shown to offset the detrimental effects of reducing the fat content of beefburgers. However the optimum level of inclusion must be determined. This work examined two levels of fibre addition (1.5% and 3% w/w) in an attempt to establish which was more favourable.

Approach: Beefburgers were manufactured containing 10% and 23% fat. Potato fibre (Potex, Lyckeby Stärkelsen, Sweden) and pea fibre (Swelite®, Consucra, Belgium) were added to the reduced fat formulations at addition rates of 1.5% and 3% w/w, giving a total of 6 treatments. Beefburgers were analysed for percentage of moisture, fat and protein (Bostian *et al.*, 1985; Sweeney & Rexford, 1987). Cook loss, water-holding capacity (WHC) and CIE L*a*b* characteristics were also measured. Kramer shear force was determined using an Instron Model 4464. An eight-member in-house panel was used to evaluate the sensory characteristics of beefburgers from each of the treatments (AMSA, 1995). Higher scores signify increased tenderness, flavour and acceptability.

Outcome: The inclusion of pea fibre at the 3% level resulted in a significant decrease in cook loss values; however burgers from the other dietary fibre treatments were not markedly affected (Table 3). Kramer shear values were higher ($p<0.05$) in reduced-fat beefburgers. The incorporation of pea and potato fibres at both 1.5 and 3% substantially reduced peak force values below those of reduced and normal fat control beefburgers. The most significant decrease was apparent with the addition of pea fibre at the 3% level.

Ratings by the sensory panel reflected these instrumental results and panellists reported an increase in tenderness with the inclusion of dietary fibres. The most palpable improvement was noted in beefburgers containing 3% pea fibre, which panellists in general scored as being more tender than the normal fat control. The inclusion of pea fibre did not affect the flavour or acceptability of the beefburgers; however, products containing potato fibre

Table 3: Effects of pea and potato dietary fibres on the physicochemical, sensory and instrumental texture values of reduced-fat beefburgers. Values for normal fat and reduced-fat burgers without added fibre (controls) are shown for comparison.

	WHC	Cook loss	CIE L*	Kramer shear	Tender-ness	Overall flavour	Accept-ability
Normal fat control	44.1^{a}	38.5^{a}	48.81^{a}	37.4^{a}	4.7^{a}	3.9^{a}	4.0^{a}
Reduced fat control	53.0^{b}	30.8^{b}	44.29^{bc}	42.6^{b}	4.1^{b}	4.1^{a}	4.2^{a}
1.5% Pea fibre	51.6^{b}	27.1^{bc}	44.23^{bc}	34.8^{ac}	4.6^{a}	4.3^{a}	4.5^{a}
3.0% Pea fibre	54.5^{b}	23.4^{c}	45.80^{b}	31.1^{c}	4.9^{a}	4.1^{a}	4.3^{a}
1.5% Potato fibre	56.3^{b}	30.1^{b}	42.49^{c}	34.1^{ac}	4.3^{b}	3.6^{ab}	3.6^{ab}
3.0% Potato fibre	53.7^{b}	26.6^{bc}	43.00c	36.3^{a}	4.6^{a}	3.4^{b}	3.4^{b}

^{a,b,c} Means in the same column with different superscripts are significantly different ($p<0.05$)

were slightly less palatable. The use of pea fibre in reduced-fat beefburgers may offer the opportunity of improved tenderness and cooking yield without any adverse effects on sensory quality.

FLAVOUR OF REDUCED-FAT BEEFBURGERS

Flavour volatiles

Flavour, whether of meat or any other food, comprises mainly the two sensations of taste and aroma or smell. Although both factors contribute to the acceptability of food, the aroma or flavour volatiles are of utmost importance because they influence the judgement of the consumer even before the food is eaten. Fats may influence both the physical and chemical stability of the flavour volatiles.

Table 4: Key flavour volatiles isolated from the headspace of cooked beefburgers.

