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PREPARATION OF DRY SAUSAGE FOR LOCAL TASTE

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(Received December 5, 1979; revised March 8, 1980)	
A process has been developed to produce easy handling meat dry sausage of good quality and stabi	otnam

lity. 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).]. The dry sausage was sliced weekly and they are prepared from uncured meats they cannot be kept

required weight of throiTJUDOTTMI umediately

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. representation and mi bedraseb

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 coarsemix 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. months moor a

In the subcontinent very few people are familiar with

Example in tested a Function as vib Ingredient Lean mutton, Regulatory requirement aracteristic teaM beef or bull meat for the sausage. Fat meat Provides protein, colour, flavour and juices. mun sensi A Decreases loss of water Fillers Meal, flour, rusk on tout on cooking/heathing, Makes firm structure. Binders Soy flour, soy Decreases loss of water suit our protein concentrate. on cooking, gives finesoy protein isolate, ness to structure and

Table 1A. Sausage ingredients and their functions

sod. caseinate, dried provides soluble casy handling and org skim milk, whey protein concentrate attempt has been made in this study

uitable under our local conditionas Solubilises muscle protein, helps bind fat

and water and provides

Seasonings All kinds of Ud Vois Provides flavour from an animal of unknowled spices and workloud to lamina institution the previous day about 16-20 hr befordend Phosphates find Sod, hydrogen is room Reduces fat and wateres loss during cooking/ phosphate, disodium heating hydrogen phosphate, Curing mixture sod. pyrophosphate, for 3/6 min in the cut-taix mach-ylogint bost U.S.A. model 84181D spec. standard Sod. sulphite, Used mostly in fresh Preservatives sod. bisulphite, 100 10 sausage to reduce

flavour, improves shelf-

life

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Preparation of Dry Sausage for Local Taste

Table 1B.	Spices and	herbs used	in sausage	industry.
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Spices	Herbas
Pepper	Thyme
Nutmeg	Sage
Mace	Marforium
Ginger	Rosemary
Cardamon	Basil
Cloves	Tarragon
Coriander	and the second second second second second
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 $4-5^{\circ}$ 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), KNO₃ (3 g), and NaNO₃ (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 $68-70^{\circ}$ 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.

pHDetermination. pH of the end-product (dry sausage) was determined on duplicates using Pye–Unicam pH meter model 292, by preblending about 10 gsausage 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 2×2 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 $45^{\circ}\pm1^{\circ}$ in a water-bath before use. Total plate counts (APC/g) were determined after 48 hr incubation at $30^{\circ}\pm1^{\circ}$, and coliform count after 24 hr incubation at 37° . 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.

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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 $4-5^{\circ}$ (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 $65-68^{\circ}$. 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

224 mbbumalestell. M. A. A. Preparation of Dry Sausage for Local Taste also. M. and buodo 2.2.

tel vitalume of Table 2. Results of various dry sausage formulations. 2210 04A 21,02201

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uuci by imparting coreat-like arona which the taste-parte-	gram nour, com mous porato nour and soys nour. An me
³ Beef tallow Corn flour As above step None Pair Using soya-protein as meat extender in beet staties, Carol et al. [13] have also reported of 6% soy-beef mix-	Good of brig Notingsio Good batelle Fat lost during salquies vent stilles acceptable acceptable of dripping so product has low fat.
S ₃ Vegetable Corn flour As above None Fair	Not satis- factory factory factory factory
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S ₅ ¹¹⁸¹ Vegetable Soy flour 68 ⁰ for Before the Fair shore the 20 store take 7 and 20 hr and addition of the base	Not satis-yell of pidetudinitie en generating vibilities brie yelle
euring mixture out house desired, flavour by hereitibhe vd 2 2 ht for influencing the acceptability by	moisture-content and a high salt-content [7,8]. Try (vona) (vgnoqs) burpose of any processing treatment, is to achieve these
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use office 20ar el rusk 7 to 20 hrs autoraddition of oseb 81	sausage-mix. Since our meat had high initial count the dry-
sage indistinguishing detailed process and concentration of	
different spices and their uses in the sausage products is	dules were not found to be satisfactory due to microbiolo-
S_7 vegetable Soy flour 44-45 for 0.7 and 0.7 and 0.7	gical considerations. eldardosanti Sical considerations.
They have mentioned the objous properties of the spices	
ingredients, the important rd b hich was antibacterial action'	types of sausages, considerable effort has been exerted to
S8 Vegetable Soy flour Dried at TEDIXOIL DIE OHE Good	brA bit hard and Fair bras mEair about ati Overall acceptable ami
Organoleptic Consid 00-82ns. Overall acce21 soldgly was	quantity of its components. Fat is an important of the work of the
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Rf 129 ghee 1588 511161 1161 52 569 4 hr ant . viilide 19998	ing points and hence are considered to cause soft and greasi-
these samples. It ind 25 56-00 nt with the finding of Catoi	ness in the end-product. This was avoided by lowering their
$ S_{10} \text{Vegetable Soy flour } 40-42^{\circ} 24 \text{ hr} = . [[1]] \text{ Mood} \\ \text{ybutz ghee 15}_{\text{oldo}} 6_{\text{i}} \text{ M} = 246662-64^{\circ} 44 \text{ hr} \text{ suppliedential} $	A not satis- factory factory factory

