PREPARATION OF FERMENTED SAUSAGES FROM UNDER UTILIZED FISH AND MEAT SOURCES

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ABSTRACT

Fermented sausages were prepared from mechanically and hand separated meat from fish frames, spent layer chickens and beef and pork trimmings.

The process was based on lactic acid fermentation of the meat at between 20°C and 23°C, followed by drying.

Untrained panels of between 24 and 72 participants judged the sausages acceptable in consistency and taste. A small minority of the panelists commented on the presence of fishy or off flavors.

INTRODUCTION

In the U.S. alone millions of pounds of animal protein from trimmings in red meat and poultry processing plants, fish frames from filleting operations and spent layer poultry either go to rendering plants or are soLd as low cost items. These meats could be utilized to produce added value products through further processing.

In Germany a popular smack sausage is a narrow diameter raw sausage having a good shelf life at ambient temperatures. It is produced from beef and pork through lactic acid fermentation.

The purpose of the present experiments was to produce an acceptably tasting narrow diameter fermented sausage from beef, poultry and fish combinations.

EXPERIMENTAL METHODS

A series of three experiments were performed using mechanically deboned flounder and fish frames in approximately 50:50 combinations with beef and pork trim and with mechanically deboned spent layer poultry.

In Experiment I, flounder frames were used. In Experiment II cod frames were deboned after 24 hours in cold storage to allow for drip from volumous rinse water needed to preclean the frames. In Experiment III the thoroughly rinsed frames were allowed to drain for 48 hours in a cooler prior to mechanical deboning.

mo the mixtures of fish with beef, pork or chicken pork fat was added to total 1 7-1 8 % fat for each mixture. Besides the fish-meat combination sausages a beef-pork was also prepared to serve as a comparison in all the testing that ensued.

The following ingredients were added to each fish-meat combination as well as to the beef-pork mixture: spices, cure, sodium erythorbate, dextrose and Pedicoccus sp. starter culture from Lactocel, Microlife Technics, Sarasota, Fla.

The four sausage combinations were stuffed into 20 mm collagen casings and linked into 10 cm long sausages .

A homemade fermentation-drying chamber combination was constructed and the sausages were fermented at between 22 and 23°C and with a starting relative humidity of approximately 92%, The pH was closely monitored by inserting a calibrated combination pH and temperature electrode into the sausage. After the Ph dropped to approximately 5.5 the relative humidity was gradually lowered until it reached approximately 30%. The relative humidity was measured by accurately weighing the sausages at frequent intervals.

Proximate analysis was carried out according to AOAC (1980). Zinc was determined by Atomic Absorbtion

Table 1. pH and Moisture Levels of Fermented Sausages

Exp't	T'tmn't.[1]	Moisture	pH Fresh	pH Fermented	pH Dried
I	F-C	20.6±1.11	6.42	5.24	5.45
	F-P	24.1±1.37	6.25	5.24	5.35
	F-B	17.3±0.99	6.32	5.31	5.34
	B-P	25.3±0.82	6.10	5.02	5.39
II	F-C	24.2±0.72	6.53	5.10	5.09
	F-P	27.2±0.87	6.37	5.12	5.14
	F-B	22.3±0.73	6.31	5.10	5.09
	B-P	26.5±1.38	5.91	5.08	5.06
III	F-C	32.3±1.47	6.85	5.45	5.73
	F-P	35.9±1.57	6.57	5.43	5.80
	F-B	33.5±1.14	7.09	5.32	5.73
	B-P	29.6±1.05	5.99	4.98	5.37

