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Research Papers

Research Notes

Milling, Baking and Chapati Making Qualities of Triticale[1]

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Manuscript received 12 *October* 1981; *revised* 20 *December* 1982

Yield of flour from triticale (UPT-7440) improved from 57.5 to 60.66 and 62.14% by cold and hot tempering respectively. Tempering, besides improving baking quality, also improved the colour grade from 9.73 to 7.3 and 7.2 K.J. Units. In view of the higher cost of hot tempering, cold tempering of grains to 14.5% moisture, prior to milling was followed. Blending 30% cold tempered triticale flour with 70% wheat flour gave bread comparable in quality to that of bread prepared from wheat (RR-21) alone. For chapatis, a blend of 60% untreated triticale flour and 40% wheat flour was found to be most suitable.

Efforts to improve quality and quantity of proteins in cereals have led to breeding of triticale[1,2]. However, it has poor milling[1], baking and chapati making qualities[3]. Tempering triticale to 14.5 per cent[4], 13 per cent[4] or 12 per cent[5,6] gave milling yields ranging between 44.2 and 66.4 per cent, while wheat gave a yield of 70 per cent flour.

Bread[4] and chapaties[3] prepared from triticale flour are of poor quality. Blending with wheat flour improved their acceptance and nutritive value.[3,4,7-9] Studies carried out to improve the milling, bread baking and chapati making qualities of triticale are reported in this paper.

Materials and Methods

Triticale variety 'UPT-7440' and wheat variety 'RR-21' grown at the Crop Research Centre of G.B. Pant University of Agriculture and Technolcgy, Pantnagar were used in this study.

Pre-treatments: Before milling, grains were tempered to 14.5 per cent with cold water or with hot water. In the latter case, grains were dipped in boiling water for 5 min. (grain to water ratio 1:3) rubbed on a wire mesh with wooden paddle to remove a part of the bran, dried at 60°C for 2.5 hr in a tray drier, and stored at room temperature in air tight containers for 72 hr to equilibrate to a moisture level of 14.5 per cent.

Milling: Triticale and wheat samples were milled in Buhler mill (model MLU 202) according to the AACC procedure[10].

Protein, fat, crude fibre, ash and gluten content, sedimentation value and flour yield were determined by the AACC procedures[10] and maltose value by the method of Ramsay[11]. Colour was measured using Kent Jones and Martin colour grader and particle size by using sieves of 50, 100 and 200 mesh[11].

Mixographs were obtained by AACC procedure[10] with Swanson mixogram using a spring setting of 11 as suggested by Lorenz[1]. Chopin alveogram was used to study the alveographs[11].

Baking test: Baking formula consisted of 100 g flour, 3 g yeast, 1 g salt, 5 g sugar, 4 g skim milk powder (SMP) and water to the desired level. Preliminary trials indicated that 5 g of shortening gave the best bread from samples containing triticale flour. It was also found that first punch after 40 min. and second after 60 min. during fermentation of 60 min[4]. gave good bread. It was proofed for 30 min.

Wheat dough was fermented for 150 min. First punch was given after 100 min. and second at the end of fermentation time. Proofing was done for 40 min. Samples were baked for 20 min. at 230°C, cooled and loaf volume measured by seed displacement method.

Preparation of chapati: Dough was prepared from *atta* samples, balls of 25 g made, each ball rolled into (milled in conventional stone milk) chapati of about 15 cm diameter, and cooked and puffed on a hot griddle (*tava*). Time needed and uniformity of puffing of chapati were noted.

Sensory evaluation: Acceptance of bread and chapaties were determined by sensory evaluations consisting

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of panels of 5 to 8 untrained persons. Rating was done on Hedonic scale.[12]

Results and discussion

Triticale ('UPT-7440') grains had protein, 14.15, crude fibre 2.26 and ash 2.28 per cent compared to 10.48, 2.16 and 2.14 per cent of protein, crude fibre and ash for wheat.[13] Protein in this variety of triticale was higher than that reported by Sehgal *et at.*[14].

The protein, fat, crude fibre and ash contents were maximum in untreated triticale flour, followed by cold and hot tempered flours (Table 1) However, this is compensated by an increase in flour yield from 57.3 per cent in control to 60.66 and 62.14 per cent in cold and hot tempered tricicales, respectively. Though the protein content of triticale flour is higher than that of wheat flour, their wet gluten content was lower and of inferior quality (Table 1). Sedimentation value for control triticale sample was 17.25 and there was reduction by 0.4 on cold tempering and 1.82 on hot tempering. Sedimentation value of wheat flour was higher. The maltose values for triticale flour was higher than that for wheat (Table 1), indicating higher reducing sugar content in the former.

Colour grade: Flours obtained from treated triticale samples were of lighter colour than the control sample, but there was not much difference between the two treatments. Colour grades obtained are in agreement with the results obtained by Kumar *et al*[5]. The difference in the colour grade values of the flours obtained under three conditions is due to incorporation of lesser amount of outer portion of the kernel which is evident from the higher ash content in the control sample. Wheat flour was of lighter colour.

Particle size: In the sieve analysis, all the flour particles passed through the sieves of 50 and 100 mesh. Hence, only the percentages of triticale flour passing through a sieve of 200 mesh has been reported (Table 1). The percentage of flour passing through 200 mesh (49 per cent) was lower in the untreated triticale samples than in the tempered grain or in the wheat grain. The particle size of flours from the treated triticale as well as in the wheat remained same. These results indicate the usefulness of treatment. However, the quality and yield of the flour improved, by hot tempering and the cost of milling also would increase.

Baking tests showed that the loaf volume increased from 300 ml for control to 320 ml for cold and 380 ml for hot tempered triticale bread (Table 2). Sensory evaluation showed that grain structure, texture, crust colour, aroma and taste, and general appearance of samples from cold tempered grains was slightly better. Hence, in subsequent studies, flour from cold tempered grain only was used. But, triticale alone did not give bread of good quality.

Rheological properties: Mixograms showed that triticale gluten is of poor quality and the flour has poor strength and mixing tolerance (Table 3). Blending with wheat flour showed that strength increased with in-

TABLE 1. PHYSICO-CHEMICAL PROPERTIES OF TRITICALE AND WHEAT FLOURS

	Triticale flour			Wheat flour (cold tempered)
	Untreated	Tempered		
		Cold	Hot	
Protein (%)*	11.67	11.45	11.23	9.57
Fats (%)*	1.33	1.29	1.27	1.37
Crude Fibre (%)*	0.46	0.46	0.45	0.45
Ash (%)*	0.62	0.58	0.57	0.51
Wet gluten (%)	23.58	23.00	22.50	29.55
Sedimentation value	17.25	16.85	15.43	20.62
Maltose value	2.45	2.44	2.42	1.89
Colour grade (K.J. Units)	9.10	7.30	7.20	4.10
Particle size**	49.00	53.33	53.33	53.33

*On dry weight basis

**% flour passing through a sieve of 200 mesh. No flour particle was retained on 50 and 100 mesh sieves.

TABLE 2. BAKING CHARACTERISTICS OF FLOUR AND BLENDS

Flour/Blend	Loaf vol. (ml)	Score* Crust colour (10%)[1]	Grain structure (20%)[1]	Texture (20%)	Aroma and Taste (25%)	General appearance (25%)
Triticale flour						
Untreated	300	6.87	13.77	13.20	16.87	16.32
Cold tempered	320	6.95	13.80	13.57	16.98	17.82
Hot tempered	380	6.70	13.95	13.85	16.14	17.65
Wheat flour						
Cold tempered	420	8.70	15.20	16.12	20.09	21.70
Blends**						
30	360	7.86	14.32	14.32	17.00	19.50
40	400	6.46	13.04	13.04	16.72	15.70
50	380	6.60	13.50	13.72	16.25	17.00
60	300	8.24	14.24	13.04	16.37	15.90

*Average score given by panel members out of max. score indicated in the parenthesis.

**Figures indicate the % triticale flour in a triticale-wheat blend

TABLE 3. RHEOLOGICAL PROPERTIES OF TRITICALE AND WHEAT FLOURS, AND BLENDS

Parameter	% Cold tempered triticale flour in blend					
	0	30	40	50	60	100
Mixogram data						
Max. curve ht (cm)	4.90	4.80	5.00	5.30	4.50	4.40
Time to reach max. ht. (min)	1.40	1.16	1.16	1.16	0.93	0.93
Area under curve for 7 min (sq. cm)	38.50	29.20	34.00	38.00	32.00	31.00
Mixing tolerance angle DOW	74.00	60.00	64.00	70.50	40.00	37.50
Width of curve at point 0 (cm)	1.80	1.00	1.20	1.40	1.30	1.30
Alveogram data						
L (mm)	33.00	23.00	26.00	30.00	14.00	14.00
P/G	5.10	4.90	5.11	5.06	5.37	5.10
Baking strength	15.60	9.49	9.75	10.14	4.16	4.03
Stability	67.32	64.68	66.00	60.72	51.48	48.64

crease in percentage of triticale flour in the blend upto 50 per cent.

Extensibility, baking strength and stability of triticale flour was low (Table 3). These characteristics were improved after blending with wheat flour. Alveograms showed that blending triticale and wheat flours in equal proportion was optimum.

Baking tests of blends: Loaf volume of breads (Table 2) obtained from blends containing 40 per cent triticale flour was maximum and it was close to that of wheat bread. Blending also improved the quality of bread, particularly the grain structure and texture. But crust colour, and aroma and taste was adversely affected. Statistical analysis of the sensory evaluation data showed that the breads from blend containing 30 per cent triticale flour was significantly superior to those prepared from other blends (Table 2).

Chapati making qualities of atta: The percentage of protein, maltose value and colour grade increased with the increase in triticale content in flour blend, but gluten content and sedimentation values decreased (Table 4). Chapatis prepared from triticale and wheat *atta* puffed well, had creamy white colour on upper surface, while the colour of internal layer of triticale chapatis was dark. Triticale chapatis were also judged as leathery and inferior to wheat chapatis. In order to determine the optimum blend of triticale and wheat *atta*, blends having 0, 50, 60, 75 and 100 per cent triticale *atta* were used.

TABLE 4. PHYSICO-CHEMICAL PROPERTIES OF TRITICALE-WHEAT FLOUR BLENDS AND SENSORY QUALITIES OF THEIR CHAPATIES

	Wheat flour	% triticale flour in blends				
		50	60	70	75	100
Protein (%, dry wt.)	10.00	11.10	11.40	11.70	11.90	12.60
Wet gluten (%)	32.00	27.80	27.60	27.30	27.00	26.00
Sedimentation value	25.00	23.00	22.60	22.90	21.70	20.30
Maltose value	2.00	2.22	2.31	2.38	2.40	2.48
Water absorption	62.00	60.50	60.00	59.30	59.30	59.00
Colour grade (K.J. Units)	13.60	17.20	17.30	17.80>	18.00>	18.00
Chewiness*	83.25	78.50	75.12	65.87	63.87	—
Colour*	90.00	80.62	80.00	67.87	62.87	—

*Score for chapathis out of 100.

Sensory evaluation indicated that there was no difference in aroma, taste, external colour and chewiness of different samples having upto 75 per cent triticale *atta*, (Table 4). However, their internal colour was found to be significantly different. There was no significant difference in the overall acceptability of pure wheat chapatis and chapatis of 60 per cent triticale *atta* blend. Both were rated superior to those from 70 and 75 per cent triticale blends, colours playing a dominant role in acceptability. However, chapatis prepared from blends containing triticale *atta* dried upon storage and became slightly stiff. The drying rate and degree of stiffening was found to increase with increase in the level of triticale in the blend. Chapatis prepared from 50 to 60 per cent blends kept well upto an hour at room temperature. This phenomena is correlated with lower water absorption and sedimentation value of triticale *atta* (Table 4). Austin and Ram[15] also have shown a similar correlation for wheat. Sinha *et al.*[16] have found a sedimentation value of 20 to 25 to be ideal for wheat chapati. Sedimentation value of different blends varied between 20.3 and 25.0, but still chapatis from a blend containing 70 to 100 per cent triticale flour whose sedimentation values were between 20.3 and 22.2 were not acceptable. This shows that the optimum sedimentation value for triticale-wheat blend may be 22.6 or higher (Table 4).

In conclusion, chapati of good quality and a higher protein content could be prepared from a blend of 60 per cent triticale ('UPT-7440') *atta* and 40 per cent wheat ('RR-21') *atta*. Composition of blends for bread and chapati found most suitable in this study was different. For bread, a blend of 30:70 of triticale and wheat flours was found to be most suitable.

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Rapid Determination of Pesticides in Fatty Foods

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The method described helps in the rapid detection and analysis of chlorinated and organophosphorus pesticides in fatty foods. It consists of extracting pesticides from oil or fatty foods with acetone and acetonitrile, passing the extract through column containing silanized glass wool topped with activated charcoal and concentrating the eluate. The concentrate is analysed by GLC and/or TLC, which can be completed within 45 min. Recovery is 99+1%.

Estimation of pesticide residues in foods involves three steps, namely, extraction, clean up and analysis. During extraction, large amount of artifacts like fats, waxes and pigments always appear which may interfere with the analysis. Cleaning operation is time consuming as the sample has to be treated with adsorbents like florisil, alumina etc.[1-7] Finally, the sample is analysed by AOAC methods[8]. As appreciable quantity of pesticides are soluble in fats, it is difficult to separate them for analysis. A simple method developed in this laboratory is presented in the communication. Carbamates were not included in this study as their occurence in fats are rare and even if they occur, this method can be used for carbamates also.

Paper presented at the First AFST(I) International Food Conference, Bangalore, India, May 23-26, 1982.

Materials and Methods

Preparation of clean-up column: Glass column (0.75 cm i.d) was filled with 1.4 g of silanized glass wool (Supleco Company, USA) and topped with one cm depth of activated charcoal.

Preparation of TLC plates[9]*:* Silica gel G (25 g) slurried with 50 ml water was spread on glass plates (20 cm × 10 cm), allowed to set, and dried at 100-105°C for one hour, cooled, stored in a desiccator before use.

Developing solvent[10]*:* Petroleum ether (60-66°C): dioxane: liquid paraffin in the proportion of 75:5:5.

Spraying reagent: (*i*) A 0.5 per cent solution of $PbCl_2$ in 8 per cent HCl was used for visualisation of organophosphorus pesticides and (*ii*) Organochlorinated pesticides, one per cent diphenylamine in rectified spirit, followed by exposure to UV light for 30 min.

GLC was carried out under the following conditions:

Column 1.5 m × 4 mm (i.d.) glass packed with 1.5 per cent SP-2250 + 1.95 per cent SP-2401 on supelcoport 100-120 mesh; carrier gas nitrogen at 60 ml/min.; detector temp.:210°C; attenuation: 16×10^2; injection temp.: 210°C; column temp. 200°C; chart speed 1 cm/min.;

Chromatograph Pye Unican GCV; and detector: ECD for organochlorine and FID for organo-phosphorus pesticides.

Analytical procedure: The columns were wetted with 6 ml of acetonitrile (E. Mark) before starting the experiment.

Extraction from mustard oil: One fifth of an ml (or 0.2 gm) of oil was taken in a 50 ml iodine flask, 1 ml of acetone and 3 ml of acetonitrile were added and the flask was shaken vigoursly on a mechanical shaker for 5 min. and allowed to stand. The contents of the flask were then passed through the silanized glass wool column care being taken not to disturb the oil layer in the flask. The eluant was collected and extraction was repeated twice. Finally 1 ml of acetonitrile was passed through the column for complete elution. All the eluants were collected and volume made upto 10 ml either by the addition of acetonitrile or by evaporation as the case may be. Pesticides were identified by TLC and analysed by GLC for confirmation.

Extraction from groundnut and milk: To finely powdered groundnut (5 g) or milk (5 g) taken in 50 ml iodine flask, 1 ml of acetone and 3 ml of acetonitrile were added and elution and analysis were carried out as described.

Results and Discussion

The GLC profile of the pesticides (Lindane and Malathion) are shown in Fig. 1. It clearly indicates that the fats and oils and other impurities were completely eliminated by adopting the described procedure. Similar observation was made in TLC. The detection can be of the order of nanogram in the case of GLC and microgram in TLC methods. The recovery is 99 ± 1 per cent (Table 1) and takes only 45 min. for complete analysis by GLC.

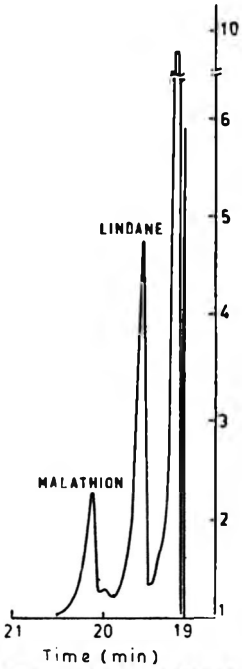

Fig. 1. GLC profile of pesticides from spiked samples (milk)

For getting reproducible results, the column must not be too tight or too loose; 1.4 g of wool packed to about 10 cm length in the specified column would be ideal. The length of charcoal in the column should not be more than one cm as the slow flow rate would adversely affect the recovery.

The method being simple, accurate and precise, can be of much use for routine analysis for the pesticide residues in fatty foods. It is also time saving compared to the method adopted so far with fatty food materials[4].

