

# Standardisation of Fat, Colour and Moisture Levels for Semi-dry Fish Sausages

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Fermented semi-dry fish sausages were prepared with different levels of fat (5-15%) and colour (0.05-0.25% colour solution). In another experiment sausages prepared with standardised ingredients were subjected to smoking (35-40°C for 2 h) and oven drying (70 or 100°C for 1 and 2 h) or just oven drying (60°C for 1-2h) without smoking. Sausages with 15% fat was faster in fermentation rate, with less growth of lactic acid and other bacteria unlike those of 5 and 10% fat. However, sausages with 10% fat level received, high organoleptic scores. Among the different colour levels, 0.2% was preferred by the panelists. Sausages, smoked and oven dried at 70°C for 1 h. and among non smoked sausages, those dried at 60°C for 2 h were preferred by the panelists.

**Key words :** Fish sausages, standardisation, fat, colour and moisture

The importance of lactic fermentation in food preservation has been well known (Joshi & Setty, 1994 a, b). Earlier papers in this series (*Ibid.*) dealt with standardisation of salt, sugar, inoculum and spice levels in lactic fermented semi-dry fish sausages. The present work was taken up with an intention to standardise the preparation of fermented semi-dry fish sausages with respect to levels of fat, colour and moisture.

## Materials and Methods

Fresh croaker fish (*Johnius dussumieri*) was brought from the local market in iced condition, dressed, washed with 5-10 ppm chlorine water, rinsed, fish meat separated, frozen at -40°C and stored at -18°C until further use. Before use the meat was thawed and minced.

Fish mince was mixed with the sausage ingredients (Table 1). The composition given for meat sausages by Kramlich et al. (1973) and Bawa & DeLong (1985) was adopted here with slight modifications, replacing animal meat with fish meat. In

this trial, the standardised level and composition of spice mixture, standardised levels of salt, lactic acid bacterial (LAB) culture, and sugar were used (Joshi, 1990). The order of addition of ingredients was; fish mince, sugar, spices, colour, fat, salt and young LAB cultures. Sausages were prepared with different levels of fat namely, 5, 10 and 15%.

For the purpose of standardisation of colour, different levels viz., 0.05 to 0.25% of colour solution (strength of colour solution: 2.5%) were used for the preparation of sausages.

Another trial was conducted for standardisation of moisture in which case, sausages were prepared with the standardised levels of all the ingredients (Table 1). Standardisation of each variable was done by varying its level while holding the other variables constant.

After mixing for 5-10 min in a stainless steel vessel using a ladle, the sausage mix was stuffed into natural casing prepared as per Madhwaraj et al. (1980). The sausages

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were linked at 5-8 cm interval, washed and hung in the smoking chamber at room temperature (27-30°C) and allowed to ferment till the desired pH of 5.0-5.1 was reached. Later sausages were smoked at 35 to 40°C for 2 h.

Moistening of wood shavings, controlling the air supply and use of wire mesh filters were adopted to reduce carcinogenic substances during the smoking process (Chandrasekhar, 1986). For standardisation of moisture content, smoked sausages were dried at either at 70°C or 100°C  $\pm$ 5°C for 1 or 2 h. Another batch of sausages were not smoked but dried for 1 or 2 h at 60 $\pm$ 5°C.

The pH, total titratable acidity (TTA), moisture content (AOAC, 1975), LAB count and total plate count (TPC) (Harrigan and McCance, 1976) of the sausages were analysed and organoleptic evaluation of the sausages was done by a group of ten trained panelists using a 10 point hedonic scale to arrive at an optimum level of fat, colour and moisture.

## Results and Discussion

Three levels of fat viz., 5, 10 and 15 percent were tried in the present study to see its effect on taste and other attributes of the sausages. As seen from the Table 2 the required pH of 5.1 was reached in 10 h time in sausages containing 5 and 10% fat, whereas in sausages containing 15% fat this pH was reached 2 h earlier. After 2h of smoking, the sausages with 10 & 15% showed slightly lower pH values (4.86 and 4.85) than those with 5% fat (4.95). A similar but increasing trend was seen in TTA values (Table 2). The possible explanation would be that the sausages with 15% fat received proportionately less meat in their formulation as compared to those with 5 and 10% fat. Thus, the reduction in the meat content may have proportionately decreased the buffering

capacity of these sausages. It is probably due to this effect, that slightly lower counts of LAB (log 9.45 g<sup>-1</sup>) and TPC (log 5.49 g<sup>-1</sup>) were observed in the 15% fat sausages as compared to higher counts obtained for sausages with 5 and 10 percent fat levels (Table 3). In sensory evaluation the mean scores varied only for taste and overall acceptability and the fact that 10% fat level was preferred by the panelists indicate its influence on the taste of sausages (Table 4).

Table 1. Recipe of semidry sausage mix used for standardisation and final standardised recipe

Ingredients	Recipe used for standardisation %	Final standardised recipe %
Fish mince	86.5 <sup>a</sup>	81.5
Hydrogenated vegetable fat	5, 10 & 15 <sup>b</sup>	10.0
Spice mixture+	2.5	2.5
Sugar	1.0	1.0
Salt	3.0	3.0
LAB culture suspension	2.0	2.0
Colour solution (2.5%) <sup>c</sup> ml	0.05 to 0.25	0.2

a Higher percentages of fat were incorporated at the expense of fish mince

b Composition of spice mixture, %

Black pepper, 55; Chilly powder, 20; Garlic, 10; Ginger, 10; and Corriander, 5

c Composition of colour solution %: Ponceau 4 R, 60 and Carmoisine, 40

In the preparation of semi-dry sausages from meat, colour is not added as an additive, but the red colour of the meat is fixed by using suitable levels of nitrites. Since the croaker fish meat is almost whitish in appearance, addition of colour solution became necessary to improve its appearance.

