EFFECTS OF DRIED APRICOT PULP ON FUNCTIONAL PROPERTIES OF BEEF SAUSAGES

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Introduction
In recent years, consumers are aware of the importance of diet for human health. Therefore, demand for healthy foods (functional foods) is increasing day by day. For the production of healthy foods, functional ingredients are used in the food industry. Residues of fruit juice production can be used as a source of functional ingredients. Dried pulp and molasses, fibre pectin, cold-pressed oils, essences, *D*-Limonene, juice pulps and pulp wash, ethanol, seed oil, pectin, ascorbic acid, limonoids and flavonoids are found in residues of citrus juice production (Fernández-López *et al.*, 2004). Fruit juice by-products are commonly used as animal feed or fertiliser in Turkey. Dietary fibres are not only desirable for their nutritional properties but also for their functional and technological properties (Fernández-Ginés *et al.*, 2003). Fibre is suitable for meat products and it has previously been used in cooked meat products to increase cooking yield due to its water and fat binding properties and to improve texture (Fernández-Ginés *et al.*, 2003; Cofrades *et al.*, 2000). The use of peach dietary fibre as a food substitute could be a good alternative in the preparation of both low fat and high dietary fibre food products. Also, peach dietary fibre has a high water binding capacity (Grigelmo-Miguel *et al.*, 1999). Our objective is to evaluate the effects of adding different levels of dried apricot pulp on water holding capacity, cook loss, production yield and gel and fat separation of beef sausages and compare with control samples.

Materials and Methods
Apricot pulp (residual of fruit juice production) was dried to 9% moisture in a drum dryer and milled to a powder. Water absorption index. (Anderson *et al.*, 1969), Water solubility index (Anderson *et al.*,1969), swollen volume (Gould *et al.*, 1989), total and invert sugar analysis (Egan, 1981) and pH analyses of dried apricot pulp were carried out. Lean beef was divided into 4 batches. The first batch was used as the control with no added dried apricot pulp. Dried apricot pulp was added to the other three batches at the levels of 5, 10, and 15%. Four different formulations were obtained with different dried apricot pulp. For sausage preparation, lean beef was ground through a 3mm plate and mixed with curing ingredients, and half of the ice/water and chopped for 1 min in a silent cutter. Than beef fat, seasonings, cornstarch, dried apricot pulp together with the remaining ice/ water were added and the batter was chopped at high speed for 4 min. Each formulation was stuffed into natural sausage casings and sausages were placed in a smoking chamber (drying at 40°C for 1 hr, smoking at 40°C for 30 min) and heat processed in water (85°C) to an internal temperature of 73°C. WHC of sausages were determined using the procedure of Hughes *et al.*, (1997) with a modification. Weight of sausages before and after cooking was recorded and the cooking loss was expressed as a percentage difference between the raw and cooked weights. Before heating, the process weight of sausage batters in casing were recorded and after heating and smoking, sausages were held in a refrigerator at 2°C for 12h. Then the samples were weighed and production yield was expressed as a percentage difference between the first and the second weights. Water and fat seperation analysis was determined using the procedure of Bloukas and Honikel (1992). The trial was performed twice and the data was evaluated by one-way analysis of variance (ANOVA). Significant difference was defined as $p < 0.05$.

Results and Discussion
Functional and chemical properties of dried apricot pulp are shown seen in Table 1.

Table 1: Functional and chemical properties of sausages.

pH	4.91- 4.90
Moisture (%)	9
Water Absorption Index (%)	11.54
Swollen volume	34 ml/100g
Total sugar (%)	17.38
Invert sugar (%)	11.52

WHC, cook loss, production yield and gel and fat separation of sausages were given in Table 2. Addition of dried apricot pulp had significant effects on all investigated parameters. Increasing dried apricot pulp level in sausage

formulation resulted in lower WHC. This result is possibly due to the decrease of protein ratio in sausage formulation. Yılmaz (2004), pointed out that a suitable amount of rye bran to be added to low-fat meatballs was no more than 10%.

Table 2: WHC, cook loss, production yield and gel and fat separation values of beef sausages.

Treatment	WHC (%)	Cook Loss (%)	Production Yield (%)	Gel and Fat Separation
Control	$83.11^{d}\pm0.90^{A}$	$10.29^{c}\pm1.04$	$90.78^{a}\pm0.52$	$9.71^{a}\pm0.01$
5%	$81.34^{c}\pm0.63$	$9.98^{bc}\pm0.78$	$90.83^{a}\pm0,50$	$9.75^{a}\pm0.01$
10%	$80.04^{b}\pm0.80$	$9.14^{ab}\pm0.49$	$92.77^{b}\pm0.25$	$9.73^{a}\pm0.03$
15%	$78.21^{a}\pm0.77$	$8.41^{a}\pm0.22$	$93.74^{c}\pm0.50$	$11.46^{b}\pm0.11$
$p < 0,05$ (significant)	0.000	0.011	0.000	0.000

^A Standard Deviation. Different letters in the same column indicate significant differences ($p < 0.05$).

The same effect was seen for cooking loss values of sausages. Cooking loss occurs by loss of fat and evaporation of moisture. With higher levels of powder addition, lower moisture content in sausages was obtained and the cook losses were decreased while cooking. Similar results were obtained by other researchers (Mansour and Khalil, 1997, Anderson and Berry, 2001, Yılmaz, 2003), For production yield there was a reverse effect; addition of 10 and 15% dried apricot pulp increased product yield. Addition of dried apricot pulp had no effect on gel and fat separation values except at the 15% level.

Conclusions

Dried apricot pulp can be used in emulsion-type sausages up to 10% without adversely affecting the functional properties. Further research should focus on investigate the effects of dried apricot pulp in low fat high added water sausage formulations.

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