TABLE 1. RESIDUES RECOVERED FROM THE SAMPLES SPIKED WITH PESTICIDES

Commodities	Pesticides added (g)	*Recovery (%) after extraction and clean-up
Mustard oil (0.2 g)	200	100
Groundnut (5 g)	200	99
Milk (5 g)	200	100

* Average of the three trials in each case is taken

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Influence of Water on the Changes During Heating of Oils

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Coconut oil (I.V 8.5) and niger seed oil (I.V 126) were heated in an iron pan with and without the addition of water. Water was added to simulate the frying conditions in the model system. It was observed that water had little effect in some of the parameters determined. Epoxy acid, hydroxyl value, oxidised fatty acids, refractive index, free fatty acid, iodine value, peroxide value, smoke point and foaming height of the oils were determined. The extent of unsaturation of an oil has no effect on the degree of deterioration on heating to frying temperature (180°C).

Deep fat frying is one of the common modes of preparing food in the Indian culinary system. Oils and fats undergo many physical and chemical changes during deep fat frying and the deteriorative changes have received much attention. There are various reports on the nutritional quality of heated oils[1-4].

Micha Peled[5] observed that presence of water in the system influences, to a large extent, the degree of deterioration of the oil during heating. There are some reports on the water accelerated thermal oxidative deterioration of the oil and also the hydrolytic cleavage of glycerides[6-8]. However, a few workers claim, that water (steam) delayed the deterioration of oils during frying[9]. In order to simulate the effect of frying, Perkins *et al.*[6] added water into the heated oil in the form of small droplets. Decrease in unsaturation and an increase in hydroxyl value indicates that the presence of water strongly accelerates the deterioration of frying fat. Firestone *et al.*[10], observed that when cottonseed oil was heated to 225°C, there was a gradual increase in epoxide oxygen and hydroxyl oxygen content. Yuki[11] observed that when soya bean oil was heated to 180°C along with water spraying, there was increase in acid value. monoglycerides content and hydroxyl value. In the absence of water, these changes were insignificant. Thompson *et al.*[12] in a brief commercial survey of oils and fats used in restaurants and other places observed wide variation in degree of fat deterioration which was more related to method of use than to degree of unsaturation.

The hydroxyl number of a fat increases during thermal oxidation. Part of the increase might be attributable to the liberation of partial glycerides by hydrolysis, but Deatherage and Mattill[13] isolated dihydroxy stearic acid from thermally oxidised oleate after saponification. Epoxides also can be found in fats treated with air at a high temperature. It has been proposed that the epoxides are formed by oxidation of double bonds with peroxy acids which results from autoxidation of aldehydes.

Arya *et al.*[14] observed formation of peroxides, decomposition of peroxides to carbonyls, epoxy and hydroxy fatty acids and polymerisation of the partially oxidised fatty acids during frying of oils. Physical and chemical changes at normal frying temperatures (180-220°C) are practically of the same order in refined groundnut oil and vanaspati.

Sulthana and Sen[15] reported that groundnut oil, vanaspati and safflower oil when heated to 180°C results in a decrease in smoke point, iodine value and increase in Lovibond colour units, viscosity,

foaming property, free fatty acids and refractive index.

The actual conditions prevailing during deep fat frying of a product are, however, different as there will always be a blanket of steam from the moisture present in the material that is fried. Hence, to simulate these conditions, water was added to the heated oil in the present investigation.

Materials and Methods

Nigerseed oil and coconut oil were purchased from the local market. Three litres of oil were heated to 180°C. Water as droplets was added into the hot oil at a rate of 1 ml/min. A parallel experiment was conducted without addition of water. Samples were collected after 3, 6, 12, 18 and 24 hr of heating. These were stored in glass bottles and kept in refrigerator till the end of the analysis.

Epoxy acid was determined as oxirane oxygen according to Chakraborty *et al.*[16] Hydroxyl value, iodine value, free fatty acids, peroxide value, smoke point were determined according to A.O.C.S. methods, oxidised fatty acids according to IUPAC methods and foaming height according to Krishnamurthy *et al.*[17]

Results and Discussion

Coconut and nigerseed oils were selected because of their wide difference in unsaturation, the iodine values being 8.5 and 126 respectively.

Changes in the various parameters during heating are shown in Fig. 1, 2 and 3.

When coconut oil and nigerseed oil were heated to 180°C, the epoxy acid content increased at a rapid rate in the initial stages in both the oils in the presence of water (Fig. 1A). The increase was gradual in the absence of water in the initial stages. But the extent of increase was almost same in both the oil systems.

Water seemed to have an inhibitory effect on the increase in the hydroxyl value in the initial stages of heating in the case of coconut oil (Fig. 1 B). But this was not observed in the case of nigerseed oil. The final increased hydroxyl values were same in both the oils either in presence or absence of water.

The development of oxidized fatty acids was slightly inhibited in the presence of water in both the oils (Fig. 1 C). The water vapour seemed to have formed a barrier between the atmospheric oxygen and the oil for the formation of oxidized fatty acids. Water did not influence the pattern of refractive index (Fig. 2A). There was a slight, gradual increase in the refractive index value, either in presence or absence of water in both the oils. Free fatty acid increase was gradual in all cases (Fig. 2B). But the increase was slightly more when water was added to both the oils, whereas in the case of iodine value, water did not have any effect on this (Fig. 2C). But the fall in Iodine value in case of coconut oil was far more than in the case of nigerseed oil.

Peroxide value variation was little in both the oils (Fig. 3A). In coconut oil, there was a gradual increase upto 18 hr heating and then there was a decrease both in the presence and absence of water. But the peroxide

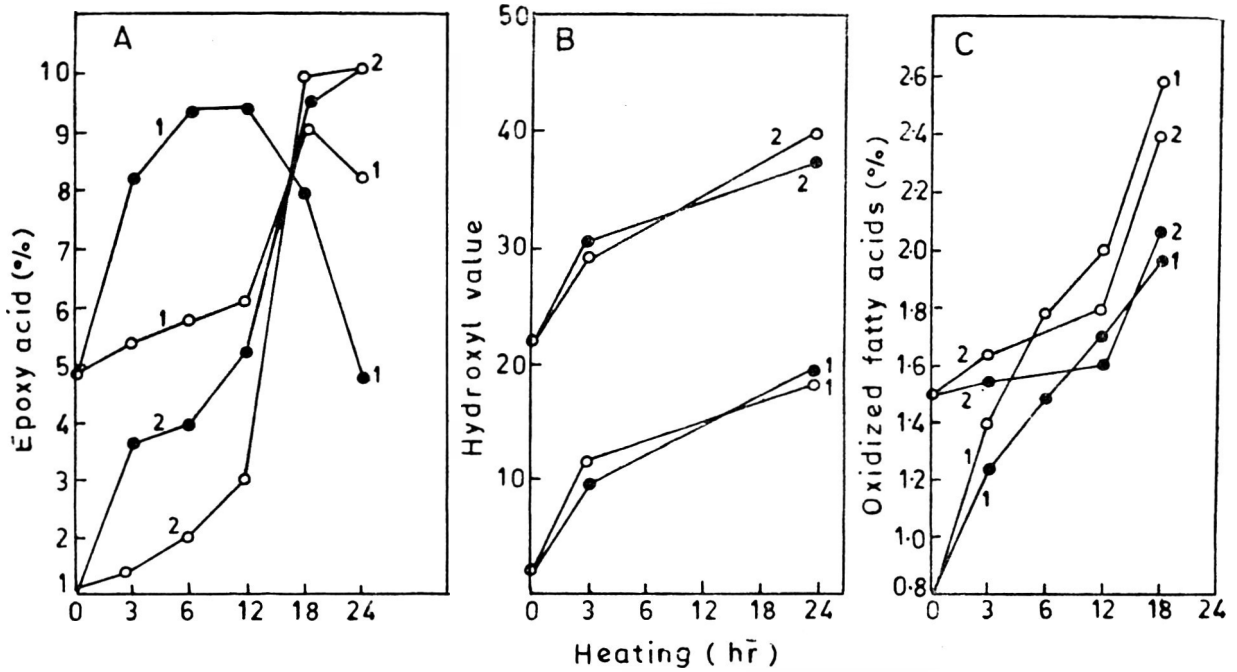

Fig. 1. Influence of water on the changes during heating of oils

● With water O Without water 1. Coconut oil 2. Niger seed oil

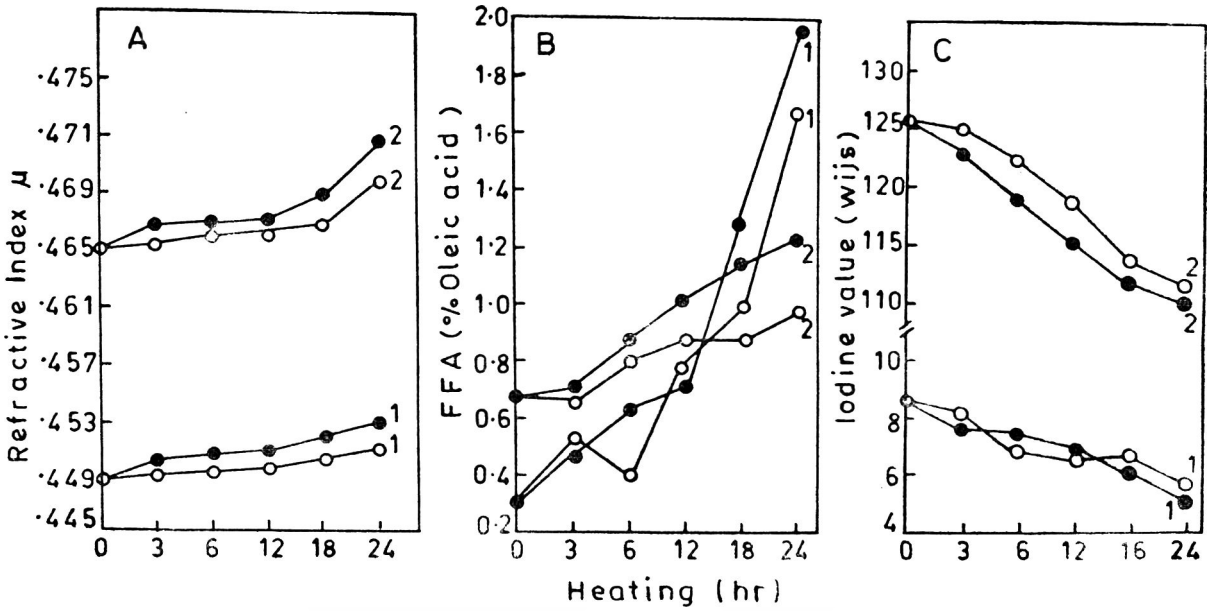

Fig. 2. Influence of water on the changes during heating of oils

● With water O Without water 1. Coconut oil 2. Niger seed oil

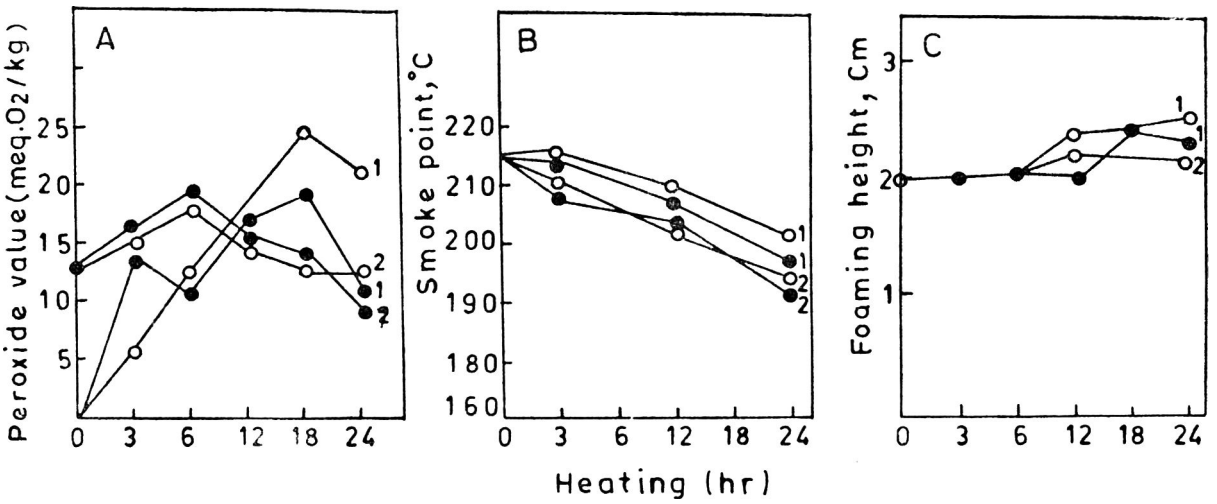

Fig. 3. Influence of water on the changes during heating of oils

● With water O Without water 1. Coconut oil 2. Niger seed oil

value increased only upto 6 hr heating in case of niger-seed oil and the decrease was gradual.

Smoke point gradually decreased in both the oils (Fig. 3B), but under the influence of water, the decrease was slightly more. Earlier, we have observed that the formation of free fatty acids was slightly more in the presence of water. No significant change was observed in the foaming height in the samples (Fig. 3C).

It was observed that the presence of water in the system made some difference in the degree of deterioration with respect to some parameters.

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Processing of Three Major Saudi Arabian Date Cultivars into Jam

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Three major Saudi Arabian date cultivars namely 'Khudari', 'Sullaj' and 'Sifri', were studied for jam-making both without and with the addition of flavours such as orange, grapefruit, banana and almond. The jams were processed in a Pilot Plant and were tested for physico-chemical and organoleptic characteristics. Physico-chemical tests indicated that all the jams conformed to the desired product standards. Sensory evaluation tests showed that acceptable jams could be prepared from the 'Khudari', 'Sullaj' and 'Sifri' date cultivars, which did not differ significantly ($P > 0.05$) from each other in their suitability for jam-making. The inclusion of orange, grapefruit, banana and almond flavours at specific levels were found equally acceptable in jams.

The Kingdom of Saudi Arabia is one of the major date-producing countries in the world. The total production of dates amounted to 400,000 tons in 1977[1]. There are about 400 different date cultivars in the Kingdom, but only fifty to sixty are widely consumed and are considered popular.[2]

Dates are mostly and largely consumed in the Kingdom at their *Rutab* (when date fruits start softening) and *Tamr* (when dates acquire a dark-brown color and a firm consistency) stages of development. There is some kind of processing in the eastern province of the Kingdom where dates are boiled and then dried and finally consumed[3] but processed products from dates are non-existent. A few date cultivars have been studied recently for their suitability for jam-making in Sudan[4], but generally studies dealing with the development of new date products are limited in literature.

Jams made from a variety of fruits are a popular food item with the local population. There are different types of jams available in the local market, most of which

are imported. Based on the fact that surplus quantities of dates are available in the Kingdom for product development and that jams are popular, the present investigation was undertaken to study the possibility of utilizing three abundant date cultivars, 'Khudari', 'Sullaj' and 'Sifri', growing in Saudi Arabia in the manufacture of jams. In addition, date jams might be another new product to be introduced to the international market, if found acceptable to the consumer.

Materials and Methods

Collection and preparation of samples: Samples of 'Khudari', 'Sullaj' and 'Sifri' date cultivars were collected from the palm tree plantation adjacent to the Regional Agriculture and Water Research Centre, Riyadh, Saudi Arabia. The dates were sorted, washed in a stainless steel basin and were spread to dry in air on a stainless steel table.

Preparation of date-pulp: Pulp was prepared from the dates at the *Rutab* stage of the three cultivars by boiling weighed amounts of cleaned and dried dates in potable water (1:6) in a cooking kettle for 40 min. until they became soft. The pulp was prepared by passing the cooked dates through a pulper-finisher to separate the seeds. The pulps so obtained were weighed and the percentages of dates in the pulps calculated. The pulps were then utilized for jam-making after determining their physical characteristics.

Physical characterization of the pulp and the jams: The pH of the pulp and the jams were measured by a pH meter. The total soluble solids expressed as °Brix were determined by using an Abbe refractometer with temperature adjustment. The titratable acidity of the jam was determined by titrating the samples with 0.1N NaOH[5].

Preparation of jam: In the preparation of jams, several variables were studied such as the sugar/pulp ratio, acidifying agents to adjust the pH, and kind and levels of flavourings. These trials resulted in the recommendation of the final recipe for the three date cultivars (Table 1). When rapid set fruit pectin was added at levels of 0.5-1.0 per cent, based on weight of sugar, and the resulting jam was compared to that without pectin, no significant difference was observed as judged by panelists with respect to the consistency of the gel in both batches and an insignificant level of syneresis was observed in the pectin free jam upon storage for six months. Moreover, observations on pectin free jam showed a better mouth feel and smoother texture. Hence, pectin was excluded from the final recipe. However, pectin may be added, if a stronger consistency of the jam is desired by the consumer.

In all trials, prior to processing, the pH of the pulp which was 5.80-6.20 was adjusted to 3.70 for obtaining a product having an acceptable acid taste. The pH was adjusted by the addition of 20 per cent citric acid solution in the preliminary trials and calculating the amount of solid citric acid needed for the test trials. The pulp was added to a cooking pan and heated for a few min, then the needed amount of sugar (45-55 parts of dates in the pulp) was added. The mixture was cooked with continuous mixing and then citric acid was added a few min. before the total soluble solids value approached 66-68°Brix. At this stage, cooking was stopped and the various natural flavours-orange, banana, grapefruit and almond were added. The amounts added of orange, banana and grapefruit flavours were 0.056 per cent and that of almond flavour 0.036 per cent of the weight of sugar plus the dates in the pulp. After the addition of flavours, the jam was mixed well before it was filled hot into glass jars and cooled quickly in cold water. The jars were stored at room temperature (25°C) for further studies.