Among the five levels of colour tried, 0.20% of colour was preferred by the panelists (Table 4).

Table 2. Changes in the pH and total titratable acidity (as % lactic acid) of semi-dry fish sausages prepared with various levels of fat

	Percent of fat					
	5		10		15	
	pH	TTA	pH	TTA	pH	TTA
Immediately after stuffing and linking	6.5	0.22	6.55	0.22	6.5	0.22
Fermentation time to reach pH 5.1, h	10		10		8	
After fermentation	5.10	0.81	5.06	0.825	5.10	0.81
After 2 h of smoking	4.95	0.88	4.86	0.89	4.85	0.89

Level of colour used: 0.1 ml

The moisture content of semi-dry sausages prepared from animal meat is usually in the range of 50-55% when they are ready for consumption. This moisture level is obtained through smoking and not by oven drying. However, during later part of smoking period temperature of smoking is raised to 65-75°C and the smoking is continued till the centre of the product attains a temperature of 60°C (Komarik *et al.*, 1974, Bawa and Delong, 1985)

In the present study the moisture content of the sausages were standardised

Table 3. Changes in the Lactic acid bacterial (LAB) and Total plate counts (TPC) (log cfu g<sup>-1</sup>) of semi-dry fish sausages prepared with various levels of fat

	Percent of fat					
	5		10		15	
	LAB	TPC	LAB	TPC	LAB	TPC
Immediately after stuffing and linking	8.62	4.85	8.65	4.84	8.58	4.64
After fermentation	9.66	5.60	9.65	5.5	9.45	5.49
After 2 h of smoking	9.52	5.57	9.52	5.48	9.31	5.47

Note: Level of colour used : 0.1 ml

for two types of products; one with smoking and the other without smoking (Table 5). A short oven drying was used to dry the smoked product, since the products had already attained the required pH of 4.9 and further reduction in pH due to fermentation during drying was not desirable. Between the two temperatures used for meat sausages, 70°C was the normal temperature generally used for meat sausages whereas 100°C was on the higher side. This higher temperature was, however, included to reduce the processing time as much as possible.

As seen from the results (Table 5) moisture content of sausages showed an

Table 4. Organoleptic evaluation scores of semi-dry fish sausages prepared with various levels of fat and colour solution

	Fat, %			Colour (2.5% solution, ml)			
	5.0	10.0	15.0	0.05	0.10	0.15	0.20
Appearance	7.21	7.22	7.21	6.11	6.12	7.15	7.13
Colour	7.21	7.21	7.20	6.10	6.11	7.12	7.13
Taste	6.50	7.33	5.33	7.15	7.13	7.14	7.15
Texture	7.30	7.30	7.25	7.15	7.14	7.15	7.14
Odour	7.10	7.10	7.10	7.11	7.11	7.12	7.11
Overall acceptability	7.20	8.00	7.00	6.12	6.11	7.15	7.15

Fat standardisation done at 0.1 ml colour solution; colour standardisation done at 10% fat.

Note: Figures represent mean panel scores for each attribute

Table 5. Moisture content of smoked and non-smoked semi-dry sausages after oven drying, %

Duration of drying, h	Smoked at 35 to 40°C for 2 h and oven dried at		Oven dried at
	100±5°C	75±5°C	60±5°C
1	61.52	62.68	67.09
2	53.00	57.25	60.19

Level of fat: 10%; Level of colour: 0.2 ml

inverse relationship with the drying temperature and time. However, the sausages dried at 100 and 70°C for 2 h scored very badly with respect to taste, texture and overall acceptability (Table 6); whereas those dried for 1 h scored very well in all the attributes. Between the temperatures

a further reduction in their moisture content was found to affect the taste, texture and overall acceptability of the products. Zeigler *et al.* (1987) noted that a desired texture within limits might be achieved by drying the sausage to a predetermined moisture level, which is in close conformity with the observation made in the present study.

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Table 6. Organoleptic evaluation scores of smoked and non-smoked semi-dry fish sausages oven dried at different temperature for different durations

	Smoked at 35 to 40°C for 2 h and oven dried at				Oven dried at	
	100±5°C for		70±5°C for		60±5°C for	
	1 h	2 h	1 h	2 h	1 h	2 h
Appearance	7.13	7.13	7.12	7.10	7.10	7.10
Colour	7.20	7.20	7.12	7.10	7.20	7.11
Taste	7.20	5.22	7.21	5.15	7.15	7.21
Texture	7.25	4.43	7.33	4.85	5.10	7.33
Odour	7.12	7.12	7.11	7.20	7.15	7.12
Overall acceptability	7.50	4.50	8.00	5.15	5.00	7.50

Note: figures represent mean panel scores for each attribute Fat 10%; colour solution 0.2 ml

tried, those dried at 70°C for 1 h scored better for overall acceptability than those dried at 100°C for 1 h.

In the case of sausages oven dried at 60°C without smoking, the sausages dried for 1 h scored badly for texture and overall acceptability, whereas those dried for 2 h scored very well. According to these results, sausages with a moisture content of around 60-63% were found acceptable but

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