Compound[1]	Aroma[1]
Aldehydes:	
Hexanal	Green/fresh
Heptanal	Green/fatty/oily
Benzaldehyde	Bitter almond
Octanal	Fatty/fruity
Nonanal	Tallowy/green/herbal
Ketones:	
2,3 Octanedione	Metallic
Limonene	Pine

MacLeod (1994)[1].

The effect of the content of fat and dietary fibre on the chemical compounds responsible for flavour was examined. Headspace analysis showed that beefburgers contain several hundred volatile components. Seven key volatiles, which were present in quantity and appeared to change between beefburger treatments, were selected and identified (Table 4).

Approach: Beefburger batches were formulated without seasoning but containing levels of 10% and 23% fat. Potato and pea fibres were incorporated into the reduced fat formulation at addition levels of 1.5 and 3% w/w; giving six treatments (listed in Figure 3 and Table 5). Volatile flavour compounds were isolated from the headspace of cooked beefburgers using solid phase micro extraction (SPME). The volatile flavour components were then separated and identified using a gas chromatography – mass spectrometer (GC-MS).

Outcome: The profiles of the selected volatiles contained in the headspace of the beefburgers were affected by fat content (Figure 1 and Table 5).

Compounds from the reduced-fat control products were consistently less intense than the compounds released from the normal fat beefburgers. Differences between fat levels were observed for heptanal and 2,3 octanedione ($P<0.05$). Volatile concentrations in reduced-fat beefburgers containing pea and potato fibre at the 1.5% level were similar to those in normal fat control products, particularly for hexanal, nonanal, benzaldehyde and octanal compounds. However incorporating pea and potato fibres at the 1.5% level increased the concentrations of volatiles in reduced-fat beefburgers to that of normal fat burgers, particularly for hexanal, benzaldehyde, octanal and nonanal.

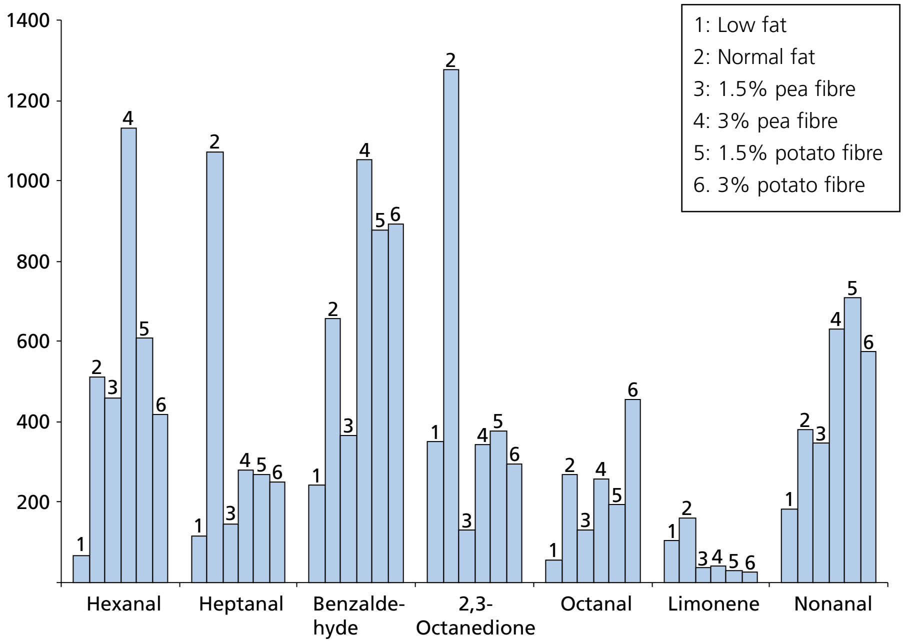

Figure 3: Content of selected flavour volatiles identified during cooking in normal fat and reduced-fat beefburgers containing dietary fibre.

Table 5: Selected flavour volatiles identified during cooking of normal fat and reduced-fat beefburgers with dietary fibre.