1. F-C = Fish-chicken
   F-P = Fish-pork
   F-B = Fish-beef
   B-P = Beef-pork

Table 2. Sensory Scores of the Fermented Sausages

Experiment	Treatment[2]	Mean Score[1] Texture[3]	Acceptability[3]
	F-C	5.7[a]	4.7[a]
I	F-P	4.3[b]	4.1[a]
(n=25)	F-B	4.1[b]	4.2[a]
	B-P	4.6[a]	2.8[b]
	F-C	4.5[a]	4.4[a]
II	F-P	2.5[b]	3.6[b]
(n=34)	F-B	2.7[b]	4.5[a]
	B-P	4.9[a]	3.1[b]
	F-C		4.3[a]
III	F-P		4.3[a]
(n=72)	B-P		3.4[b]

1 Score of 1 = resilient for texture or highly acceptable for acceptability rating. Score of 10 = soft for texture or unacceptable for rating of acceptability.

2 F-C = Fish-chicken
F-P = Fish-pork
F-B = Fish-beef
B-P = Beef-pork

3 Within a column figures with different letters are significantly different. ($p<0.05$).

Spectrophotometry according to Perkin and Elmer (1982). In the taste tests 3 panels were employed, one for each experiment. These varied between 25 and 72 participants. The panelists were asked to score the sausages for texture and overall acceptability. The results of the sensory evaluations were tested by ANOVA and Multiple Range analysis in a SAS-ANOVA program in a GLM procedure (SAS 1982).

RESULTS AND DISCUSSION

Table 1 shows the moisture contents and the pH's of the freshly stuffed sausages, after 2 days of fermentation and after 5 days of drying. The pH's of the fermented sausages always rose slightly at the end of the drying period.

The moisture contents of the 5 day dried fish-meats sausages ranged between 17 and 24% in Experiment I; 22-27% in Experiment II and 32-36% in Experiment III. The moisture contents of the control beef-pork sausage also increased between Experiment I and Experiment III. These moisture contents reflected fluctuations in the humidities in the makeshift chamber between the three experiments. These averaged 82.5, 88 and 92% relative humidity for the first 24 hours in Experiments I, II and III respectively. However, when comparing the pH and water content of the fish-meat sausages in Experiments II and III it can be seen in each fish-meat combination, as the pH rose so did the water content.

The isoelectric point of actomyosin is in the vicinity of 5 (Hamm 1960). The pH's of the fish (cod)-meats sausages in Experiment III were further away from the isoelectric point of actomyosin than those in Experiment II. The greater a protein is from its isoelectric point the easier it retains water. This could further explain the higher water content of the fish (cod)-sausages in Experiment III as compared to those in Experiment II.

The zinc content of the fish (cod)-beef was 53.7 + 2.42 ppm; that of the fish (cod)-pork was 36.9 + 2.68 ppm; that of the fish (cod)-chicken was 19.9 + 1.93 ppm and beef-pork sausages had 42.4 ppm zinc. Thus fish-beef combinations gave the highest zinc content. Fish-beef, fish-pork and beef-pork sausages are thus good sources of zinc in the diet.

Table 2 shows the results of the panel evaluations of the sausages. The lower scores indicated greater resilience or greater acceptability. The panelists found fish-chicken sausages made with flounder or cod to be in the middle of the range between resilient and soft, similar to beef-pork. The fish (flounder)-pork and the fish (flounder)-beef were more resilient but the fish (cod)-beef and the fish (cod)-pork were significantly more resilient than the fish (flounder)-sausages.

For overall acceptability the beef-pork controls were most preferred. However, all combinations of fish with chicken, pork or beef were found acceptable. Some comments on fishy flavors were noted.

The fish-chicken combinations received the most comments for such off flavours. This might be explained by the presence of sulphur compounds (Minor et al. 1965) oxidized products from fatty acids (Dimick and MacNeil 1970), carbonyl compounds in poultry flesh and skin (Pippen et al. 1958) or the interaction of nitrogenous bases with fat (Davis and Gill 1936). Such reactions could take place during the mechanical deboning of the chicken and fish. Future research will indicate which of the compounds are responsible for the formation of the off flavors and this will enable the taking of steps to minimize or eliminate the phenomenon.

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