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PREPARATION OF DRY SAUSAGE FOR LOCAL TASTE

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A process has been developed to produce easy handling meat dry sausage of good quality and stability. The product which has been tailored to local taste can be stored without refrigeration for up to 8 weeks. Seventeen different samples were prepared using various formulations and processing treatments and were subjected to organoleptic and shelf-life evaluation. The best product selected on the basis of the evaluation contained 15% added fat, 6% soya flour binder and remaining as meat proteins, moisture, condiments and spices. (Locally available beef on the shops has been used to indicate that manufacture of dry sausage does not necessarily require prime quality beef).

INTRODUCTION

Curing of meat is a very old practice which is carried out to preserve meat without refrigeration and to improve its organoleptic characteristics. In advanced countries many types of meat products like beef in grary (gulash), corned beef, beef patties and stick and sausages of many types are prepared from cured meats. By and large meat sausages utilize the bulk of the flesh going towards meat products. Commonly used sausage ingredients and their functions [1] may be seen in Tables 1A and B.

Dry sausage is a common food item and is very popular in large section of the world. It is produced commercialy in almost all the countries of Europe and America but the largest number of present-day products of its kind are traceable to Italy. The term dry sausage implies to a product which is prepared from ground cured and seasoned meat stuffed into animal or artificial casing and dried. These are generally prepared from beef, pork and/or a mixture of the two, and processed in a way to be used as ready-to-serve meat products. Different nationalities have distinctive appetite for certain flavours in dry sausage. For example North European like smoked product while the Latin races find more taste in unsmoked [2]. Such sausages are coarse-mix type and are classified as dry or semidry on the basis of their moisture-content. A dry sausage has 30–35% moisture and for the semidry-types it is 50%. Speaking in other terms a well-dried sausage will loose 30–40% of its initial weight and this could be at the rate of 10% per day in some cases. Meat formulations, particle size, spicing, degree of tang, intensity of smoke flavour, processing, temperature and type of casing are the variables which contribute to the wide variety of semidry and dry sausages.

In the subcontinent very few people are familiar with

Table 1A. Sausage ingredients and their functions

Ingredient	Example	Function
Meat	Lean mutton, beef or bull meat Fat meat	Regulatory requirement for the sausage. Provides protein, colour, flavour and juices.
Fillers	Meal,flour,rusk	Decreases loss of water on cooking/heathing, Makes firm structure.
Binders	Soy flour,soy protein concentrate, soy protein isolate, sod. caseinate, dried skim milk, whey protein concentrate	Decreases loss of water on cooking, gives fineness to structure and provides soluble protein
Salt		Solubilises muscle protein, helps bind fat and water and provides flavour,improves shelf-life
Seasonings	All kinds of eatable spices and herbs	Provides flavour
Phosphates	Sod. hydrogen phosphate, disodium hydrogen phosphate, sod. pyrophosphate, sod. tripoly-phosphate.	Reduces fat and water loss during cooking/heating
Preservatives	Sod. sulphite, sod. bisulphite, sod.-metabisul-phite	Used mostly in fresh sausage to reduce bacterial growth

Table 1B. Spices and herbs used in sausage industry.

Spices	Herbas
Pepper	Thyme
Nutmeg	Sage
Mace	Marforium
Ginger	Rosemary
Cardamon	Basil
Cloves	Tarragon
Coriander	
Cinnamon	
Pimento	
Cayenne pepper	
paprika	

this type of product, however, products like 'seekh' and 'shami' kabab are quite popular. The latter are prepared from fresh minced meat and eaten soon after. Since they are prepared from uncured meats they cannot be kept for longer period, whereas dry sausage which is prepared from aged and cured meat has a longer shelf-life. Furthermore, dry sausage has better nutritional qualities than seekh/shami kababs. The processes of ageing and curing meat are known to improve the organoleptic characteristics of meat and minimise the loss of nutrients like B-complex vitamins [3]

A large number of formulations of dry sausages appear in the literature but these do not suit to our taste and climatic conditions. In countries where sausages are popular the climate is usually colder than ours. In those countries, therefore, the products with higher fat content can be made to have longer shelf-life while reverse would suit our relatively warmer climate.

Keeping in view the afore-mentioned advantages of easy handling and storage of dry sausage and the differences of our taste, an attempt has been made in this study to prepare a product suitable under our local conditions.