Sensory evaluation of jams: The finished products were presented to a taste panel of 13-15 judges selected from colleagues at the Research Centre including local nationals as well as expatriates. Therefore, this test can be regarded as a consumer test. Each judge was presented with three samples at a time with one control and two test samples. The judges were asked to evaluate the jams for colour, taste and overall acceptability on the basis of preference tests using the hedonic scale from 9-1 with 9 being the most liked and 1 the most disliked[6]. The data were statistically analysed by the analysis of variance method.[7]

TABLE 1. PHYSICAL CHARACTERISTICS OF DATE CULTIVARS AND THE JAM RECIPES DEVELOPED FOR EACH CULTIVAR

	'Khudari'	'Sullaj'	'Sifri'
Physical characteristics			
Wt./fruit (g)	14.90	9.14	9.13
Seed wt./fruit (g)	0.94	1.10	1.13
Flesh (%)	94	88	88
Colour	Dark brown	Golden-brown	Golden-brown
Recipes			
Pulp/sugar ratio	55/45	55/45	55/45
Citric acid[a] (%)	1.02	0.98	1.32
Dates-in-pulp (%)	62.4	70.5	65.5

a Amount of citric acid added is expressed on per cent of dates in the pulp.

Flavour pH was adjusted to 3.7 in all cases added on the basis of sugar + dates in the pulp. Orange, banana and Grapefruit were added at 0.056% level for such cultivars and almond added at 0.036% level.

Results and Discussion

Physical characteristics: Prior to processing of the jams, the physical and chemical characteristics of the three date cultivars, 'Khudari', 'Sullaj' and 'Sifri', were determined at the various stages of maturity[8,9]. Data on the physical characteristics (Table 1) showed that the average weight of the fruit of 'Khudari' cultivar was higher and the average weight of the seed lower than the 'Sullaj' and 'Sifri' cultivars, hence, the yield of edible portion (flesh) was higher in 'Khudari' (94 per cent) than in other two cultivars (88 per cent). In comparison to other fruits, the average yield of date pulps, is higher than those of the stone fruits. Fruits of 'Khudari' had dark-brown colours and those of 'Sullaj' and 'Sifri' had a golden-brown colour.

Chemical composition: The chemical composition of the three date cultivars was earlier reported by Sawaya *et al.*[8,9] Evidently, the three date cultivars did not markedly differ from each other with respect to the amount of various chemical constitutents. In general, the three cultivars contained low amounts of protein (2.69-3.43 per cent) and fat (0.15-0.20 per cent), fairly good amounts of ash (1.92-2.12 per cent) and crude fibre (3.00-3.55 per cent), and high amounts of total sugars (77.2-78.4 per cent) and reducing sugars (58.4-64.8 per cent), with relatively lower amounts of sucrose (13.3-18.8 per cent) on a dry weight basis. The pectin content was relatively high (0.65-0.85 per cent) and was comparable to other fruits like apricots, plums and strawberries. The ash had a high content of potassium to sodium ratio and fairly good amounts of potassium, iron and copper when compared to the recommended dietary allowances (RDA) and suggested daily intakes of NRC/NAS of U.S.A.[10]. In general, the composition of date fruits is comparable to other fruits used in jam making, except for the high concentration of sugars which is a desirable attribute for jam making.[11]

Physical analysis: The pH, titratable acidity (as a per cent of citric acid) and the total soluble solids (°Brix) contents of the jams are shown in Table 2. The initial pH of the pulps varied between 5.80 and 6.20 for the three date cultivars and is considered high for jam making. The pH of the pulps was, therefore, adjusted to 3.70 which was fixed on the basis of the overall acceptability of jams in preliminary trials. The pH of the various jams ranged between 3.93 and 3.96 which is slightly higher than the initial pH of the pulp (3.70). The slight increase in the pH may be due to a tendency of neutralization of citric acid added till a final equilibrium in solute concentration is achieved. The total soluble solids content of the various jams ranged between 66.7 and 67.2°Brix at the time of filling and showed a slight decrease at the end of 90 days of storage at room temperature (25°C), which may be due to the slight loss of residual moisture from the dates in the pulp to the preserving medium, (sugar), till an equilibrium is reached in solute concentration. The titratable acidity of the jams was 0.55, 0.51 and 0.49 per cent (expressed as citric acid) for the jams processed from 'Khudari', 'Sullaj' and 'Sifri' cultivars, respectively. These acidity levels are within the range of acidity for jams.

TABLE 2. CHEMICAL COMPOSITION OF JAMS[a]

Chemical parameters	'Khudari'[b]	'Sullaj'[b]	'Sifri'[b]
pH of pulp	5.80	6.00	6.20
pH of Jam[c]	3.93	3.95	3.96
	(3.90-4.00)	(3.90-4.00)	(3.90-4.00)
°Brix at filling	66.6-67.7	66.1-67.0	66.4-67.4
°Brix after 90 days	65.0-66.6	64.8-65.9	64.8-65.6
Titratable acidity (%)[d]	0.55	0.51	0.49

[a]Means of four randomly selected jams.

[b]Flavours added to each type of jam were orange, grapefruit, banana and almond.

[c]Figures in paretheses indicate the range of pH values for the control and flavoured jam.

[d]Expressed as per cent of citric acid.

TABLE 3. SENSORY EVALUATION SCORES OF FLAVOURED JAMS

Type of flavours	Colour	Taste	Overall acceptability
	Khudari		
Control	7.46	7.38	7.15
orange	7.23	7.54	7.31
grapefruit	7.08	6.92	7.00
banana	7.08	6.38	7.00
almond	7.00	6.77	6.77
	Sullai		
control	7.43	6.71	7.07
orange	7.07	7.21	6.93
grapefruit	7.29	7.00	7.00
banana	7.14	7.07	7.14
almond	7.21	6.86	6.64
	Sifri		
control	7.47	7.07	7.00
orange	7.67	7.73	7.67
grapefruit	7.33	7.20	7.20
banana	7.60	6.80	6.80
almond	7.20	7.13	7.00

Means of 13-15 responses.

TABLE 4. SENSORY EVALUATION SCORES OF DATE JAMS OF KHUDARI, SULLAJ AND SIFRI CULTIVARS

Cultivars	Colour	Taste	Overall acceptability
'Khudari'	6.77	6.77	6.62
'Sullaj'	7.54	7.31	7.14
'Sifri'	7.46	7.08	7.00

Scores are the means of 13 responses.

Sensory evaluation: Results of the sensory evaluation of the date jams are shown in Table 3. The data indicate that the average scores for the colour are between 7 and 8 on a 9-point hedonic scale. Colour scores were the least variable and did not differ significantly ($P>0.05$) among the flavoured and non-flavoured jams prepared from different cultivars. The score for taste and the overall acceptability were between 6 and 8 points which is considerably above the average score. The jams were, therefore, highly acceptable with respect to their taste and overall acceptability. No significant differences ($P>0.05$) were observed among the products for these two attributes.

Furthermore, the effect of the individual date cultivars used in the present investigation on the organoleptic properties of the jams was also investigated by presenting to the panelists the three different samples at the same time. The results (Table 4) show that the colour, taste and overall acceptability of the jams prepared from any of the three date cultivars are comparable and does not differ significantly ($P>0.05$). This indicated that the effect of the individual date cultivars was negligible on the three attributes of the jams evaluated and, therefore, equally acceptable jams could be prepared from any of the three date cultivars.

It can be concluded that the three date cultivars studied can be successfully employed for making jams, both without and with added flavours such as orange, grapefruit, banana and almond. From the economical point of view, the utilization of dates in the manufacture of jams is of considerable value since Saudi Arabia produces surplus quantities of dates, but imports jam and other similar products.

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Trace Elements in Some Canned Meat Products

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Metallic contamination with copper, zinc, tin, lead and arsenic in canned meat products is one of the important problems facing the consumers and the manufacturers. The research carried out with some canned meat products manufactured in India, has established that the degree of contamination with heavy metals is lower than the tolerances prescribed by the Meat Food Products Order of the Government of India, 1973.

The possible sources of metallic contamination in canned meat products are; (*i*) machinery, equipment and utensils used, (*ii*) raw material, (*iii*) water, and (*iv*) corrosion of the container. Trace metals are unique environmental and industrial pollutants which are transported and incorporated in the products[1]. Heavy metals, like, copper, zinc, tin, lead and arsenic, etc. have deleterious effects on human health, even when ingested in small amounts over long periods. Cumulative poisoning due to ingestion of food containing lead or arsenic is well known.[2] Elements such as copper and zinc, although essential for life in trace amounts, have deleterious effects when ingested in higher amounts.[3] Though tin is not considered as a poisonous metal, very large doses produce serious digestive disturbances in humans. Apart from the toxic effects, tin may also impart metallic taste in canned foods[3].

Levels of trace metals viz., copper, zinc, tin, arsenic and lead found in some canned meat products manufactured in India are reported in this paper.

Materials and Methods

Four hundred and seventy samples of canned meat products, representing twenty six types, collected from various manufacturers in India were analysed for heavy metals viz., copper, zinc, tin, arsenic and lead.

Copper, arsenic and lead were determined by ISI[4] method, while tin and zinc were determined by the method of Pearson.[5]

Results and Discussion

All the Samples analysed (Table 1) contained copper amounts less than the prescribed[6] limit of 20 ppm. No significant difference in mean value of copper concentration in various types of products was observed.

TABLE 1. TRACE ELEMENTS IN SOME CANNED MEAT FOOD PRODUCTS

Product	No. of samples	Mean values (ppm)		
		Copper	Zinc	Tin
Beef sausage	2	5.5	13.5	124.5
Cocktail sausage	10	7.4	16.4	72.2
Goa beef sausage	2	9.5	35.0	191.0
Oxford sausage	5	5.8	14.2	59.6
Pork sausage	16	9.3	18.3	68.1
Goa pork sausage	1	18.0	10.0	191.0
Frankfurter	5	11.6	15.4	51.8
Hot dog	2	3.0	17.0	71.5
Bacon paste	1	11.0	13.0	83.0
Bacon rasher	2	14.0	6.0	32.0
Cooked ham	1	10.0	32.0	115.0
Ham chunks	1	6.0	15.0	25.0
Ham mince	6	4.5	15.8	49.8
Ham paste	3	7.0	17.0	46.0
Ham roll	8	9.1	12.6	76.4
Hong shao beef	19	10.0	14.2	111.5
Corned beef	310	7.3	19.2	69.3
Liver paste	1	10.0	22.0	81.0
Hung shao mutton	1	18.0	15.0	13.0
Mutton curry	7	3.0	15.7	37.3
Mutton kheema	5	4.8	17.2	43.8
Chicken curry	5	11.4	11.0	58.2
Chilli chicken	1	7.0	10.0	64.0
Chicken paste	5	7.8	16.8	48.6
Chicken soup	22	4.3	12.0	94.7
Luncheon meat	29	6.7	17.1	74.7

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However, the highest mean value of 18 ppm in case of Goa pork sausage and Hong shao mutton, and the lowest mean value of 3 ppm in mutton curry were recorded as against 2 ppm reported by Assaf and Bratzler in raw beef[7]. The higher concentration of copper recorded in our study may be attributed to the utensils and equipment used for processing of the products or by contamination through the ingredients used.

The highest mean value of 35 ppm of zinc in Goa beef sausages followed by 32 ppm in cooked ham, and the lowest mean value of 6 ppm were observed in Bacon rashers, as against 17 ppm in raw beef[7].

73.8 per cent of the samples had less than 20 ppm of zinc and all the samples were within the limits prescribed by MFPO[6]. 92 samples (19.6 per cent) had a tin concentration above 100 ppm, and all the test samples had tin content within the permitted limits[6] of 250 ppm. Goa beef sausage and Goa pork sausage had 191 ppm being the highest mean value. The reason for having more tin in these two products could be due to their acidic nature as compared to other meat products analysed. In conformity with the observation of Dicknson and Raven[8], 80.4 per cent of the tested samples contained less than 100 ppm of tin. The excess of tin noticed in the remaining 19.6 per cent of the samples may be due to the interaction of meat with tin plate or might have come from the processing equipment. All the samples tested answered for the presence of arsenic and lead.

All the meat products analysed showed arsenic and lead in the concentration less than the maximum permissible limit of 2 and 2.5 ppm respectively as prescribed by MFPO.[6] Our study is in accordance with the work of Maggi *et al.*[9] who have shown lead in canned beef in the concentration of 0.05 to 2.20 ppm. It was also expressed by Williams[10] that lead is seldom found in foods nowadays in dangerous amounts.

Conclusion: Analysis of twenty six types of various canned meat products revealed that the metal contamination due to copper, zinc, tin, arsenic and lead was much lower than the maximum permissible limits[6] and some of the samples analysed had shown metal's concentration close to the maximum permissible limit, making it necessary to analyse meat products for metallic contents.

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A Method of Debittering Fish Protein Hydrolysate

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Fish protein hydrolysates prepared by using papain, bromelin, etc., are bitter in taste and therefore, have limited use in food materials. Ethyl alcohol was used to remove bitter peptides from enzyme hydrolysates. The solvent can be reused after refining, followed by distillation. It was observed that increase in the concentration of alcohol causes an increase in the yield of less bitter fraction. The debittered fraction contains more proteoses and less of α-amino nitrogen than bitter fraction.

Fish protein hydrolysates are prepared by enzymatic process. The composition and usefulness of hydrolysates as human food have been studied.[1-5] Hevia *et al.*[3] reported that hydrolysates prepared by using pronase

were less bitter and contained higher proportion of low molecular weight peptides (mol. wt. ∽300) than those obtained with bromelin and ficin. Lalasidis *et al.*[5] prepared protein hydrolysates free of bitterness using bacterial endopeptidase-alcalase, followed by pancreatin. They have also reported[6] a method to remove bitter fraction from enzymatic protein hydrolysates using secondary butyl alcohol. The present study reports the separation of bitter fraction from enzymatic fish protein hydrolysate by using ethyl alcohol.

Materials and Methods

(*a*) *Preparation of fish protein hydrolysate:* Hydrolysates were prepared from thread fin bream meat and ribbon fish meat, using the procedure described by Thankamma *et al.*[4] The fish protein was hydrolysed for 30 min at 55°C and pH 6.5 using papain. The reaction was stopped by boiling and the contents were filtered through Whatman No 1 filter paper. The filtrate was dried in vacuum drier after adjusting the pH to 7.

(*b*) *Separation of bitter fraction:* Three hundred and fifty grams of vacuum dried hydrolysate was dissolved in 350 ml distilled water. The solution was then divided into five equal portions and ethyl alcohol. (sp. gr. 0.81258) was added with continuous shaking at ambient temperature (30°C), to bring the concentration to different levels and left overnight to allow the precipitate to settle. The supernatant, which contained bitter fraction, was taken out and dried in a vacuum drier after concentrating in a vacuum evaporator. The solvent was rectified for reuse. The sediment was dried in a vacuum drier at 50°C.

(*c*) *Chemical analysis:* Total nitrogen was estimated by microkjeldahl method and ∝-amino nitrogen by modified Pope and Stevens[7] method. The absorbancy of 6 ml of 1 per cent aqueous solution of both the separated fractions after addition of 0.1 ml saturated aqueous zinc sulphate solution was compared with that of 1 per cent aqueous proteose peptone (Difco) using systronic spectrophotometer at 630 nm. and based on the principle of Bomer–Zinc Sulphate method.[8]

Results and Discussion

The effect of ethyl alcohol on precipitation is shown in Table I. Recovery of debittered fraction increases with the increase in ethyl alcohol content used for separation. The supernatant of all samples, except sample S1 became clear after keeping overnight. Organoleptic evaluation carried out by a set of panel members showed that sample S3 was the best followed by sample S2. It was also observed that the precipitation was quicker at low temperature. The supernatant contained the bitter peptide. The vacuum dried fraction of the supernatant was bitter, highly hygroscopic and clear. Similar results were obtained with secondary butyl alcohol by Lalasidis and Sjöberg 6.

Table 2 shows that total nitrogen and ∝-amino nitrogen were almost similar in all the treatments.

Bitter fraction always contains more ∝-amino nitrogen than debittered fraction. Increase in alcohol content causes an increase in ∝-amino nitrogen content in less bitter fraction. The absorbancy of less bitter fractions (Table 3) was projected on the standard curve (33 Y=6X–1.023) obtained by using different per cent of proteose peptone (Difco) solution (X) and corresponding absorbancy (Y).

