THE EFFECTS OF DIETARY FIBRES ON THE PROPERTIES OF PORK SAUSAGES.

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BACKGROUND:

Research into healthier meat products is primarily due to consumers concerns about health and nutrition but more recently, the use of functional ingredients to nutritionally enhance meat products has been investigated. Twelve broad groups of ingredients have been identified as having potentially beneficial effects on humans (Goldberg, 1994): (1) dietary fibre; (2) oligosaccharides; (3) sugars; (4) amino acids; (5) glucosides; (6) alcohols; (7) isoprenes and vitamins; (8) chloine; (9) lactic acid bacteria; (10) minerals (11) unsaturated fatty acids; and (12) antioxidants. Dietary fibres from oat, sugar beet, soy, apple, pea, wheat have been included in the formulations of several meat products such as patties, sausages and bologna etc. (Backers and Noll, 2001; Steenblock *et al.*, 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 (Jimenez-Colmenero *et al.*, 2001).

OBJECTIVES:

With the development of second generation dietary fibres, which have such neutral characteristics as taste and colour, the incorporation of these fibres in meat products merits further research (Backers and Noll, 2001). Therefore the objective of this research was to investigate the effect of the incorporation of a number of dietary fibres (inulin, two types of oat fibre and pea fibre) on the quality characteristics of both reduced fat (8%) and normal fat (23%) pork sausages.

METHODS:

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 an addition rate of 3%. Two controls, without the functional fibres, were also prepared to give a total of 10 treatments. For each product, moisture fat and protein were determined (Bostian *et al.*, 1985; Sweeny & Rexford, 1987). Cook loss, water-holding capacity (WHC) were also determined. Texture profile analysis (TPA) was carried out using an Instron Model 4464 (Bourne, 1978). Sensory analysis was carried out on each treatment by eight trained in-house panelists (AMSA, 1995). The trial was performed twice and the data from both was combined prior to statistical analysis. Data was compared using two-way analysis of variance (ANOVA) with the fat level and the fibre type as factors.

RESULTS AND DISCUSSION:

Proximate analysis indicated that fat levels in the raw sausages were close to the predicted values of 8% and 23%. Reducing the fat content increased cook losses from 8% to 15%, while dietary fibre type had no effect ($P>0.05$) on cook loss at both fat levels (Table 1). This effect of fat content has been reported previously in beef patties (Berry, 1992 and Troutt *et al.* 1992). Tornberg *et al.* (1989) concluded that fat was more easily removed during cooking from higher fat beef burgers due to a low density protein matrix, together with a large fat instability (coalescence instability). A two-way interactive effect ($P<0.001$) between fat level and fibre type was observed for WHC. The low-fat sausages had significantly lower WHC than their full-fat counterparts except for sausages containing the enhanced oat fibre; the fat level had no affect. Sensory analysis showed interactive effects ($P<0.05$) for overall flavour and acceptability, but no interactive effect was observed for tenderness. Low-fat sausages were slightly more tender ($P<0.05$) that the full-fat (5.9 Vs 5.6). Inulin improved the tenderness ($P<0.05$) at both fat levels while the other fibres had a slight toughening affect (Table 1). Similar results were found for juiciness, sausages containing inulin were significantly more juicy than sausages containing the other fibres and similar to the control. Steenblock *et al.* (2001) also reported that the addition of oat fibers to frankfurter formulations increased toughness in comparison to the controls. The interactive effects for both overall flavour and acceptability showed that at low-fat levels inulin had higher panelist scores while the other fibre types had a higher score at the full-fat level. The control, inulin and oat fibre were rated similar in terms of flavour ($P>0.05$). The enhanced oat fibre had the lowest rating. Full-fat sausages were found to be more acceptable that the low-fat sausages, except for those containing inulin. Overall, the results showed that sausages containing inulin, pea and oat fibre were of similar acceptability to the control. Troutt *et al.* (1992) reported that control patties with 20% fat generally were more moist and juicy than other low-fat patties formulated with unhydrated sugarbeet, oat and pea fibres and their combinations with potato starch and polydextrose. An interactive effect was also observed for the TPA attribute of hardness. Inulin significantly reduced hardness (45.7N) at the full-fat level in comparison to the other fibre types including the control (52.6-63.1N) while at the low-fat levels all fibre types had similar hardness values including the control (36.6-39.2N). Increasing the fat content resulted in a concomitant rise in hardness, which contrary to what taste panels showed. Overall the incorporation of the fibres into the sausages had no effect on hardness in comparison to the control except for oat fibre which increased the hardness value. Steenblock *et al.* (2001) reported that there were no major increases in hardness values of frankfurters formulated with oat fibres. These authors also found, as was the case in this study, that hardness values for frankfurters measured by the Instron did not show the same results as sensory values.

CONCLUSIONS:

Reducing the fat level in sausages decreased the quality of the products particularly in terms of cook loss, flavour and acceptability. Inulin functioned more favorably than the other fibres examined. Sausages formulated with inulin were comparable ($P>0.05$) to control sausages in terms of WHC, tenderness, flavour and overall acceptability. Inulin improved the tenderness ($P<0.05$) at both fat levels while the other fibres had a slight toughening affect. A number of interactive effects were also observed between inulin and fat level for flavour, acceptability and hardness. The results show that dietary fibres, such as inulin can be added to reduced-fat sausage products without any adverse effects on texture and flavour.

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Pertinent Literature

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Table 1: The effects of dietary fibres on the physicochemical, sensory and instrumental texture parameters of both low-fat and full-fat pork sausages.

	Cook Loss	WHC	Tenderness	Overall Flavour	Overall Acceptability	Hardness
A: Fat Level						
Low-fat	14.8	41.5	5.9	3.9	3.8	37.4
Full-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×B	**ns**	***	**ns**	*	*	**
Samples						
LF Control	14.5	39.2	6.1	3.9	3.8	36.6
LF Oat Fibre	14.9	40.2	5.5	3.8	3.8	39.2
LF Inulin	13.3	40.3	6.3	4.3	4.3	36.1
LF Pea Fibre	15.9	44.2	5.8	3.8	3.8	37.5
LF Enhanced Oat Fibre	15.5	43.7	5.6	3.5	3.4	37.5
HF Control	7.4	61.9	5.9	4.2	4.3	52.6
HF Oat Fibre	7.9	51.7	5.4	4.1	4.0	63.1
HF Inulin	8.4	59.6	5.9	3.9	4.1	45.7
HF Pea Fibre	7.9	51.2	5.5	4.0	4.1	52.6
HF Enhanced Oat Fibre	7.4	43.4	5.1	3.6	3.8	54.2