Volatile	Linear Retention Index	ng/100g of beefburger						Sig. level	Method of identification
		Low fat control	Normal fat control	Pea 1.5% (low fat)	Pea 3% (low fat)	Pot 1.5% (low fat)	Pot 3% (low fat)		
Aldehyde:									
Hexanal	801	68^{b}	511^{ab}	458^{ab}	1130^{a}	610^{ab}	417^{ab}	*	MS + LRI
Heptanal	850	114^{b}	1071^{a}	146^{b}	282^{b}	270^{b}	251^{b}	***	MS + LRI
Benzaldehyde	884	242^{b}	655^{ab}	367^{ab}	1051^{a}	876^{ab}	894^{ab}	*	MS + LRI
Octanal	1002	56^{b}	270^{a}	132^{a}	256^{a}	132^{a}	456^{a}	ns	MS + LRI
Nonanal	1054	185^{b}	382^{ab}	348^{ab}	632^{a}	708^{a}	576^{ab}	*	MS + LRI
Ketone:									
2,3 Octandione	891	351^{b}	1276^{a}	130^{b}	342^{b}	377^{b}	295^{b}	**	MS + LRI
Limonene	1017	104^{ab}	159^{a}	38^{b}	41^{b}	29^{b}	27^{b}	**	MS + LRI

^{abc} Mean values for ng/100g of beefburger in the same row with different letters are different (P<0.05), NS= not significant, MS + LRI = Mass Spectrometry and Linear Retention Index

Time Intensity

Perception of flavour occurs over real time. Aroma, taste, texture and even thermal and pain sensations elicited by food and beverages display dynamic changes in intensity over time (Lee & Pangborn, 1986). Time Intensity is a sensory method which provides a graphical relationship between the perceived strength to a sensory attribute and the duration of its perception (Shamil *et al.*, 1992). It provides an opportunity to develop a better understanding of the factors influencing the release of flavours from food systems.

A taste panel was selected and trained according to ISO standards for time intensity studies. The trained panel examined the influence of fibres on flavour release from reduced-fat beefburgers. This was achieved using a computerised technique which records flavour intensity over time (Figure 4).

Figure 4: Compusense five - a computerised technique which records the detection of flavour intensity over time by taste panellists.

Approach: Eighteen candidates were recruited from the laboratory staff based on their ability, experience in sensory analysis of meat products, good health and lack of disabilities which would affect their senses. The four basic tastes (bitter, salt, sour and sweet) were used as stimuli and panellists were trained until their scores matched those required by ISO standards (ISO 8586-1, 1993) in matching, recognition, ranking and threshold tests. Following formal, basic training of the taste panellists, product tasting was initiated to familiarise panellists with the characteristics of low- and normal-fat beefburgers. When the assessors were familiar with the products, specific training in the use of the computerised time intensity system was conducted (Compusense Five, Release 4.4). Two chewing gum products of different mint intensities were used in these familiarisation sessions as chewing gum is known to lose its flavour very quickly and the loss of flavour is quite exaggerated.

Beefburger batches were formulated containing levels of 10% and 23% fat. Potato and pea fibres were incorporated into the reduced-fat formulation at addition levels of 1.5 and 3% w/w; giving six treatments. Breadcrumbs (about 200g/kg burger mix) and egg yolk (2 medium yolks per kg) were added to the burger mix to produce a more commercial style of burger. The trained assessors were asked to assess the overall flavour intensity of the different beefburger formulations. The test time was 40 seconds during which the overall flavour intensity of the products was recorded and, with the aid of the computer software, curves were generated and results analysed. Assessors were also asked to rate the commercial acceptability of the beefburger as very acceptable, moderately acceptable or not acceptable

Outcome:
Individual time intensity (TI) curves were generated for each of the eight assessors. Figures 5 and 6 show typical curves generated by one of the panellists. An initial comparison was made between the flavour intensity of the low and normal fat beefburger formulations (Figure 5). The second curve illustrates the effect of different levels of fibre inclusion on reduced fat beefburgers (Figure 6).