MATERIALS AND METHODS

Preparation of the Sausage. Fresh ground beef muscle was procured from a nearby butcher's shop. The meat was from an animal of unknown background and slaughtered the previous day about 16–20 hr before. The meat mince was put in the bowl chopper and a premixed curing mixture added according to the quantity of the meat (40–42 g/kg beef). Curing mixture was thoroughly mixed with the meat for 5/6 min in the cut-mix machine (Hobart Manufacturing Co. U.S.A. model 84181D spec. 9294 RPM 2850). The material was then spread on stainless-steel trays and cured at 4–5^{o} for 48 hr. After curing the material was again put in the cut-mix machine (bowl chopper) with additional ingredients i.e., fat, binder, seasonings and spices and chopped for another 5 min. A typical dry sausage formulation is: beef (1kg), curing mixture (40–42), fat (100–150g), soy flour (60 g), chillies (6 g), coriander (8 g), peppers (6 g), and water in the form of ice cubes, not more than 450 g. The formula of curing mixture is: sod chloride (250 g), glucose (125 g), sucrose (40 g), ascorbic acid (5 g), KNO_3 (3 g), and $NaNO_3$ (0.7 g). During this chopping ice cubes were added in small quantity so that the temperature did not exceed 10^{o} at any stage of this operation. The chopped material was then stuffed into synthetic casings and the ends tied properly. The sausages were hanged in air-driven oven at 68–70^{o} for 48 hr. Furhter drying was carried out at room temperature by hanging the sausages in air under shadow.

Moisture and Fat Determination. The samples of sausage were analysed for moisture and fat according to the AOAC method [4]. The dry sausage was sliced weekly and required weight of the slices was used immediately.

pH *Determination.* pH of the end-product (dry sausage) was determined on duplicates using Pye–Unicam pH meter model 292, by preblending about 10 g sausage with 20 ml distilled water. Standardisation of the pH meter was made using phosphate buffer or pH 6.80.

Rancidity Test. Apart from the objective evaluation of rancidity by the taste panelists, the subjective methods of Vernon *et al.* [5] for TBA – number, and of peroxide value [6] were followed. Both methods were followed as described in the references.

Taste Panel. All the seventeen (17) different samples were tested by an expert taste-panel of seven people. The quality attributes were evaluated by scoring as 3–4 unsatisfactory, 5–6 fair, 7–8 good, and 9–10 excellent.

Microbiological Examination. Total aerobic plate count (APC) and coliform count were enumerated using accepted procedures. Ten g samples were asceptically weighed in sterile petri-dish and homogenised for 2x2 min with 90 ml diluent (Buterfield's Phosphate Buffer pH 7.1) at medium speed in sterile jar. Serial dilutions were made in the diluent and 1 ml aliquots of each dilution were used for plating with the standard media. Media were tempered to 45$^{o}\pm$1^{o} in a water-bath before use. Total plate counts (APC/g) were determined after 48 hr incubation at 30$^{o}\pm$1^{o}, and coliform count after 24 hr incubation at 37^{o}. Reported results are the average from duplicate experiments.

The counts were made at weekly intervals after the first phase of drying the sausage was over. Further drying, however, did occur when the sausage was hanging in the air at room conditions. The samples drawn later on, therefore, may have been of different moisture level.

RESULTS AND DISCUSSION

Dry sausages samples of 17 different types were prepared during our experimentation. These differed from one another on the basis of beef formulation, content of tallow or/and vegetable fat and the type of binders like gram flour, corn flour, potato flour and soya flour. All the samples were later evaluated organoleptically and by some physicochemical methods. A summary of the results may be seen in Table 2.

The composition of a dry sausage rated good during our study, had added fat 15% and 5–6% of the soya-flour binder. Moisture determination carried out on 5 sample batches (formula S14) ranged from 32 to 35% in the ready-to-eat sausage.

Processing Conditions. Keeping qualities of fermented, dry and semidry sausages are attributable to low pH, low moisture-content and a high salt-content [7,8]. The overall purpose of any processing treatment is to achieve these goals. It can be seen (Table 2) that curing of meat was best achieved at temperatures around 4–5^{o} (in the fridge) which is same as reported in the literature [9] for prior-cured dry sausage-mix. Since our meat had high initial count the drying was made to be quick at 65–68^{o}. Other drying schedules were not found to be satisfactory due to microbiological considerations.

Fat. Because of the economic importance of these types of sausages, considerable effort has been exerted to improve methods of its production and on the quality and quantity of its components. Fat is an important component of the dry sausage. Generally, beef fat and pig back-fat (speck) is used but we have the option of beef, mutton or vegetable fat only All of these have comparatively low melting points and hence are considered to cause soft and greasiness in the end-product. This was avoided by lowering their use to about 15% level whereas in some European and American varieties it is around 25–35% [10]. Vegetable ghee of local origin appeared to work better than the commercially available beef fat in respect of the end-products flavour. The beefy flavour in our animal fat stemmed from the used and otherwise uneconomical animals which are normally slaughtered for beef in our country [11,12]. The economics of the dry sausage, however, demand that beef fat should be used. We, therefore, later on, tried selected beef fat which proved to be acceptable under our processing conditions. This aspect can be further extended for investigation.

No rancidity of the fats was noticed until the storage period of 2 months, by the taste-panelists. The TBA [5] and peroxide tests for rancidity were also negative.

Binder. Binders are non-meat protein additives that function primarily to emulsify fat, bind water and contribute to cohesiveness in the sausage. Of all the binders tried, soy flour (6%) was found to be best. It imparted a reasonably good texture and meaty flavour to the sausage while other binders affected the meaty flavour by pushing up their own. Higher percentage of soy also affected the product by imparting cereal-like aroma which the taste-panelists could quickly detect.