TABLE 1. EFFECT OF ETHYL ALCOHOL ON PRECIPITATION

Sample No.	Alcohol to water ratio (by vol.)	% of less bitter fraction (by wt.)	Quality of fraction after debitterring
S1	200 : 70	30 . 51	Slightly bitter
S2	300 : 70	42 . 17	Not bitter, but slight unacceptable after taste.
S3	400 : 70	49.24	Not bitter and no bad taste
S4	500 : 70	52.24	Not bitter but unacceptable after taste
S5	600 : 70	53.87	,, ,,

TABLE 2. COMPOSITION OF SEPARATED FRACTIONS

Sample No.	N content (%)		∝-amino N content (%)	
	Less bitter fraction	Bitter fraction	Less bitter fraction	Bitter fraction
S1	13.16	13.66	2.52	2.55
S2	13.55	13.46	2.19	2.80
S3	13.60	13.41	2.38	2.69
S4	13.64	13.40	2.48	2.56
S5	13.65	13.40	2.51	2.58

TABLE 3. ABSORBANCY AND PROTEOSE CONTENT OF LESS BITTER FRACTIONS

Sample No.	Absorbancy of 1% less bitter fraction	Proteose content* (% of DIFCO proteose peptone)
S1	0.173	1.125
S2	0.189	1.120
S3	0.180	1.160
S4	0.175	1.133
S5	0.174	1.127

* obtained from standard curve.

The absorbancy of 1 percent solution of bitter fraction was negligible. Table 3 shows that proteose content[8] of 1 per cent solution of less bitter fraction is equal to that of corresponding per cent of DIFCO proteose peptone. The proteose content decreases with the increase of alcohol content in samples except in sample S1.

The results show that the increase in alcohol content in samples causes the precipitation of more lower peptides which are responsible for increase in ∝-amino nitrogen content; less bitter fractions contain more proteoses than their bitter counter parts. There is also possibility to use the above method to remove bitter fraction from concentrated filtrate of protein hydrolysate prior to vacuum drying; this will eliminate the cost of initial vacuum drying and also minimise handling cost.

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Salmonella in Meat

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Two hundred mutton carcasses from Mysore city slaughterhouse, hundred from retail shops and hundred processed in modern abattoir of CFTRI were examined for *Salmonella*. Nine per cent of the carcasses from the city slaughterhouse and eight per cent of the meat samples from the retail shops showed the presence of *Salmonella*.. *Salmonella* was not detected in the carcasses processed in the modern abattoir. Chopping blocks, knives and the rectal swabs from the animals revealed the presence of *Salmonella*. The serotypes, *S. gaminara*, *S. adelaide*, *S. virchow*, *S. newport* and *S. paratyphi* B were isolated. Sanitary handling during slaughter and dressing of sheep brings down the incidence of *Salmonella* in meat.

Occurrence of *Salmonella* food poisoning of animal origin is being reported frequently[1-10]. Attempts are being made to provide meat of better quality to the consumer by improving the conditions in abattoir. Investigations were undertaken to ascertain the incidence of *Salmonella* in mutton carcasses processed in Mysore city slaughterhouse and at Modern Training Abattoir at CFTRI, Mysore. *Salmonella* isolates were also tested for pathogenicity to different laboratory animals.

Materials and Methods

Slaughter of sheep in the local slaughterhouse: Sheep were led to the slaughterhouse from different places and slaughtered (Halal) on the floor without providing proper rest or food prior to slaughtering. The carcasses were dressed on the floor, hoisted manually on the rails, viscera and pluck were removed, washed and shifted to retail units.

Slaughter of sheep in the CFTRI Modern Training Abattoir: The animals were not given any feed except water for 24 hr before slaughter. They were electrically stunned at 70 V for 10 sec, and were slaughtered (Halal) adopting modern slaughterhouse operations.

Sample collection: Standard swab method[11] was followed to isolate microorganisms from the carcasses. An area of 6.25 cm^2 near the rump region of carcass was selected with a sterile template and then swabbed using a sterile swab moistened with sterile 0.1 per cent peptone water. The swab was broken into a test tube containing 10 ml selinite cystine broth[12]. Two hundred samples, one from each carcass from the local slaughterhouse and hundred samples from each carcass processed in modern abattoir were collected. Swab smears were also taken from 25 chopping blocks and knives of retail shops and 30 from modern abattoir. Rectal swabs were collected from sheep prior to slaughter. One hundred meat pieces taken from carcasses in retail shops and meat pieces from the carcasses in the modern abattoir were also examined. Thirty g of meat was blended for 2 min in 100 ml of selenite cystine broth and transferred to steile flasks. Isolation and identification of *Salmonella* were carried out as per standard procedures of Compendium of Methods for the Microbiological Examination of Foods (American Public Health Association)[12] and those described by Galton *et al.*[13] and suspected *Salmonella* isolates were sent to National Salmonella and Ecsherichia Typing Centre (NSEC), Kasauli for serotyping.

Animal pathogenicity: The animals selected[14] were: (*i*) one year old male rabbits, (*ii*) six-week old male albino mice, (*iii*) ten-week old male guinea pigs and the corresponding body weights of each were 1 kg, 30 g and 600 g. Six animals in each group were selected for the test. Three animals were set apart as controls in each group. Cell suspensions of *Salmonella*, grown on nutrient agar slants for 18 hr at 37°C were collected in 10 ml of sterile physiological saline and preserved at 4°C for 24 hr or until used. The suspension was analysed for total counts as per the standard procedures.[12] The suspension was adjusted to obtain 2.0×10^7 cells/0.5 ml and each experimental animal was injected intraperiotoneally with 0.5 ml of *Salmonella* cell suspension. Control animal received 0.5 ml of sterile physiological saline intraperitoneally. Koch's postulates[15] were followed to establish pathogenicity and death of the test animals. Tissues, such as intestines and heart were collected and tested for the presence of *Salmonella* from the dead animals.

Results and Discussion

The present studies reveal that 9.0 per cent of the carcasses processed from Mysore City slaughterhouse and 8.0 per cent of meat samples obtained from retail shops were found to carry *Salmonella* (Table 1). Only one *Salmonella* strain occurred in each carcass.

In an earlier study[5] conducted at Mysore, it was observed that 4.4 per cent of carcasses were contaminated with *Salmonella*. Manickam and Victor[6] found that 4.9

TABLE 1. ISOLATION AND CHARACTERIZATION OF *SALMONELLA* ISOLATED FROM CARCASS AND PROCESSING GADGETS OBTAINED FROM MYSORE CITY

Kind of sample	Source	No. of samples examined	No. of positive samples	% positive samples	Serotypes isolated		Antigenic structure
Carcasses	Local slaughter house	200	18	9.0	*S. gaminara*	(5.0)	16:*d*:1.7
					S. adelaide	(3.5)	35:*fg*:-
					S. newport	(0.5)	6,8:*eh*:1.2
Meat cuts	Retail shop	100	8	8.0	*S. adelaide*	(3.0)	35:*fg*:-
					S. newport	(2.0)	6,8:*eh*:1.2
					S. virchow	(1.0)	6,7:*r*:1,2
					S. paratyphi B	(2.0)	6,7:*r*:1,2
Rectal swabs	Live animal	25	3	12.0	*S. gaminara*	(8.0)	1,6:*d*:1,7
					S. adelaide	(4.0)	35:*fg*:-
Chopping blocks	Retail shop	25	2	8.0	*S. newport*	(4.0)	6,8:*eh*;1,2
					S. paratyphi B	(4.0)	4,5,12:*b*:1,2
Chopping knives	Retail shop	25	1	4.0	*S. newport*	(4.0)	6,8:*eh*:1,2

Figures in parentheses indicate % of serotypes.

TABLE 2. EVALUATION OF CARCASSES PROCESSED IN MODERN ABATTOIR FOR *SALMONELLA*

Kind of sample	No. of samples examined	No. of positive samples	% positive samples	Serotypes isolated		Antigenic structure
Rectal swabs*	50	5	10.00	*S. gaminara*	(8.0)	16:*d*:1,7
				S. adelaide	(20.0)	35:*fg*:-
Carcasses	100	Nil	—	—		—
Meat cuts	100	Nil	—	—		—
Chopping knives	30	Nil	—	—		—
Chopping blocks	30	Nil	—	—		—

*From live animals before slaughter.

Figures in parentheses indicate % of serotypes.

per cent of meat samples from retail shops in Madras City were contaminated with *Salmonella*. The high incidence of *Salmonella* in the present study may be attributed to improper handling during slaughtering, dressing and evisceration of sheep.

Details of results obtained with the isolation of *Salmonella* from carcasses processed in modern abattoir are presented in Table 2. *Salmonella* was not detected in the carcasses processed under hygienic conditions in modern abattoir. The hygienic conditions included: (*a*) resting the animals after transportation, (*b*) starving the animals prior to slaughter, (c) dressing and evisceration of carcasses over the rail pipe system, (*d*) careful removal of viscera, (*e*) use of sterile knives during operations, (*f*) frequent washing of butcher's hands and use of clean water.

During the course of this investigation, *S. gaminara* (5.0 per cent), *S. adelaide* (3.5 per cent) and *S. newport* (0.5 per cent) were isolated from carcasses processed in Mysore City slaughterhouse. *S. adelaide* (3.0 per cent), *S. newport* (2.0 per cent), *S. virchow* (1.0 per cent), and *S. paratyphi* B (2.0 per cent) were isolated from retail shops. Isolation of *S. adelaide* from human infections, from sheep and goat has been reported.[16] *S. newport* has been reported from sheep and from buffaloe calves[17] and from mesenteric lymph nodes of pigs.[9] This serotype might gain access into sheep due to cross contamination during grazing. *S. bareilly* and *S. senftenberg* have been reported in mutton carcasses. *S. typhimurium* and *S. bredeney* have been isolated in meat samples from retail shops.[6]

It was pointed that different serotypes of *Salmonella* could occur in meat depending on feeding schedule of sheep.[2] *S. virchow* has been reported from feces of a dysentry patient.[18] The isolation of *S. virchow* and *S. paratyphi* B from mutton in the present study is significant from public health point of view as these serotypes are host specific for man. These human serotypes might have gained access to meat from persons handling meat.

An attempt has been made to isolate *Salmonella* from live animals prior to slaughter in Mysore City slaughterhouse. Rectal swabs obtained before slaughter showed that 12.0 per cent of animals possessed *Salmonella*. infection, whereas 10.0 per cent of the animals brought to modern abattoir harboured the organism. The presence of *S. gaminara* and *S. adelaide* in the rectum indicates the possibility of contamination of carcasses either directly by fecal matter or due to the rupture of viscera.

Two out of (8.0 per cent) twenty five chopping blocks of the local retail shops examined showed the presence of *Salmonella*. The serotypes included *S. newport* and *S. paratyphi*. B. Randhava and Kalra[4] isolated *S. anatum*, *S. newport* and *S. weltevreden* from chopping blocks. From twenty five chopping knives of the retail shops, *Salmonella* belonging to serotype *S. newport* was isolated from only one. Chopping blocks and chopping knives used in the modern abattoir did not show any *Salmonella*.

The results of animal pathogenicity test are given in Table 3. *S. paratyphi* B killed all the mice in 18 hr. Regarding *S. newport*, 3 mice died after 18 hr and the remaining three after 24 hr. All the mice inoculated with *S. gaminara* died after 24 hr. *S. adelaide* killed two mice after 18 hr. and the remaining four after 24 hr. It has been reported that when mice were inoculated intraperitoneally with a dose of about 500 million cells of *S. paratyphi* bacilli, death occurred in 1 to 3 days.[15] The mortality in rabbits occurred between 24 and 36 hr after inoculation with *Salmonella* cultures, whereas in guinea pigs, death occurred in 36 to 48 hr. The results indicate that *Salmonella* were more virulent to mice than to rabbits and guinea pigs. Many species of *Salmonella*

TABLE 3. PATHOGENICITY OF *SALMONELLA* STRAINS TO LABORATORY ANIMALS

Salmonella strains	Mice			Rabbits			Guinea pigs		
	No. of animals injected	Death time* (hr)	No. of animals died	No. of animals injected	Death time* (hr)	No. of animals died	No. of animals injected	Death time* (hr)	No. of animals died
S. adelaide	6	18	2	6	18	—	6	18	—
		24	4		24	4		24	—
		36	—		36	2		36	2
		48	—		48	—		48	4
S. gaminara	6	18	—	6	18	—	6	18	—
		24	6		24	1		24	—
		36	—		36	5		36	1
		48	—		48	—		48	5
S. newport	6	18	3	6	18	—	6	18	—
		24	3		24	6		24	—
		36	—		36	—		36	4
		48	—		48	—		48	2
S. virchow	6	18	5	6	18	—	6	18	—
		24	1		24	5		24	—
		36	—		36	1		36	3
		48	—		48	—		48	3
S. paratyphi B	6	18	6	6	18	—	6	18	—
		24	—		24	4		24	—
		36	—		36	2		36	2
		48	—		48	—		48	4

*Death time calculated from the time of injection to death.

have been found to posses high or moderate virulence to laboratory animals.[15] The results also suggest that biological/animal kill test takes longer time to detect the pathogenic property of Salmonella.

In conclusion, it may be stated that *Salmonella* serotypes detected in market meat samples and in processing gadgets are potential hazard to the persons engaged in meat handling and also to the public. Hygienic processing of carcasses reduces the incidence of *Salmonella* in meat.

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Influence of Polyphosphate Treatments on the Quality and Shelf Life of Indigenous Ready-to-cook Broilers*

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Ready-to-cook broiler carcasses were soaked in 6 and 12 per cent sodium tripolyphosphate (STPP) solution for three and one hour respectively and evaluated for their qualities initially on the day of soaking and after 10 days of freezing. Carcasses soaked in chilled water for one or three hours acted as controls. STPP treatment significantly increased the muscle pH and improved the water holding capacity and shelf life by decreasing the microbial load. There was no change in moisture content of the meat. STPP treatment reduced the toughness of meat and improved juiciness and flavour. Six per cent STPP treatment was superior to 12 per cent STPP treatment.

Polyphosphates are used extensively in food processing for improving the texture, consistency and uniformity of appearance of the meat. They increase the water holding capacity[1,2] extend the shelf life of poultry meat[3,4] and lower the shear value.[5]

Usefulness of food grade sodium tripolyphosphate (STPP) in improving the quality of indigenous broiler meat was studied.

Materials and Methods

Twelve batches, each comprising of eight ready-to-cook, 8-10 weeks old commercial broilers were used in this study. They were slaughtered after overnight starvation, dressed, eviscerated and washed hygienically. Each trial consisted of:

T_1: Carcass soaked in chilled water for one hour (control).

T_2: Three carcasses soaked in 12 per cent STPP solution for one hour.

T_3: Carcass soaked in chilled water for three hours (Control-II).

T_4: Soaking three carcasses in 6 per cent STPP solution for 3 hr.

The chilled water and the STPP solutions were maintained at 5-8°C during soaking, after which soak solutions were drained for 5-10 min and the samples of skin and breast muscles were taken for analyses. The samples were collected aseptically, for total plate count. Analysis were done initially and after 10 days.

The pH, moisture content,[6] water holding capacity[7] of the meat and the microbial load (total plate count)[8] of skin sample and the shear value of the breast muscle (0.5 in. thickness) at three points, using a Warner Bratzler Shear Press, were determined by standard procedures.

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The organoleptic evaluation of the meat for tenderness, juiciness and flavour was carried out after cooking bits of breast muscle in a pressure cooker for 10 min at 1.1 Kg/cm.^{2} and subjecting to organloeptic evaluation by a five member taste panel. The results were recorded on a 9 point score card with ascending ratings for the desired attributes. The data collected from the 12 batches of broiler meat were analysed statistically.[9]

Results and Discussion

STPP treatment increased the pH (Table 1) of the broiler breast muscle significantly ($P<0.01$) soon after immersion and this was maintained even after 10 days. Maximum pH was noticed with 6 per cent STPP solution. Ockerman[2] and Peterson[10] have also made similar observations with polyphosphate solutions. No change was noticed in the moisture content of the breast muscle with STPP treatment, which is in agreement with the findings of Spencer and Smith[3] and Schermerhorn *et al.*[11] STPP treatment, also influenced water holding capacity of the carcass muscles significantly ($P<0.01$). In this case also, 6 per cent solution, with longer soaking time, was found better. Similar observations have been made by Hamm.[1] Water holding capacity of the STPP treated material did not vary much even after 10 day's storage. There were significant ($P<0.01$) differences in total plate count among samples obtained from different treated materials. Soaking in 6 per cent STPP for 3 hr was the best. This is similar to the findings of Spencer and Smith,[3] Panda,[4] and Elliot *et al.*[14] Van Wazer[15] attributed this to the interaction of proteins with STPP.

Chicken meat from STPP treated and frozen carcass showed lower shear value (Table 2) and was also found to be tender. Here also, 6 per cent STPP treatment was better than that of 12 per cent solution. STPP treatment also improved the organoleptic quality significantly ($P\leq0.05$). Tenderness, juiciness and flavour scores were better noticeable in the carcasses soaked in 6 per cent STPP for 3 hr than in the samples soaked for 1 hr in 12 per cent STPP.

TABLE 1. EFFECT OF SOAKING BROILER CARCASSES IN STPP ON ITS QUALITY SOLUTIONS

Treatment	pH	Moisture (%)	Water holding capacity (cm^2 of exuded water)	Total plate count (log val./g)
		Zero Day		
T_1	5.79 ± 0.06^a	77.05 ± 0.33	6.48 ± 0.60^a	4.58 ± 0.03^c
T_2	5.88 ± 0.05^b	76.05 ± 0.24	5.27 ± 0.34^a	4.43 ± 0.04^{bc}
T_3	5.75 ± 0.06^a	76.91 ± 0.30	8.58 ± 0.90^b	4.56 ± 0.03^c
T_4	5.92 ± 0.05^b	76.52 ± 0.16	5.18 ± 0.43^a	4.19 ± 0.05^a
		Eleventh Day		
T_1	5.76 ± 0.06^a	77.33 ± 0.31	9.21 ± 0.55^b	4.48 ± 0.02^{bc}
T_2	5.89 ± 0.06^b	77.02 ± 0.23	5.17 ± 0.34^a	4.33 ± 0.03^b
T_3	5.78 ± 0.06^a	76.88 ± 0.39	9.38 ± 0.53^b	4.45 ± 0.02^{bc}
T_4	6.02 ± 0.05^c	77.74 ± 0.26	5.50 ± 0.28^a	4.03 ± 0.04^a

Figures in the same column with different superscripts differ significantly ($P<0.01$).