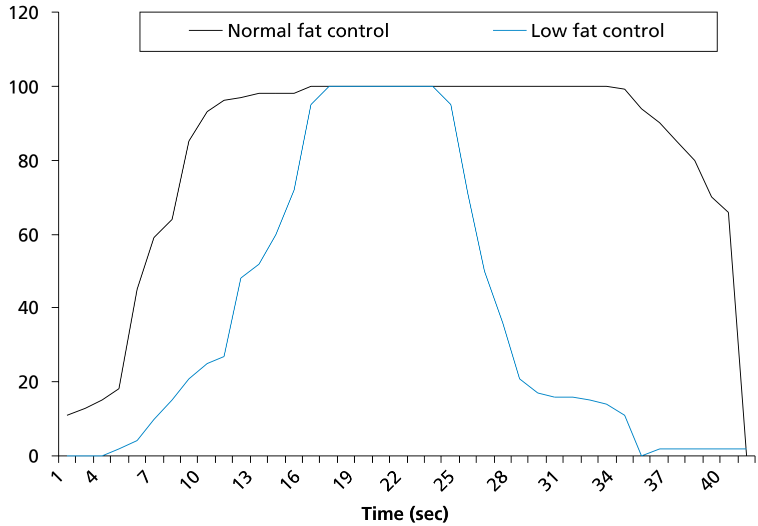

Figure 5: Time Intensity curve of flavour release during tasting of normal fat and reduced-fat beefburgers.

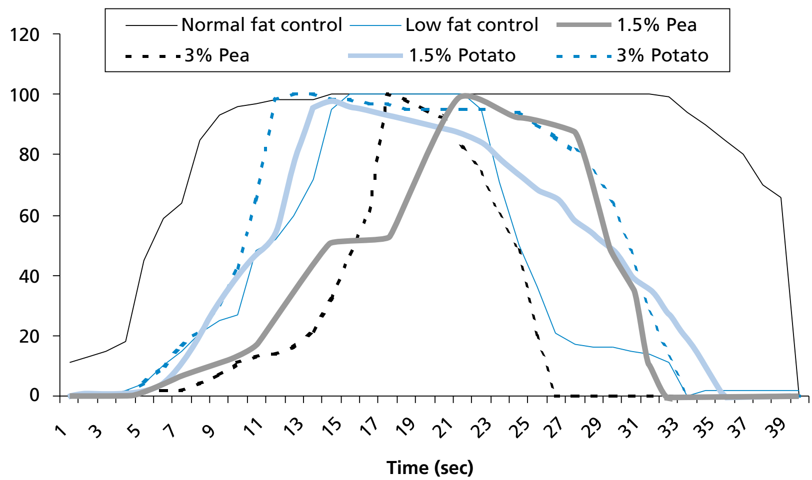

Figure 6: Time Intensity curves of flavour release during tasting of reduced fat beefburgers containing dietary fibres compared to the normal fat beefburgers.

The curves generated from the low and normal fat beefburger data (Figure 5) are very different. The normal fat beefburger produced an extended TI curve unlike the reduced-fat burger curve, which peaked early and decreased rapidly indicating that reduction in fat produced an initially intense but transient flavour. The addition of fibres resulted in prolonged flavour intensity indicated by the extension in the TI curves (Figure 6).

A number of quantitative measurements of flavour can be extracted from the time intensity curves and several of these are presented in Table 6. The maximum intensity (Imax) is the highest point on the curve as recorded by the panellist. (Imax) was slightly lower in beefburgers containing 1.5% pea fibre compared to the rest of the treatments. Tmax is the time in seconds required to reach the maximum intensity. The normal fat product and reduced-fat control values for Tmax were very similar (15 and 16 respectively) which indicates that maximum intensity was reached at the same time for both fat levels.