Using soya-protein as meat extender in beef patties, Carol *et al.* [13] have also reported of 6% soy–beef mixture as the best for meaty aroma and flavour. They had further discovered that increasing the salt concentration in the soy–beef mixture pushed up the meaty traits until the amount of soy is 6%. Above 6% level of soy, the meaty flavour and aroma decreased irrespective of the salt level. The present study, therefore, reinforces the quantitative and qualitative aspects of adding soy-protein as binder.

Spices. These are added to produce desired flavour which is important for influencing the acceptability by the consumer. List of spices was selected on the basis of a variety of taste panel experiments. The ingredients of the spices used in our recipes has already be described. Table 1B describes the various spices for possible use in the sausage industry. The detailed process and concentration of different spices and their uses in the sausage products is given in the two reviews of Reuter and Hammer [14,15]. They have mentioned the various properties of the spices ingredients, the important of which was antibacterial action of garlic and antioxidative properties of some others.

Organoleptic Considerations. Overall acceptability was determined on the basis of these points. Visual summary of Table 2 indicates that samples having about 15% of added vegetable fat and 6% of soy flour rated best in overall acceptability. The individual trait rating was also best in these samples. It is in agreement with the finding of Carol *et al.* [13].

Microbiological Considerations. Microbiological study was undertaken to obtain definitive information regarding occurrence of total viable bacteria and coliforms in fresh meat used in the process and in sausages during processing and storage. Coliforms were not detected in any of the samples of fresh meat or processed sausage examined. This is indicative of the fact that neither primary contamination of meat due to prevalent environment and nor secondary contaminaton arising as a result of handling and processing introduced intestinal types of bacteria in the material. The numbers of APC in fresh meat varied between 80,000 – 100,000/g, however, meat samples used in our study were only those containing 85,000 or less APC/g. The number of the viable bacteria present initially in raw material decreased, invariably, during processing and storage of the

Table 2. Results of various dry sausage formulations.

Sample No.	Type and fat %	Type and binder %	Drying temp and schedule	Any other variation	Colour	Texture	Flavour	Taste	Acceptability
S_1	Beef tallow 33	Rusk 8	68° for 48 hr continuous	None	Fair	Hard	Not acceptable	Too much fatty	Unacceptable
S_2	Beef tallow 33	Corn flour 8	As above	None	Fair	Good	Not acceptable	Good	Fat lost during drying as result of dripping so product has low fat.
S_3	Vegetable	Corn flour 8	As above	None	Fair	Not satisfactory	Fair	Not satisfactory (3-4)	Unacceptable
S_4	Vegetable ghee 15	Soy flour 5	As above	None	Fair	Fair (5-6)	Good (7-8)	Fair	Acceptable except for the hard skin
S_5	Vegetable ghee 20	Soy flour rusk 7	68° for 20 hr	Before the addition of curing mixture pH brought to 5.5 by addition of acetic acid (dil.)	Fair	Not satisfactory (spongy)	Acidic	Sour	Unacceptable
S_6	Vegetable ghee 20	Soy flour rusk 7	60° for 20 hr	pH lowered by addition of anardana, extract.	Good	"	"	"	"
S_7	Vegetable ghee 15	Soy flour 5	44–45° for 24 hr 60° for 24 hr	–	Good	–	Acidic	Unacceptable	"
S_8	Vegetable ghee 15	Soy flour	Dried at 58–60° for 48 hr continuously	–	Good	A bit hard to chew but good	Fair	Fair	Overall acceptable
S_9	Vegetable ghee 15	Soy flour 5	42–44° 20 hr 52–56° 4 hr 60–64° 24 hr.	None	Good	Good	Good	Fair	Acceptable
S_{10}	Vegetable ghee 15	Soy flour 6	40–42° 24 hr 62–64° 44 hr	–	Good	Not satisfactory	Good	Not satisfactory	Unacceptable
S_{11}	"	Potato flour 8	" "	–	Good	"	Good	Fair	"
S_{12}	"	Soy flour 5	50° for 12 hr 60 for 12 hr 70° for 24 hr	–	Good	"		Fair	"
S_{13}	"	Potato flour 5	" "	–	Satisfactory	"	Fair	Fair	"
S_{14}	"	Soy flour 6	70–72° for 42 hr continuously	–	Good	Good	Good	Good	Acceptable
S_{16}	Vegetable ghee 10	Soy flour 5	" "	–	"	"	"	"	"
S_{17}	Vegetable ghee 15	"	" "	–	"	"	"	"	"

sausages. Whereas this number decreased on the average, by about 20% during processing and drying, there was about 80% reduction in the number during subsequent storage. The decline in the number of the viable bacteria during storage was gradual and the trend continued through the storage period lasting about 8 weeks. The number of APC was 15,000 – 20,000/g at the end of the storage period. Such decrease in the number of surviving bacteria is quite expected in view of the declining a_w of the product during storage, and indicated good agreement with Nurmi's [16] results.

Considering the results of microbiological and other investigations the product can be classed as safe for human consumption up to a storage period of at least two months.

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