Values are Mean$\pm$S.E.

TABLE 2. EFFECT OF SOAKING BROILER CARCASSES IN STPP SOLUTIONS ON ITS QUALITY

Treatment	Shear value (kg)**	Tenderness**	Juiciness**	Flavour*
		Zero Day		
T_1	1.90 ± 0.16^f	5.32 ± 0.23^b	5.40 ± 0.22^{bc}	5.58 ± 0.15^b
T_2	1.72 ± 16^e	6.02 ± 0.28^{ab}	5.78 ± 0.24^b	5.98 ± 0.22^{ab}
T_3	1.77 ± 0.13^e	5.65 ± 0.35^b	5.67 ± 0.28^b	5.53 ± 0.29^b
T_4	1.45 ± 0.13^b	6.98 ± 0.40^a	6.42 ± 0.37^a	6.47 ± 0.33^a
		Eleventh Day		
T_1	1.71 ± 0.13^e	5.12 ± 0.27^b	5.08 ± 0.25^c	5.58 ± 0.23^b
T_2	1.54 ± 0.12^c	6.44 ± 0.19^a	5.93 ± 0.21^{ab}	5.98 ± 0.24^{ab}
T_3	1.61 ± 0.12^d	5.17 ± 0.36^b	5.05 ± 0.33^c	5.67 ± 0.22^b
T_4	1.34 ± 0.12^a	7.36 ± 0.27^a	6.56 ± 0.25^a	6.46 ± 0.28^a

Figures in the same column with different superscripts differ significantly

**Highly significant ($P<0.01$)

*Significant ($P<0.05$)

Values are Mean$\pm$S.E.

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Interrelationship Between Certain Measures of Shell Quality in Quail Eggs *(Coturnix coturnix Japonica)*

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The relationship between various parameters of egg shell quality on 476 quail eggs has been studied. The results indicate significant positive correlations between specific gravity, shell thickness, shell weight and shell % (wt.g.). The third degree polynomial curve is a better fit than the linear multiple regression curve and should be used for the determination of any one of these factors. Among the different factors studied, shell thickness is the best single indicator of specific gravity and of shell quality.

Eggs are produced commercially under different conditions, leading to the marketing of eggs with thin shells and other shell faults. Thin shelled eggs cause considerable wastage during handling, transportation and distribution, resulting in a heavy monetary loss to the producer, marketing agencies and the consumers. In India, candling and immersion of eggs in water, are the methods used to find out the quality of eggs, in the market. Candling reveals the internal quality and immersion technique indicates the shell quality to a great extent.

Egg shell quality is a trait that is commonly assessed and reported in different units. As a result, correlation amongst different measures of quality are of real importance when comparing data reported for the same trait but presented in different units. Periodical examination of these relationships are useful and has been done in the eggs of hen in determining their stability, resulting in a lot of literature. However, the published information is scanty on quail eggs. Therefore, this study was undertaken in order to examine the relationship between various measures of egg shell quality in quail eggs.

Materials and Methods

A total of 476 eggs were obtained on different days from the quail farm maintained at this Institute.

Eggs were weighed to the nearest two tenths gram.

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The maximum diameter and length of each egg were measured to the nearest 0.1 mm with flat-jawed calipers and shape index computed by the following formula.

$$\frac{\text{maximum diameter}}{\text{maximum length}} \times 100$$

The specific gravity was determined using floatation method[1] by placing them in salt (sodium chloride) solutions of different concentrations, the densities of which ranged from 1.06 to 1.10, with a gradual increment of 0.005. The egg volume was determined by water displacement method. Egg shell thickness (without membranes) was taken in the mid region of each shell with an Ames thickness gauge. Egg shells, including membranes, were allowed to dry for 24 hr at room temperature[2] and then weighed.

The data were analysed in the computers IBM-1620 and Burroughs-B 4700 using multivariate regression analysis technique.[3]

Results and Discussion

The mean values for different measures of egg shell quality are presented in Table 1.

The simple correlation coefficients between various characteristics are presented in Table 2. Since loss of weight occurs in eggs during handling and storage, correlation of shell thickness with egg volume was examined. It was found to be low (r=0.14) which compares favourably well with the findings in hen's eggs.[4] The results further indicate that there was a significant positive correlation among the traits: (*i*) specific gravity (*ii*) shell thickness; (*iii*) shell weight, and (*iv*) shell per cent (wt.g.). The correlations were of the order of 0.54, 0.51, 0.49, 0.57 and 0.50 for specific gravity *vs* shell thickness, specific gravity vs per cent shell, specific gravity vs shell wt, shell thickness vs shell weight and shell thickness vs shell percentage (wt.g), correspondingly. Though similar trends have been reported by other workers[5-7], on hen's eggs., the correlation values observed by them were of high magnitude than the quail eggs. This seems to be due to thinner shells of quail eggs when compared to those of hen.

In view of these correlations, a linear relationship, as shown in Fig. 1, could be used to determine the unknown factor from the available data. Fig. 1 depicts the linear regression of shell thickness and specific gravity with a third degree polynomial curve. It was of interest to note that the difference between the sum of squares due to regression when the third degree polynomial curve was fitted leads to a significant cubic term. This greater variation as explained by R^2 in the cubic curve suggests that a curve of this nature was more suitable than when compared to linear relationship. The increase in the R^2 from linear to cubic was almost of the order of 33 per cent. However, it was not as ideally fit as in the case of hen's eggs[5]. Since the third degree polynomial curve covers the larger span of data as compared to the linear relationship, it should be used when converting values of one factor to another. Almost similar trend was observed when shell wt and specific gravity were plotted along with third degree polynomial curve (Fig. 2). The value of R^2 for cubic relationship was 69.45 per cent i.e., almost three times the value of R^2 (23.48 per cent) for linear relationship.

Further analysis of regression was performed on the

TABLE 1. MEAN VALUES OF MEASURES OF EGG SHELL QUALITY OF QUAIL EGGS

Measures	Mean ±S.F.
Egg wt. (g)	10.31 ±1.04
Egg vol. (ml)	10.06 ±1.19
Sp. gr.	1.0770±0.0007
Shell wt. (g)	0.83 ±0.11
Shell % (wt. g)	8.11 ±0.89
Shape index	77.68 ±3.40

TABLE 2. CORRELATION COEFFICIENT MATRIX BETWEEN MEASURES OF EGG SHELL QUALITY OF QUAIL EGGS

Measures	Egg wt (g)	Sp. gr.	Shell wt (g)	% shell	Shell thickness (mm)	Egg vol (ml)	Shape index
Egg wt (g)	1.00	0.04	0.53	–0.29	0.17	0.73	–0.16
Sp. gr.		1.00	0.49	0.51	0.54	–0.11	–0.05
Shell wt (g)			1.00	0.66	0.57	0.45	–0.13
Shell % (wt g)				1.00	0.50	–0.14	–0.0002
Shell thickness (mm)					1.00	0.14	–0.01
Egg vol. (ml)						1.00	–0.09
Shape index							1.00

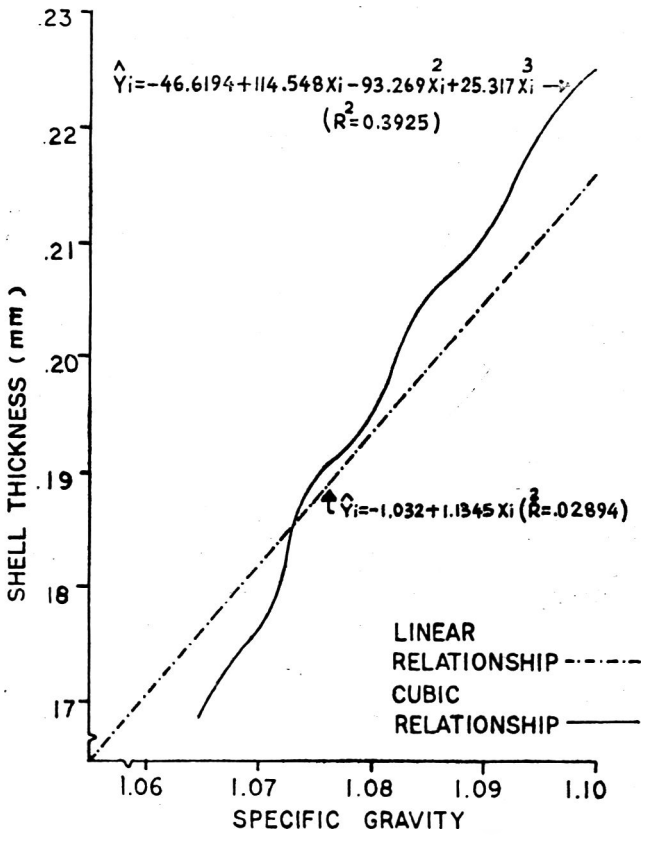

Fig. 1. Linear relationship of shell thickness and specific gravity with a third degree polynomial curve fitted to the same data

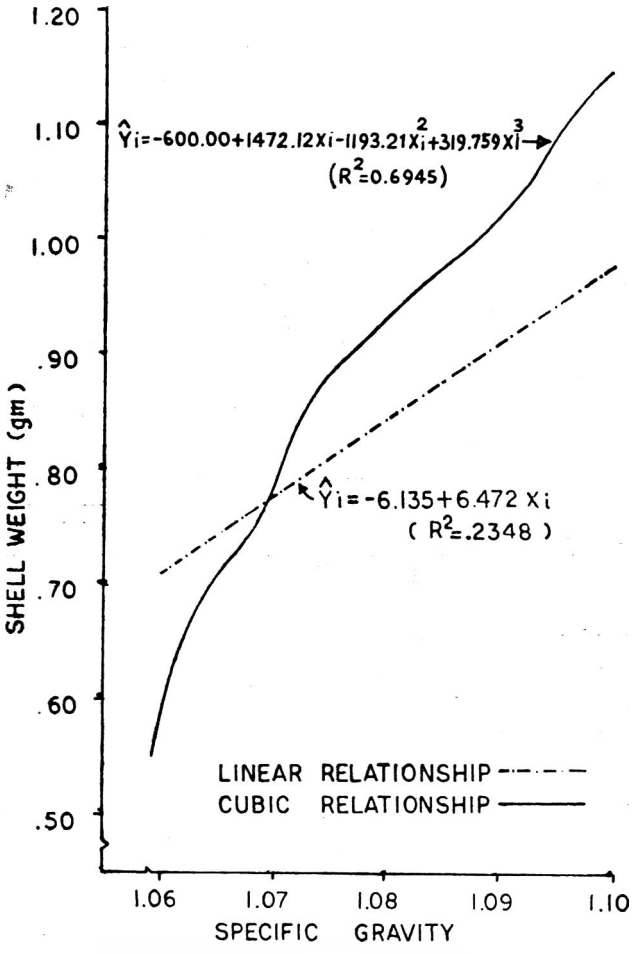

Fig. 2. Linear relationship of shell weight and specific gravity with a third degree polynomial curve fitted to the same data

TABLE 3. MULTIPLE REGRESSION EQUATION, COEFFICIENTS OF DETERMINATION (R^2) AND T-TESTS OF PARTIAL REGRESSION COEFFICIENTS

No. of eggs	Regression equation	R^2	Calculated t-values for partial regression coefficients			
			b_1	b_2	b_3	b_4
476	$\hat{Y}= 1.04+0.00015x_1-0.0025x_2+0.16x_3+0.034x_4$	0.4399	0.36	-7.39**	7.73**	9.16**
476	$\hat{Y}= 1.04-0.0024x_2+0.16x_3+0.35x_4$	0.4372		-7.36**	7.69**	6.88**
476	$\hat{Y}=1.03+0.18x_3+0.020x_4$	0.3370			8.50**	5.83**
476	$\hat{Y}= 1.03+0.26x_3$	0.2894			13,89**	
476	$\hat{Y}= 1.05+0.036x_4$	0.2348				12.06**

**Regression coefficients are significant at $P \leq 0.01$

Y=Sp. gr.; X_1=Egg wt in g; X_2=Egg vol. in ml; X_3=Shell thickness in mm and X_4=Shell wt in g.

trait, specific gravity, taking (*i*) egg weight (*ii*) the egg volume (*iii*) shell thickness and (*iv*) shell weight as independent variables, which indicated significant multiple linear regression. In all, 43.99 per cent of the variation was covered by these four variables (Table 3). Test of significance of partial regression coefficients indicated that egg wt made insignificant contribution to sp. gr as shown in Table 3. This variable can be omitted as the egg volume, shell thickness and shell weight only accounted for almost total variation (43.99 vs 43.72 per cent). Since egg vol made significant but negative contribution, it was also excluded to assess the positive contribution of shell thickness and shell weight which accounted for 33.70 per cent of the variation in specific gravity. Further, it was observed shell thickness and shell weight accounted for 28.94 and 23.48 per cent variation, respectively. Thus, this study indicates that shell thickness can be the best single index of specific gravity and *vice versa*.

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Influence of Electrical Stunning on Quality of Mutton

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Sixteen Bannur rams were used in studying the influence of electrical stunning on the quality of mutton compared to the conventional method of slaughter. Lactic acid level in blood was significantly higher in stunned sheep while glucose level was comparable. The bleed out value per Kg of live weight did not differ significantly in stunned and non-stunned sheep. No blood splashes were noticed in any of the carcasses. Glycogen level in stunned sheep was found lower as compared with the control. Water holding capacity of leg muscle of stunned sheep was significantly lower than that of non-stunned sheep, while cooking loss showed no significant difference. The sensory quality viz. firmness, toughness, succulence and overall quality and Warner-Bratzler shear values did not vary significantly between the two groups. Apart from creating a slight stress reaction, electrical stunning did not influence mutton quality significantly.

Halal, the Moslem ritual method is widely practised in India for slaughter of sheep. In this procedure, the major blood vessels in the neck are cut transversely and the animal is allowed to bleed to death without being rendered unconscious by stunning. The effect of stunning on the meat quality has been extensively studied[1-6] in porcine muscle. The literature on the effect of stunning on the quality of mutton is scanty. Therefore, an investigation was undertaken to study the extent of stress caused by electrical stunning and its effect on meat quality as compared with conventional ritual slaughter and the findings are reported in this paper.

Materials and Methods

Sixteen Bannur rams of live weight 25±6 kg procured from Government Sheep Breeding Farm were used in these studies. They were slaughtered in V-restrainer by *Halal* after electrical stunning at 70 volts and 0.2 Amp. using a tong type stunning apparatus or without stunning An aliquot of the blood was collected directly

from the draining blood and analysed for glucose (anthrone method) and lactic acid.[7] Sodium citrate solution was used as an anticoagulant and the total volume of blood collected was recorded.

Glycogen in neck muscle was estimated from samples at 30 min and 24 hr. postmortem by anthrone method of Roe and Dailey[8]. After chilling the leg muscles, Biceps femoris (BF) and Semi-membranosus (SM) from both the thighs were excised. The muscles from left thigh were minced and used for estimation of water holding capacity (WHC) by the centrifugation method of Bouton *et al*[9] centrifuging at 15,000 rpm for 2 hr.

The SM and BF muscles of right thigh were placed in HDPE pouches, immersed in boiling water and cooked for one hour. Loss in weight of muscle after cooking was noted. Rectangular samples of $1 \times 1 \times 5$ cm dimension were used for taking the Warner-Bratzler (WB) shear readings across the fibres using single blade in the shear apparatus and approximately 1 cm cubes were used for sensory evaluation. SM from non-stunned sheep was given as the known reference sample (R) which was also given coded as one of the treatments. A trained panel of 10 staff members participated. Firmness, toughness and succulence were evaluated on a 9-point quantitative descriptive procedure.[10] Overall quality was evaluated with respect to R on a 7-point scale, 4 being equal to R, 1-3 being poorer and 5-7 better than R. Texture as the combined effect of firmness and toughness and overall quality with respect to R marked=10 by magnitude estimation[11] were evaluted as a double check.

Analysis of variance followed by Duncan's new multiple range test[12] was used to segregate the treatment means.

Results and Discussion

Blood spots and extent of bleeding: Electrical stunning is known to produce blood splashing due to increased blood pressure in peripheral capillaries. All the 16 carcasses from stunned as well as non-stunned sheep did not show any blood spot indicating that the voltage used was not severe.

The volume of blood collected did not differ significantly in both stunned and non-stunned sheep indicating that the extent of bleeding was not affected in stunned and non-stunned sheep. This is in agreement with the findings of Warris[13] and Warris and Leach.[14]

Glucose and lactic acid levels in blood: Data on extent of bleeding, glucose and lactic acid content in blood and glycogen in neck muscle are presented in Table 1. The glucose and lactic acid levels in blood indicate the physiological condition of the animal at the time of slaughter.[6] Electrical stunning did not produce a significant difference in glucose level, whereas lactic acid level was significantly higher indicating that stunned animals were subjected to more stress than the non-stunned ones.