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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 for the investigations the product can be classed as safe for human 10 consumption up to a storage period of at least two months. The provide violation of the period of at least two months. The provide violation of the period of at least two months. The provide violation of the period of at least two months. The provide violation of the period of at least two months. The provide violation of the period of at least two months. The provide violation of the period of at least two months. The provide violation of the period of at least two months. The provide violation of the period of at least two months. The provide violation of the period of

60 mesh nylon sieve and in which the agitation was provided by the disc itself.

EXPERIMENTAL

A 2-1 beaker was kept on a thermostatic magnetic stirter hot plate (Gallenkamp cat. No. SWT 500-010), approximately 250 ml of ordinary water was added and warnied till its temperature reached about 38° . Another 1-1 beaker was then put inside this 2-1 beaker carrying in it exactly 500 ml of dissolution medium (simulated gastric juice USP XVIII omitting pepsin). This dissolution vossel carries a litermometer, the liquid was stirred manually till its temperature reaches $37^{\circ} \pm 0.5^{\circ}$.

Rotating Disc. A high density polythene round disc dia 41 mm and height 12 mm was employed, a magnetic follower (Callenkamp cat. No. SWX 310) was fixed in its holnetic stirror, the disc was marked on one side to aid in counting the revolutions per minote. The disc has 2 small holes in centre, two pericyazine tablets (10 mg) held side by side to each other were wrapped in a 60-mesh hylon sieve and were tted on the upper flat surface of the disc with the aid of stainless-steel wire. This disc rotates untformity in the borrom of dissolution medium.

The experiments were conducted at 120±5 and 210±7 rev/min, the temperature of dissolution medium was kept Official Agricultural Chemists, Washington, D.C., 1965), tenth edition.

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reported, e.g. the USP XVII apparatus is redesigned and sieve of 10 mesh is replaced with that of 100 mesh [4] making the apparatus suitable for testing of sustained release tablets. Bates *et al.* [5] have described a simple method where they have employed a1--lithree-neck-flask and wherein the agitation is provided by a controlled speed stirrer at the rate of 150 rev/min. Similar apparatuses have been used by other workers for stuides of solid dosage forms [6]. A rotating flask at very low speed, i.e. 0.9-2.4apparatus is also been used as a dissolution vessel [7], this apparatus is also suitable for timed release tablets. Heyd holder of stainless-steel, which is fixed in the dissolution vessel and wherein the agitation is provided by a magnetic attrer, the cell is so designed that it is suitable for holding attrer, the cell is so designed that it is suitable for holding and studying dissolution of macromolecules such as einlylene malic acid copolymers.

Lin et al. [9] have dealt with the methodology in detail, and have disseased various techniques for determining dissolution rate of capsules. They have used hydrophobic adhesives for sticking the capsules to a rotating device, to a basket or to a stirrer padole. They have concluded that the size of stirrer is critical factor in the dissolution rate studies.

Khalel et al. [10], have converted the B.P. disintegra

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