Time to maximum intensity was highest for products containing 1.5% potato fibre (Tmax=22) and lowest for beefburgers containing 3% potato fibre (Tmax=13); this indicates that the flavour was released earlier in the products

Table 6: Influence of fat and fibre content of beefburgers on measurements of flavour release during tasting: maximum intensity (Imax), time to max (Tmax) and area under the curve (Area).

	$T_{max(sec)}$	$I_{max(sec)}$	Area (cm^2)
Normal fat	15	100	3274
Reduced fat	16	100	1505
1.5% Pea	15	98	1789
3% Pea	18	100	901
1.5% Pot	22	100	1422
3% Pot	13	100	2026

containing 3% potato fibre. The total area under the curve was also calculated and the largest area ($3274 cm^2$) was found for the normal fat control. The area values for 3% pea ($901 cm^2$) and 1.5% potato ($1422 cm^2$) were lower than the reduced-fat control value ($1505 cm^2$). This indicates that the flavour was released and the products became bland quite quickly. Taste panel acceptability ratings showed that beefburgers with added pea and potato fibre at the 1.5% level were the most acceptable.

CONCLUSIONS

- Reduced and normal fat sausages formulated with inulin were comparable to control sausages in terms of water-holding capacity, tenderness, flavour and overall acceptability.
- The addition of both pea and potato fibre to reduced-fat beefburgers increased their overall acceptability to a level similar to that of a normal fat beefburger.
- A 3% w/w addition of fibres to beefburger formulations had a more favourable effect than a 1.5% w/w addition rate.
- The concentrations of flavour volatiles in reduced-fat beefburgers containing both pea and potato fibres at a 1.5% w/w addition level were similar to those in normal fat beefburgers.
- Normal fat beefburgers produced an extended Time Intensity curve unlike the reduced-fat burgers which produced curves that peaked early and decreased rapidly, indicating that reduction in fat produces an initially intense but transient flavour.
- The addition of the fibres to the reduced-fat beefburger formulations prolonged the flavour intensity, as indicated by the extension of the Time Intensity curves.

RECOMMENDATIONS TO INDUSTRY

There has been a phenomenal growth of the ‘healthier options’ within the food industry. Many consumers have genuine health and nutritional concerns, and these concerns are often cited as the major factors influencing choice. Of all the food sectors to suffer from adverse publicity, the meat industry has been most severely hit by the perceived relationship between meat products and the incidence of obesity and cardiovascular disease. The meat industry in the United States of America has recognised the importance of improving the healthy image of meat; Europe's meat industry is slowly beginning to accept its importance. The advent of a more health conscious consumer has led to a growing preference for meat products with reduced content of synthetic compounds and fat. These consumer-driven demands have led to meat processors developing alternative, healthy, safe, nutritious products while maintaining overall product quality and consumer acceptability and confidence. The Irish meat industry should embrace the functional trend and incorporate functional ingredients into their products, thereby providing a nutritionally enhanced product to the consumer.

Meat products may be nutritionally enhanced by incorporating a range of dietary fibres in sausages and beefburgers, as shown here. Pea and potato fibres in particular have been shown to improve the flavour intensity and overall acceptability of low-fat products, providing the consumer with a healthier option. The Irish meat industry must consider the inclusion of functional ingredients, such as dietary fibres, plant stanol esters, phytochemicals, vitamins/minerals, proteins etc. into existing meat products to fortify and improve their nutritive value. Lycopene is the carotenoid that gives tomatoes the characteristic red colour. This phytochemical antioxidant has been associated with reduced risks of cancer and coronary heart disease. Intake of 2-3g of esterified plant stanol per day reduced LDL-cholesterol by about 10 to 20% (Nguyen, 2000). Processed meat manufacturers should consider nutritional enhancement and the use of functional ingredients, which will be one of the biggest growth areas in the food processing sector in the years to come.

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