Glycogen: The initial glycogen levels (30 min post mortem) were much lower in both the treatments than the reported values for sheep muscle.[15,16] Preslaughter stress would influence the postmortem glycolysis of sheep muscle as a result of increased muscle activity.[16] In muscle from stunned sheep, the values at 30 min. and 24 hr. postmortem were considerably lower than those from non-stunned sheep. More than half of the initial (30 min postmortem) glycogen level is depleted in 24 hr postmortem in neck muscle from stunned sheep, whereas the decrease in the case of nonstunned sheep was only little over one third. Electrical stunning may influences the glycolysis in muscle.

Meat quality: The data on WB shear, cooking loss, WHC and sensory evaluation are presented in Table 2. WB shear values and the cooking loss were not significantly different between stunned and non-stunned sheep and also between SM and BF from the same treatment. WHC was significantly lower in stunned as compared to non-stunned sheep. Earlier observations in this laboratory (unpublished) showed that the final pH values (5.2-5.4) for stunned sheep were lower when compared to those of non-stunned sheep (5.5-5.7). This indicates that low pH is associated with low WHC of muscles. Bouton *et al*.[9] have also reported a similar finding. SM had a significantly higher WHC compared to BF from stunned as well as non-stunned sheep.

TABLE 1. EXTENT OF BLEEDING, LEVELS OF GLUCOSE & LACTIC ACID IN BLOOD AND GLYCOGEN IN NECK MUSCLE BETWEEN STUNNED AND NON-STUNNED SHEEP

Treatment	Blood (ml/kg live wt)	Glucose in blood (mg/ 100 ml)	Lactic acid in blood (mg/100 ml)	Glycogen (mg/100 g muscle)	
				30 min postmortem	24 hr postmortem
Stunned	29.0±3.7(7)	117.0±21.0	91.9±20.2(8)	312±53	146±36(4)
Non-stunned	30.5±3.5(6)	105.9±20.9	66.1±8.2 (8)	395±97	232±59(5)

Values expressed as mean±S.D. Figures in parentheses indicate number of animals used.

TABLE 2. COMPARISON OF WB SHEAR, WHC, COOKING LOSS AND SENSORY QUALITY MEAN VALUES BETWEEN STUNNED AND NON-STUNNED SHEEP

Parameters	Stunned		Non-stunned		SE_m	Stunning vs. Non-stunning	SM vs. BF
	SM	BF	SM	BF			
WB shear (kg)	4.70	3.95	4.74	3.91	±0.32	NS	NS
WHC	0.514^b	0.493^b	0.576^a	0.526^b	±0.013	**	*
Cooking loss (%)	45.72	44.13	46.00	44.14	±1.34	NS	NS
Firmness	5.86	5.28	5.71	5.45	±0.18	NS	NS
Toughness	5.85	5.35	5.83	5.50	±0.21	NS	NS
Succulence	5.62	5.29	5.62	5.40	±0.17	NS	NS
Overall quality	3.98	4.43	3.83	4.28	±0.22	NS	NS
Texture (ME)	10.24	10.90	9.43	10.52	±1.05	NS	NS
Overall quality (ME)	10.27	10.76	9.35	10.92	±1.05	NS	NS

SM—Semi-membranosus; NS—Not significant BF—Biceps fomoris; $*0.01 < P \leq 0.05$

$**0.001 < P \leq 0.01$

WHC carrying different superscripts are significantly different ($P \leq 0.05$)

Except cooking loss which has 18 df, all other SE_m have 15 df.

ME—Magnitude estimation with respect to Reference=10.

(Consolidated analysis of sensory data by 10 panelists on only six replications-animals paired on the basis of age and weight randomly allotted to the treatments)

The sensory firmness, toughness and succulence did not vary significantly between stunned and non-stunned sheep as also between SM and BF. There was no significant difference in the overall quality of muscles from the two treatments. Likewise, the magnitude estimates of texture and overall quality with respect to the known reference sample did not show any significant deviations.

Conclusion: Electrical stunning causes stress in the animal as indicated by high lactic acid content in blood, lower initial glycogen content in muscle and its rapid fall postmortem in stunned animals. Since the slaughter was carried out in V-restrainer the amount of struggle was much reduced. There was no significant difference in the texture, succulence and overall quality of meat from stunned and non-stunned sheep when carcasses were chilled for 24 hr.

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Development of an ∝—Amylase Production Medium by Utilising Agro-industrial Wastes

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A strain of *Aspergillus oryzae* (CFTRI 1120) which was producing ∝-amylase when grown on corn meal liquid medium, was cultivated on different media prepared from plant material including tapioca starch refuse (TSR). Maximum enzyme yield was obtained from a medium prepared from TSR, defatted groundnut meal, rice bran and salts. Enzyme yields were in the range of 325-424 units/ml of culture filtrate. Iso-propanol was found to be the best precipitative agent and the powder obtained possessed ∝-amylase activity of 151 units/mg.

Fermentation industry, is always under constant pressure to find better and cheaper substrates. Agro-industrial by-products like wheat and rice brans, defatted oilseed meals, molasses, etc. are being utilized for compounding fermentation media. These products, however, at present are in great demand in animal feeds industry and hence the cost has increased sharply. Therefore, it has become necessary to find alternate substrates. Starch and starchy substrates are utilized in media for producing amylolytic enzymes[1]. Tapioca (*Manihot esculenta* Crantz) starch refuse (TSR) is a waste product of tuber processing industry, which accounts for about 20 per cent of the roots processed and poses disposal problems. Sun-dried TSR contains 61.0-63.0 per cent starch and 12-15 per cent fibre besides other carbohydrates and minerals.[2] Studies were undertaken to compound a suitable medium for ∝-amylase production by utilizing TSR and other agro-industrial by-products, by a strain of *Aspergillus oryzae* (Ahlb.) Cohn. The results are reported in this communication.

Materials and Methods

A strain of *Aspergillus oryzae* (Ahlb.) Cohn maintained at CFTRI (No. 1120) was utilized in these studies. The culture was maintained on potato dextrose-agar (PDA) slants. Inoculated slants were incubated for 7 days at 30°C and stored in a refrigerator till use.

Starch factory refuse was obtained from M/s. Kamala Sugar Mills Ltd., Amaravathinagar, Tamil Nadu, India. The composition of TSR has been reported by Kunhi *et al.*[2] Wheat bran, corn meal, rice bran, groundnut meal, tapioca starch and corn starch were collected from the local market. Water hyacynth and rice straw were utilized in the experiment.

The basal medium contained the following ingredients (g./l). $(NH_4)_2SO_4$, 1.4; $CO(NH_2)_2$, 0.3; KH_2PO_4, 4.0; $K_2H\ PO_4$, 0.84; $CaCl_2.2H_2O$, 0.3; $MgSO_4.7H_2O$, 0.3; $FeSO_4.7H_2O$, 0.005; $MnSO_4.H_2O$, 0.00156; $ZnCl_2$, 0.00167; $CoCl_2.\ 6H_2O$, 0.002; peptone, 0.25; yeast extract, 0.10; tap water to make 1l. Unless otherwise

stated, carbohydrate source equivalent to 3 per cent yellow corn meal was used in the experiments.

Fermentation: Fifty ml of the medium was taken in 250 ml Erlenmeyer flasks and autoclaved at 1.1 kg/cm^2 for 20. min. Inoculum was prepared by suspending the spores from one tube in 10 ml of sterilized distilled water containing 0.1 ml Tween 80 (10^5 spores/ml). One ml of the inoculum was used per flask. The flasks were incubated at 25-28°C on a rotary shaker revolving at 230 rpm with a 5 cm storke.

Analytical procedure: ∝-Amylase was estimated by the procedure of Manning and Campbell[3] at 60°C and pH 6.0. One unit of ∝-amylase activity is that quantity of enzyme which hydrolyses 10 mg of starch per minute under given conditions of assay.

Results and Discussion

During screening trials carried out earlier, a strain of *Aspergillus oryzae* (CFTRI 1120) was found to give high ∝-amylase activity. This strain was grown in media containing the basal medium and different plant products at concentration to provide carbon equivalent to 3 g per cent of Yellow corn meal. After 120 hr of growth, ∝-amylase activity of culture filtrates was estimated. (Table 1) The results indicate that wheat bran was the best medium for ∝-amylase production followed by TSR and corn meal.

Media containing plant products in different concentrations and combinations were prepared and the fungus was grown on these media. Peptone and yeast extract were not added to the media since a mixture of natural products were utilized. Data on enzyme activities of the culture filtrates are presented in Table 2. Out of the several combinations, a medium consisting of 4 per cent TSR with 2 per cent groundnut meal and 1 per cent rice bran gave very high enzyme activity. Maximum enzyme yield was obtained after 120 hr of growth.

Earlier experiments had also indicated that groundnut meal extracts stimulated several enzyme production by fungi[4].

The medium consisting of 4 per cent TSR, 2 per cent groundnut meal and 1 per cent rice bran contained nitrogenous salts and other minerals besides carbon sources. The necessity of fortification of this medium with different nitrogenous salts was then evaluated. The results obtained are presented in Table 3.

Among the nitrogen sources used, maximum enzyme activity was observed with sodium nitrate and ammonium nitrate used individually. Highest enzyme activity of 401 units/ml was however, recorded when

TABLE 1. SUITABILITY OF CERTAIN PLANT PRODUCTS FOR ∝-AMYLASE PRODUCTION BY *ASPERGILLUS ORYZAE* (1120)

Plant substrates*	∝-amylase activity (units/ml)
Wheat bran (WB)	333
Tapioca starch refuse (TSR)	257
Corn meal (yellow) (CM)	257
Tapioca starch (refined) (TS)	61
Corn starch (refined) (CS)	41
Rice straw (untreated) (UTS)	114
Rice straw (alkali treated) (ATS)	114
Water hyacinth (powered) (WH)	114
Groundnut meal (defatted) (GM)	216
Rice bran (RB)	141

*All the substrates were used at a concentration to supply carbon equivalent to 3% yellow corn flour. For basal medium content see text.

TABLE 2. PRODUCTION OF ∝-AMYLASE BY *A. ORYZAE* (1120) GROWN IN MEDIA COMPOUNDED WITH INDIVIDUAL PLANT MATERIAL OR IN COMBINATION

Substrates*	∝-amylase activity (units/ml) 96 hr	120 hr
TSR 2%	223	238
3%	247	257
4%	223	345
5%	297	345
TS 2%	58	123
4%	26	62
WB 2%	222	277
4%	290	278
CM 2%	114	176
3%	114	257
4%	151	274
5%	—	114
RB 2%	35	35
3%	141	70
5%	141	106
TSR 4%+GM 1%+RB 1%	355	401
TSR 4%+GM 2%+RB 1%	263	424
TSR 4%+GM 1%	289	401
TSR 4%+GM 2%	230	401
TS 2%+GM 1%	263	257
TS 4%+GM 1%	263	289
TS 4%+GM 2%+RB 1%	263	333

*For Abbreviations see Table 1.
Basal medium as in text but without peptone and yeast extract.

TABLE 3. EFFECT OF FORTIFICATION WITH DIFFERENT NITROGEN SOURCES ON ∝-AMYLASE PRODUCTION BY *A. ORYZAE* (1120)

N sources*	∝-amylase activity (units/ml)	Culture filtrate pH
$CO(NH_2)_2$	212	7.7
$(NH_4)_2SO_4$	246	7.2
KNO_3	309	8.1
$NaNO_3$	345	8.4
NH_4NO_3	345	8.4
NH_4Cl	275	6.5
$CO(NH_2)_2+(NH_4)_2SO_4$	401	6.7

*Basal medium as in text (N sources different) except it did not contain peptone and yeast extract.
Carbohydrate source: TSR 4%+GM 2%+RB 1%

combination of urea and ammonium sulphate was used. Ammonium nitrate had also been reported to be good nitrogen source for ∝-amylase production.[5,6] Forriksova[7] has reported that ammonium sulphate was a good nitrogen source for ∝-amylase production by *Aspergillus oryzae*. She also recommended use of phosphate buffer in the medium, since this not only helped the release of enzyme into the medium but also doubled the yield of ∝-amylase. Earlier studies carried out in this laboratory[5] had indicated that when KH_2PO_4 was used at 0.4 per cent concentration along with K_2HPO_4 at 0.084 per cent in the medium, *A. niger* produced maximum ∝-amylase. The effect of addition of different concentrations of KH_2PO_4 and K_2HPO_4 in the medium was studied and the results obtained are detailed in Table 4.

As seen from Table 4, KH_2PO_4 and K_2HPO_4 used at levels of 0.4 and 0.084 percent in the medium, maximum enzyme activity was recorded. However, it was noted that ∝-amylase production was low when only KH_2PO_4 was used in the medium at 0.2 per cent level. When K_2HPO_4 was also incorporated into the medium along with KH_2PO_4, there was gradual increase in enzyme activity which reached maximum at 0.4 per cent KH_2PO_4 and 0.084 per cent K_2HPO_4.

It has been reported,[8-11] that calcium and magnesium are necessary to enhance the synthesis of ∝-amylase by *Aspergillus* species. Experiments conducted without calcium and/or magnesium and micro-nutritents in the medium revealed that they influence enzyme production. Data presented in Table 5 show that there is sharp drop in enzyme activity in the absence of these components in the medium.

Trials upto one litre batch size (1 l. medium in 4 l. Fernbeck flask) were experimented, based on the data

TABLE 4. EFFECT OF DIFFERENT DOSAGES OF KH_2PO_4 AND K_2HPO_4 ON ∝-AMYLASE PRODUCTION BY *A. ORYZAE* (1120)

Salt Concn in the medium (%)		∝-amylase activity (units/ml)	Culture filtrate pH
K_2HPO_4	KH_2PO_4		
0.084	Nil	263	8.1
Nil	0.1	247	8.2
Nil	0.2	180	7.9
Nil	0.3	279	7.8
Nil	0.4	279	7.7
0.084	0.1	247	8.1
0.084	0.2	250	8.1
0.084	0.3	289	7.9
0.084	0.4	325	7.8

Carbohydrate source: TSR 4%+GM 2%+RB 1%

Basal medium contained (g/l): $(NH_4)_2SO_4$=1.4; $CO(NH_2)_2$=0.3; $CaCl_2 2H_2O$=0.3; $MgSO_4.7H_2O$=0.3; $FeSO_4.7H_2O$=0.005; $MnSO_4.H_2O$=0.00156; $ZnCl_2$=0.00167; $CoCl_2.6H_2O$=0.002; tap water to make 1 l.

TABLE 5. EFFECT OF CERTAIN MINERAL SALTS ON ∝-AMYLASE PRODUCTION BY *A. ORYZAE* (1120)

Nutrients	∝-amylase activity (units/ml)	Culture filtrate pH
No $MgSO_4$	140.8	7.0
No $CaCl_2$	140.8	7.2
No micronutrients	105.6	7.15
Control*	395.0	6.85

*Basal medium as in text.
Carbohydrate source: TSR 4%+GM 2%+RB 1%

collected and enzyme yield of about 400 u/ml was obtained.

Preparation of crude enzyme powder: To prepare the crude enzyme powder from the culture filtrate, ethanol, methanol, iso-propanol and acetone were used as precipitants. Of these so-propanol was found to be the best. Gates *et al.*[12] have also made similar observation. One litre of the culture filtrate yielded 2.4 g of crude enzyme powder, which had an ∝-amylase activity of 151 units/mg. This enzyme powder readily liquefied corn as well as tapioca starches.

These studies indicate that tapioca starch refuse in combination with groundnut meal and rice bran in the medium can be used for producing ∝-amylase using *Aspergillus oryzae* by submerged fermentation.

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Effect of Some Process Parameters on Production of Active Dry Baker's Yeast

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Effect of process parameters like fermentation time, number of stages of cultivation and drying methods and conditions on active dry yeast production were studied in 2.5 and 25 kg batches. Yeast harvested after 24 hr fermentation, grown in 4 stages from slant culture gave a satisfactory product after drying. Among the drying methods studied namely, cross flow, truck drier, batch through flow drier and fluidised bed drier, batch through flow drier was found suitable for small scale operation, whereas fluidised bed operating with an air temperature at 45°C, produced satisfactory dry yeast on large scale.

With the rapid growth in bakery industry, the requirement of baker's yeast has been steadily increasing. It is predicted that the country's requirement of Active Dry Yeast (ADY) will be about 7000 tons per annum by 1983. Most of the bakeries are of medium or small scale with limited storage facilities. Their raw material requirement is meagre. Active dry yeast is well suited for satisfying the demand of these units, since it has a long shelf-life under ambient conditions.

ADY is being produced on a large scale since several years, but the details of production are not available as the processes have been patented. Reviews on drying yeast have been presented by many authors,[1-5] but complete data on the processing aspects have not been published.

The present study was undertaken to collect data on process parameters like, fermentation time, number of stages of fermentation etc., on the production of active dry bakers yeast.

Materials and Methods

Cane molasses diluted to 10 percent sugar content and adjusted to pH 4.5 was sterilized, clarified and used as carbohydrate source in the studies. Acid treated commercial super phosphate extract (6 per cent on molanes basis) was mixed with urea (3 per cent on molanes basis) and used as nutritents in the studies.

An inoculum of selected strain of *Saccharomyces cerevisiae* was built in 4 flasks of one litre capacity and fed to a 10 l fermentor. After 15 hr of fermentation, the contents were transferred to 200 l fermentor. A cylindrical SS vessel of 0.5 M(d) $\times$ 1.2M(h) (200 l) provided with an SS air sparger at the bottom was used.

Molasses (pH 4.5) was added for 13 hr at the rate of 3.2 l/hr. and the fermentation continued at 30 $\pm$ 1°C with aeration of 1V/V/min. The pH of broth did not vary during fermentation. At the end of 15 hr, the yeast was harvested in a Sharples super centrifuge.

The wet yeast was suspended at 30$\pm$1°C in molasses medium (3 per cent sugar, pH 4.5) and aerated at 0.5V/V/min for 10 hr. The yeast was harvested in Sharples super centrifuge and granulated in an oscillatory type granulator.

The wet granules were dried in a batch through flow drier at 30°C for 6 hr at a tray loading of 0.5 kg per sft. and air velocity 0.5 ft per sec. The dried granules were packed in cans under nitrogen.

The viability of dry yeast was examined using buffered methylene blue stain[7] and the activity was determined by the time required to double a fixed quantity of dough[6].

For large scale trials, the yeast grown from 200 l. fermentor was inoculated to a 600 l SS fermentor (0.7 M(d) $\times$ 1.5 M) and fermented for 15 hr at 30$\pm$1°C. The yeast broth was used as inoculum for the final stage.

The final fermentor (4000 l) consists of vertical cylindrical MS epoxy coated vessel (1.4 (d)M $\times$ 3.25 M) with SS air distributor at the bottom, with provision for circulating the broth through a plate heat exchanger cooled with water at 20°C.

Air from a rotary vane blower was passed through a water cooled (20°C) coil and a separating chamber to free it from oil, dust etc., before entering the fermentor.

The conditions of fermentation were same as indicated earlier except that the medium was fed at an uniform rate of 60 l. per hr. The temperature, pH and cell density were recorded at regular intervals.

After separating the broth in a nozzle centrifuge, the cream was conditioned in 3 per cent sugar for 10 hr. The yeast was harvested, washed in a nozzle separator and filtered in a filter press. The wet cake was granulated and dried in a fluidised bed drier at 40$\pm$5°C.

The fluidised bed drier consisted of a stainless steel (SS) conical vessel of 460 mm dimaeter with steam heated air heater at the bottom. An exhaust fan capable of sucking 1700 cubic meters (40-45°C) per hr through the bed of material supported on SS mesh at an air velocity of one meter per sec is also attached to the chamber. About 20 kg of wet yeast was charged per batch. Inlet and exhaust air temperatures were recorded at regular intervals.

Trials were also conducted using cross flow truck drier with hot air at 50°C and tray loading of one kg per sft. The granules, after dyring were analysed for moisture, percentage viability and dough raising time.[6]

Results and Discussion

Effect of fermentation period on the activity of dry yeast: It can be seen from Table 1, that the product got by fermentation of 13, 18 and 20 hr without conditioning, did not have sufficient activity. Even after conditioning, yeasts cells grown for less than 20 hr did not maintain their activity on drying, while yeast grown for 20 hr and conditioned gave a product with sufficient activity. Conditioning of cells and maturity for a period of 5-8 hr may perhaps be necessary for the synthesis of trehalose.

Studies were carried out on the activity of yeast obtained in the 4000 l fermentor feeding the medium for 13 hr and removing the broth after 5 and 9 hr of maturing period and dried with or without conditioning. It can be seen from Table 1, that the activity of yeast was poor after maturing for a period of 1 and 5, while sufficient activity was noticed in yeast got after 9 hr maturation followed by conditioning. It may be concluded from this that a minimum maturity period of 6-9 hr is necessary along with conditioning for obtaining yeast with sufficient activity.

TABLE 1. EFFECT OF FERMENTATION TIME, BATCH SIZE AND CONDITIONING ON DRY YEAST ACTIVITY

Fermentation period (hr)	Batch size (kg)	With conditioning		Without conditioning	
		Dough raising time (min)	Viability (%)	Dough raising time (min)	Viability (%)
13	2.5	>90	<10	—	—
14	25.0	90	60	—	—
18	2.5	>90	<10	—	—
18	25.0	90	60	—	—
20	2.5	33	90	>90	10
22	25.0	40	92	60	75

Moisture content of dry yeast was 8%

TABLE 2. EFFECT OF NUMBER OF STAGES OF FERMENTATION ON ACTIVITY OF DRY BAKER'S YEAST

Source of inoculum	No. of stages	Dough raising time (min)	Viability (%)
Slant	2	>120	50
Slant	3	40	90
Slant	4	40	92
Reconstituted dry yeast	2	40	85

TABLE 3. EFFECT OF DRYING METHOD ON DRY YEAST ACTIVITY

Drying method	Drying temp. (°C)	Dough raising time (min)	Viability (%)
Through flow drier	27-30	45	85
Cross flow type truck drier	45	42	85
Fluidised bed drier	60	75	60
Fluidised bed drier	45	42	85

Effect of propagation stages: The activity of dry yeast has been found to be influenced in the method of inoculum development (Table 2). When reconstituted dry yeast was used as inoculum for 600 l fermentor and finally in 4000 l fermentor, the activity of the biomass was high enough. The lower activity for yeast grown in 2 stages may be due to the high growth rate and lack of maturity period. Yeast propagation in 3-4 stages may, therefore, be necessary to get dry yeast with enough activity.

Method of drying: The drying of yeast press cakes (76-77 per cent moisture) was facilitated by granulating in an oscillatory granulator to strands of 1-2 mm diameter. They were then loaded on trays for drying.

During drying of yeast at ambient temperature (25°C), the activity was lost rapidly when the moisture level fell below 20 per cent.

Yeast granules were dried at 30-35°C in an experimental through-flow dryer by passing air through a fixed bed. The moisture content was reduced to 8 per cent in 4-5 hr and the yeast had an activity of 90 per cent. Reed and Peppler[1] have reported a drying time of 3-4 hr in a 4 chamber continuous belt drier at an air temperature of 42, 41, 32 and 28°C. The drying time varied from 3-6 hr for an air temperature less than 45°C and yeast temperature less than 40°C, for US belt drier.

Yeast granules were also dried in a cross flow truck drier at 50-52°C at a tray loading of 1.0-0.75 kg per sft. The drying time was 4 hr and sufficient activity was noticed.

Granulated yeast was fed to batch fluidised bed drier at 20-25 kg of wet yeast and dried at 40-60°C. The material temperature was below 32°C. Drying time varied from 0.5 to 1 hr.

Drying conditions: Table 3 represents the comparative activity of yeast produced by various drying methods and drying conditions. The dry yeast got from fluidised bed drier at 60°C had low viability (60 per cent), whereas yeast dried at 40-45°C, had considerable viability. Initial caking of the granules occured and they were broken after 10-15 min operation. Cyclic variation of air temperature from 40-60°C also did not give yeast with enough activity. Reported values[5] indicate an air temperature of 46°C and a drying time of 120 min for commercial fluidised bed driers. It is important to keep the yeast temperature as low as possible.

Conclusion: From these studies, ADY can be produced by growing the yeast for 23 hr in 4 stages and conditioning it. Batch through-flow driers are satisfactory for small capacities, where the capital outlay is limited and fluidised bed driers operating at an air temperature of 45°C would be useful for large scale operation.

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RESEARCH NOTES

PRESERVATION OF HIGH MOISTURE PADDY WITH COMMON SALT

High moisture paddy harvested during rainy season in a Malnad village was mixed with powdered common salt and its preservative effect tested. Under the humid climate of Malnad (25-26°C and 85-90% RH), paddy with 30–35% moisture was preserved for two months with 2.5% salt when stored either in gunny bag or open heap. At 5% salt concentration, it was preserved for 3 months. After the cessation of the rain, the stored paddy was dried and milled. Milled rice contained less than 1% salt which did not acceptance, by consumers. affect its

Preservation of high moisture paddy is a serious problem especially in areas where the harvesting time coincides with the onset of monsoon. Several treatments such as acetic acid, ammonia, urea, bleaching powder, propionates and sodium chloride[1-9] have been suggested for prolonging the life of the moist grains. Among these, sodium chloride seems promising because of its universal availability and nontoxic nature, but the paddy becomes sticky and difficult to handle. Inspite of these drawbacks, it has been used succesfully in field trials. The preservative action of common salt on high moisture paddy under laboratory conditions in Mysore and field conditions in Malnad area of Karnataka, during the monsoon of 1980 is reported here.

Powdered common salt was mixed with 5kg of paddy of about 37 per cent moisture at 1-6 per cent levels. Moisture removed by exosmosis in the first 24 hr, and moisture content of paddy[10] after stroage for two weeks in cotton bags under ambient atmosphere were determined (Table 1). Mohr's titration method[11] was adopted for estimating the salt content of the grain. Known quantity of the grains were soaked in water overnight and the brine leached out from the grain, was collected by decantation with repreated washing. Salt content of this solution was determined and expressed as per centage of salt in the grain. The paddy treated with 1-4 per cent common salt developed foul smell possibly due to microbial attack. The paddy treated with 5-6 per cent common salt had normal colour and smell. It was found that removal of water from moist paddy by exosmosis was higher at 5-6 per cent concentration of salt. There was gradual moisture loss even in the untreated (control) paddy possibly due to small size of the sample. In subsequent trials, split dose application of salt, was made to 'assess' its efficacy for moisture removal and preservation of paddy. As 5 per cent salt was found to afford satisfactory preservative action, this amount of salt was added in split doses as indicated in Fig. 1 and the total volume of fluid drained from the paddy was collected and measured. Split dose application of salt did not enhance the removal of water from the paddy.

This was followed by large scale studies in a village near Shimoga in the Malnad area of Karnataka State. Two tonnes of freshly harvested paddy (var. 'Jaya') having 30-35 per cent moisture was mixed with 2.5 and 5 per cent levels of powdered common salt and the preservative action noted. The treated paddy was stored both in gunny bags and in open heaps. The field studies confirmed that under humid environment of Malnad (25-26°C and 85-90 per cent RH), even 2.5 per cent salt could preserve high moisture paddy for about two months. A second dosage at the end of two months

TABLE 1. EXOSMOSIS AND SALT RETENTION IN HIGH MOISTURE PADDY TREATED WITH COMMON SALT

Salt concn (%)	Brine drained in 24 hr. (ml)	Paddy moisture after 2 wk* (%)	Salt content of paddy after preservation* (%)
0	85‡	19.3**	ND
1	470	21.8	0.72
2	615	22.5	1.25
3	740	21.0	1.50
4	895	20.0	2.52
5	910	22.1	3.20
6	1080	21.9	2.99

*Wet. basis.

**Initial moisture of paddy: 37%

‡This is the volume of brine oozed out from the grains collected in a tray.

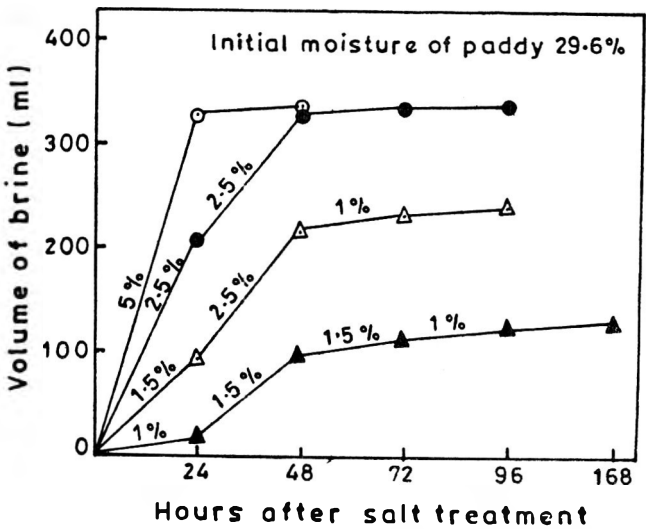

Fig. 1. Effect of split dose application of salt on rate of removal of brine from high moisture paddy

with 2.5 per cent salt further enhanced the storage life by one more month. Paddy treated with 5 per cent salt in a single dose also was preserved for 3 months. At the conclusion of the rainy season, corresponding to 2-3 months of storage representative samples of paddy were dried in the sun and shelled and milled in laboratory McGill sheller and miller respectively. A random sample of rice obtained from 5 per cent salt treatment showed that 1 per cent salt concentration was rather high as compared to the earlier observation.[8] This could be due to prolonged storage of paddy under high humidity or due to some unknown factors. The salt content in treated rice increased the cooking time from 15 min (untreated rice) to 18 min. The rice had very good taste as assessed by the local people to whom the rice was given for evaluation and also by the authors. The milling quality of the paddy was not altered. Encouraged by the results, many farmers adopted this method with advantage during the 1981 season.

While the preservative effect of common salt is highly useful, the salt solution sticking to grains imparts a moist and sticky appearance. This could be overcome by mixing the paddy with fine sand during drying followed by sieving.

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RAPID DETECTION OF SESAME OIL IN COLOURED FATTY FOODS

A rapid method for detection of sesame oil in coloured fatty foods has been developed. It consists of extraction of coloured oil from foods by acetone and acetonitrile mixture, cleaning up of extractants by passing through a column of activated charcoal and silanized glass wool layer and finally subjecting to modified 'Baudouin' test with concentrated eluants. This sensitive method can detect 10 mg of sesame oil per gram of sample.

Presence of sesame oil in fatty foods, is usually detected by the modified Baudouin test.[1,2] This test is not applicable to coloured sample, particularly those containing fat soluble colours which turn pink to red with the addition of HCl. Method[3,4] available for removal of such colours are not very effective and time consuming. In this communication, a simple and convenient method has been proposed for removal of oil soluble colours and subsequent detection of sesame oil in coloured fatty foods.

Glass column (0.75 cm I.D.) is filled with 1.4 g of silanized glass wool (Supleco Company, USA) topped with 2 cm column of activated charcoal.

The columns are pre-wetted with 6 ml of acetonitrile. One ml (or 1 g) of the fatty material is taken in a 50 ml iodine flask, 1 ml of acetone and 3 ml of acetonitrile are added and shaken vigorously in a mechanical shaker for 2 min and allowed to stand. The contents of the flask get separated into two layers, the upper layer is poured on the silanized glass wool column slowly. This extraction procedure is repeated three times. Finally, 1 ml of acetonitrile is passed through the column. All the eluants are collected and evaporated in a rotary flash evaporator. One ml of conc. HCl and 0.04 ml of furfural solution (2 per cent solution in ethanol) are added to the residue

and shaken for a while. Appearance of pink to red colour indicates the presence of sesame oil; the colour generated is stable even on dilution with equal volume of water. The method is sensitive and rapid. It can detect upto 10 mg of sesame oil in one gram of the fatty foods.

Appearance of colour by the Baudouin test is known to be due to the presence of sesamolin which yields sesamol on hydrolysis. In this method, sesamolin and sesamol are extracted from the sample along with some quantity of most of the colour. The colour and the interfering substances are eliminated by passing through the column.

Reproducible results are obtained if the column is not filled too tight or too loose (approx. 1.4 g of wool occupies 10 cm of the column). The length of charcoal should not be more than 2 cm and less than 1.5 cm as it has been observed in either case that the recovery and the elimination of interfering materials are adversely affected. The quantity of the sample under investigation should be about 1 ml or 1 g. With an increase of the size of the sample the adsorbent (the column diameter as well as length) should be increased.

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CHARACTERISTICS AND COMPOSITION OF *SIMAROUBA GLAUCA* D.C. SEEDS AND FAT

The seed fat of *Simarouba glauca* D. C. (Simaroubaceae) of Central American origin, is edible and used as a substitute for cocoa butter after fractionation. The characteristics and fatty acid composition of the seed and fat of an Indian grown variety were found similar to those found in other countries. The seeds consist of 40.0% kernel, which contain 60.3% fat, having an iodine value of 52.6 and saponification value of 190.5. The fatty acid composition (mol. %) is as follows: 16:0, 12:6; 18:0; 30:4; 18:1, 52.1; 1.9; 18:3, 1.3 and 20:0, 1.7.

The seed fat of Simarouba glauca D. C. (Simaroubaceae), the Aceituno tree (a native of El Salvador) are edible and find use as cocoa butter substitute after fractionation. It has been recently introduced into India from El Salvador by the National Bureau of Plant Genetic Resources at the Regional Station, Amravati, Maharashtra, and a seed sample from Amravati supplied by the Directorate of Oilseeds Development, Government of India, Hyderabad-500 029 was investigated.

S. glauca seeds are brown coloured and oval-shaped. The seed and fat characteristics given in Table 1 were determined according to the methods of the American Oil Chemists' Society.[1] The seeds contain 40.0 per cent kernels and the kernels contain 60.3 per cent fat. The odourless, greenish-yellow fat melted at 26.4°C, and had iodine value 52.6 and saponification value 190.5. Negative turbidity[2], picric acid[3] and Halphen[4] tests on the fat indicated the absence of hydroxy, epoxy and cyclopropene fatty acids respectively. Thin-layer chromatography of the fat and its methyl esters on silica gel G using hexane. diethyl ether: acetic acid (80:20:1, v/v/v) also showed the absence of unusual fatty acids. The fatty acid composition was determined as methyl

TABLE 1. CHARACTERISTICS OF *SIMAROUBA GLAUCA* D.C. SEEDS AND FAT

	Reported values Ref. 5	Ref. 7	Present work
Origin	El Salvador	Burundi	India
Seed characteristics			
Wt. of 100 seeds, (g)	—	—	35
Vol. of 100 seeds, (in n-hexane)	—	—	120
Kernel, (%)	30	—	40
Hull, (%)	70	—	60
Seed moisture (%)	14.0	3.7	8.3
Kernel moisture (%)	—	—	10.6
Hull moisture (%)	—	—	3.9
Oil in kernels, (%[a])	63.9	70.1	60.3
Oil in hulls, (%[a])	—	—	1.1
Protein in kernels, (%[a])	50.0	—	54.6
Protein in hulls, (%[a])	—	—	4.5
Ash in kernels, (%[a])	—	—	4.5
Ash in hulls, (%[a])	—	—	3.5
Kernel oil			
Refractive index, n_D^{40}	1.4596	1.4595	1.4552
Acid value	0.7	0.5	0.6
Iodine value	57.4	50.4	52.6
Saponification value	192.1	198.0	190.5
Unsaponifiable matter, (%)	0.4	0.4	0.3
Melting point, (°C)	28.0	27.0	26.4

[a]dry basis.

TABLE 2. FATTY ACID COMPOSITION (MOL. %) OF *SIMAROUBA GLAUCA* D.C. KERNEL FAT

	Reported values			Present work
	Ref. 5*	Ref. 7+		
	El Salvador	San Salvador	Burundi	India
Palmitic	33.5	11.6	11.4	12.6
Stearic		27.7	27.4	30.4
Oleic	62.6	55.0	57.4	52.1
Linoleic	3.5	3.9	1.9	1.9
Linolenic	0.4	—	0.2	1.3
Arachidic	—	1.8	1.5	1.7

*Alkali isomerisation method, others by gas chromatography.
+Also reported to contain 0.2% of 16:1.

esters using a Hewlett-Packard 5840A gas chromatograph fitted with a HF detector and coupled with a data processor. A glass column (2.0 m ×0.8 mm) packed with 10 per cent DEGS on chromosorb W HP and maintained at 200°C was used. The mole per cent composition was calculated from the weight per cent composition and is given in Table 2, along with other published values. The major fatty acids components are oleic (52.1 per cent) and stearic (30.4 per cent) followed by palmitic (12.6 per cent). The characteristics of fat and the fatty acid composition of the seed fat of the Indian origin do not significantly differ from those reported for seeds of other countries[5-7].

The protein in kernel is 54.6 per cent the protein but is not fit for feed purposes because of toxicity[5].

Considering the high fat content in the kernels and the moderate iodine value and high content of oleic and stearic acids, the fat has good potetnial for use as edible fat, or for blending with vanaspati, or for use as a cocoa butter substitute or as an extender, after suitable fractionation. *S. glauca* tree is, threrefore, worth cultivating on a large scale in forests and other-non-agricultural areas.

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A PRELIMINARY STUDY ON A TRADITIONAL INTERMEDIATE MOISTURE BEEF PRODUCT

The present study reports on the contribution of coconut sugar and salt in lowering the water activity (a_w) of a traditional Indonesian intermediate moisture (IM) beef product known as *dendeng*. The combination of coconut sugar and the spices coriander, garlic, tamarind and roots of greater galanga achieve a characteristic flavour of the finished product. This traditional IM meat has the potential as a base for modification into a variety of IM products.

Recently, there has been a resurgence of interest in IM products as human food and current research includes a search for new humectants and humectant combinations.[1-2] Some studies have also explored traditional IM meat products as reported by Labuza[3-4], Van der Riet[5] and Taylor.[6]

The spicy dehydrated meat known as *dendeng* is a traditional Indonesian IM beef product which incorporates coconut sugar, salt and spices. It is being produced at the cottage industry level for many years and has high acceptance in that country, possibly also in some regions in Asia. The coconut sugar and spices added give a characteristic flavour, which differentiates this product from other traditional IM meats such as *pemmican*, *biltong* and *jerky*. Attempts made to gain some information about the factors affecting the quality and stability of *dendeng* have been summarized here.

The composition of the soaking mixture for 1 kg meat (sliced round steak) was 200 g coconut sugar, 55 g cooking salt, 60 g coriander, 7 g garlic, 8 g tamarind, 2 g roots of greater galanga and 50 ml of water. The flow sheet for *dendeng* preparation is given in Fig. 1. The AOAC procedure for the determination of moisture content of meat and meat products was followed[7] and a Vaisala HM 11 electric humidity meter and probe calibrated against salt solutions of different saturation in the RH range of 52 per cent (sodium bromide) to

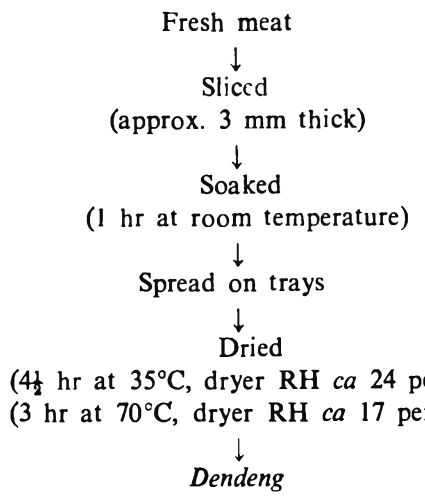

Fig. 1. Flow sheet of *dendeng* preparation.

97 per cent (potassium sulphate) was used for water activity (a_w) determination. The results are presented in Table 1. The dehydration at 70°C for 180 min or 35°C for 270 min resulted in moisture contents of 15-20 per cent. There was no significant variation in drying rate between the different treatments, but the a_w of the untreated dried sample dehydrated at 35°C for 270 min was 0.67, while the a_w of the other samples ranged from 0.52 to 0.60.

TABLE 1. MOISTURE CONTENT AND a_w OF MEAT SLICES SUBJECTED TO DIFFERENT TREATMENTS AND DRIED FOR 30 MIN. AT 35°C OR FOR 3 HR AT 70°C

Treatment to meat slices	Drying temp. (°C)	Drying time (min)	Moisture content (%)	Water activity (a_w)
Control	—	0	72.4	0.99*
	35	270	15.7	0.67
	70	180	15.4	0.55
Soaked in coconut sugar and salt	—	0	60.3	0.95
	35	270	16.6	0.57
	70	180	15.9	0.52
Soaked in spices	—	0	71.6	0.99*
	35	270	16.1	0.54
	70	180	20.4	0.55
Soaked in coconut sugar, salt and spices	—	0	56.3	0.93
	35	270	17.9	0.60
	70	180	14.6	0.57

*the sample was spoiled

It is evident from the results that the addition of coconut sugar and salt lowered of the moisture content and a_w of the products, while the spices did not contribute in any way. Sucrose and sodium chloride are safe and effective agents for reducing a_w levels in IM foods and sucrose, as the main component of coconut sugar, makes the major contribution to the reduction of the a_w of this product. The use of high concentrations of these humectants is limited only by organoleptic considerations. However, the combination of coconut sugar and spices imparted a characteristic flavour to the finished IM beef and the palatability and acceptability of the product was improved.

Samples were rehydrated for one week at room temperature in glass jars over salt solutions of seven different saturations in the RH range of 52 to 97 per cent. Meat slices which were rehydrated in atmospheres of high RH (85 to 97 per cent) resulted in having moisture contents and a_w in the range of 30 to 40 per cent and 0.74 to 0.93 respectively, as compared to untreated meat having a moisture content of 33 per cent and a_w of 0.96. Rehydrating at lower RH (52 to 80 per cent) gave moisture contents and a_w in the range of 15 to 28 per cent and 0.60 to 0.80 respectively, as compared to untreated meat with a moisture content of 15 per cent a_w of 0.62. Presumably, some of the sugar and salt remaining on the surface get bound to other food components and form an amorphous solid when drying is sufficiently rapid. If these products are exposed to conditions of high relative humidity, an uptake of water will occur and can increase the moisture content of the products.

Further studies are contemplated on the storage stability of traditional and modified *dendeng* products in terms of rancidity, protein quality (eg changes in available lysine), non-enzymic browning and microbiological quality. The aim of this work was to produce IM products which show either increased storage stability, increased nutritional quality or less costly to manufacture and distribute to local populations, or in which some of the meat is substituted by less expensive and readily available local ingredients such as corn grits or breadfruit.

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PRODUCTION OF THERMOSTABLE DEOXYRIBONUCLEASE AND ENTEROTOXINS BY *STAPHYLOCOCCUS AUREUS* IN *KHOA* DURING STORAGE

Thermostable deoxyribonuclease and detectable levels (2 μg) of enterotoxins were produced by strains of *Staphylococcus aureus* in Khoa having different moisture levels (26-48%) and kept for a week at room temperature (25-35°C).

Strains of *Staphylococcus aureus* are of public health importance in view of their ability to elaborate thermostable enterotoxins and deoxyribonuclease (TDNase) in various foods including indigenous milk products, the consumption of which would result in food poisoning outbreaks. Among the several Indian milk products, *Khoa* (concentrated milk) having a moisture level of 26-28 per cent is widely consumed and used in the preparation of Indian milk sweets. This milk product is exposed to *Staphylococcal* contamination, due to manual handling of the product.

Incidence of *Staphylococci*, including enterotoxigenic strains have been reported to be high in market *Khoa*.[1-3] It has been reported that there is production of enterotoxin in raw and pasteurised milk and cheese, if the products have high initial load of *S. aureus*[4-9]. The present study was undertaken to find out the ability of *S. aureus* cultures to produce enterotoxins and TDNase, if inoculated into samples of *Khoa* having 3 levels of moisture and stored under natural conditions.

The test cultures included (*i*) three wild isolates of *S. aureus* (K-283, K-192 and K-220) isolated from samples of market *Khoa*.[1] of which K-283 and K-192 produced enterotoxins A and E, respectively, while K-220 produced toxins A,B,D and E and (*ii*) one standard strain A_{100} producing toxin A only. The wild isolates were identified according to the procedure described by Baird-Parker.[10] Individual enterotoxins were detected by optimal sensitivity plate method of Robbins *et al.*[11]

The test organisms were grown in 3.7 per cent brain heart infusion (BHI) broth for 24 hr at 37°C and centrifuged at 10,000 r.p.m. for 20 min. The resulting supernates were discarded and the cells were suspended in sterile 0.9 per cent saline, to give 50 per cent transmittance at 600 nm. Serial dilutions were then prepared and plated on egg yolk-tellurite-glycine-pyruvate agar (ETGPA) of Baird-Parker[12] to determine the colony forming units (CFU) in their respective dilutions.

One litre aliquots of good quality raw cow's whole milk were boiled in an open pan (*Karahi*) over fire with continuous stirring till the product reached a pasty consistency. The pan was removed after scraping and contents allowed to cool down to room temperature. During processing precautions were taken to avoid microbial contamination. The final product was stored in previously sterilised glass stoppered bottles.

Khoa samples having moisture levels of 26-38 per cent (low), 38-42 per cent (medium) and 45-48 per cent (high), were prepared, by utilizing sterile glass distilled water wherever necessary. One hundred g quantities of *Khoa* were inoculated with the test cultures at levels of 1×10^3CFU/g. Inoculated samples were incubated at room temperature-RT (25-35°C) and at 4-5°C and analysed for TDNase and enterotoxins, periodically upto 1 week. Samples stored at RT were analysed. Uninoculated *Khoa* samples served as controls. Test samples of *Khoa* were not enumerated for staphylococcal counts. Fresh *Khoa* prior to inoculation with *S. aureus* test cultures were analysed for total bacterial counts by pour plate method using tryptone yeast extract dextrose agar, staphylococcal counts by surface plating of the appropriate dilutions of the samples on ETGPA of Baird-Parker[12] and also for the presence of TDNase and enterotoxins.

The method of Read *et al.*[13] for the extraction of enterotoxins from cheese was followed for the extraction of TDNase from *Khoa* with a slight modification. Dilutions (10^{-1}) of *Khoa* in 2 per cent sodium citrate buffer were centrifuged at 10,000 r.p.m. for 30 min, and the resulting supernatants were acidified to pH 4.5 with 6N HCl and again centrifuged at 10,000 rpm for 30 min. The resulting supernatant fluids were neutralised to pH 7.0 with 1N NaOH and then steamed for 15 min, followed by centrifugation at 10,000 r.p.m. for 20 min. The final supernatant fluids were screened for TDNase by the toluidene bluedeoxyribonucleic acid (TB-DNA) agar plate method of Lachica *et al.*[14]

Optimal sensitivity plate method of Robbins *et al.*[11]

TABLE 1. PRODUCTION OF TDNASE AND ENTEROTOXIN(S) BY *S. AUREUS* IN KHOA DURING STORAGE

Storage period (days)	Storage temp. (°C)	K-283		K-192		K-220		A_{100}	
		TDNase* (mm)	Ent. toxin	TDNase (mm)	Ent. toxin	TDNase (mm)	Ent. toxin	TDNase (mm)	Ent. toxin
Moisture level 26–28%									
2	25–35	20	A	18	E	18	AB	14	A
4	25–35	24	A	24	E	24	AB	20	A
6	25–35	24	A	24	F	24	ABE	20	A
7	25–35	24	A	24	E	24	ABE	20	A
7	4–5	Nil	Nil	Nil	Nil	Nil	B	Nil	Nil
Moisture level 38–42%									
2	25–35	20	A	22	E	20	ABE	16	A
4	25–35	22	A	22	E	20	ABE	20	A
6	25–35	22	A	24	E	22	ABE	24	A
7	25–35	24	A	24	E	22	ABE	24	A
7	4–5	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Moisture level 45–48%									
2	25–35	24	A	24	F	22	AB	15	A
4	25–35	24	A	24	E	22	AB	18	A
6	25–35	25	A	25	E	22	AB	22	A
7	25–35	25	A	25	E	22	AB	24	A
7	4–5	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

*Zone diameter includes initial diameter of well (5mm) on TB-DNA agar plates.

Khoa was free from TDNase and enterotoxins prior to inoculation.

was adopted for screening for enterotoxins A,B,C,D, & E in acidified samples mentioned above.

Fresh *Khoa* was free from *S. aureus*, enterotoxins and TDNase.

The results presented in Table 1 show that all the test cultures of *S. aureus* produced TDNase during storage of incoculated *Khoa* samples within week. The levels of TDNase produced by different wild cultures of *S. aureus* were almost the same as evidenced by the zone diameters which ranged from 18 mm after 2 days to 25 mm after 6 days of storage. However, the levels of TDNase produced by the standard strain A_{100} was slightly less as compared to the wild cultures. The varying levels of moisture in *Khoa* showed no appreciable effects on the levels of TDNase produced by the cultures. The TDNase increased rapidly during the first 4 days of storage after which its increase was only marginal. All the four test cultures of *S. aureus* failed to produce TDNase in *Khoa* samples stored at RFGT for a week. Control samples also were negative for the presence of TDNase. Presence of TDNase (zone diamter of 10-12 mm) in market *Khoa* samples reported' earlier were due to contamination of *Khoa* with *Staphylococci* after processing.

The data presented in Table 1 also reveal that detectable levels (2μg) of enterotoxins) are produced by *S. aureus* during storage of *Khoa* at RT. Quantification of toxins was not performed. The wild cultures of *S. aureus* K-283 and K-192 and the standard strain A_{100} produced their respective enterotoxins A,E and E. The other wild type K-220 which was capable of producing more than one enterotoxin maintained its character in Khoa also. Although toxin D was produced by K-220 in BHI broth, the same was not detected in *Khoa* during storage. There was no appreciable effect of the varying moisture levels on enterotoxin(s) production by *S. aureus* cultures in *Khoa*, except in case of wild isolate K-220. In the presence of low moisture level, toxins A and B were produced during the first 4 days of storage and subsequently there was the appearance of E. However, in *Khoa* with medium moisture level, toxins A,B and E were detected throughout the period of storage. In the presence of higher moisture level, toxin E was not detected, whereas toxins A and B were detected during the entire period of storage.

In RFGT stored samples, cultures K-283, K-192, K-220 and A_{100} did not produce their respective enterotoxins, however, toxin B was produced by K-220 in low

moisture *Khoa*. Control samples were negative for the presence of enterotoxin(s). Enterotoxin(s) detected in *Khoa* during storage were those produced by *S. aureus* cultures, since the samples prior to inoculation were negative for the presence of toxins.

Since no attempts were made to quantify the enterotoxins produced by the cultures in *Khoa*, it cannot be stated as to whether there was an increase in the concentration of toxins as the storage period progressed. Although the effect of water activity on production of enterotoxins A and B has been studied[15,16], the variation in toxin production by K-220 in the present study cannot be attributed to the role of water activity, since work on this line was not carried out in this investigation.

In view of the ability of *S. aureus* cultures to elaborate TDNase and enterotoxins in *Khoa* during storage, hygienic practices are to be strictly enforced in the *Khoa* industry at all stages of manufacture and distribution.

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A NOTE ON LACTOSE FERMENTING YEASTS IN MILK PRODUCTS

Milk products were analysed for lactose and non-lactose fermenting yeasts. *Dahi* and cheese-whey contained only non-lactose fermenting yeasts, whereas cream and butter contained both types, the majority being non-lactose fermenting yeasts. All the lactose fermenting yeast isolates were identified as *Candida pseudotropicalis*.

Lactose fermenting yeasts have been extensively used, along with lactic cultures in the preparation of alcoholic fermented milk products such as *kefir* and *koumiss* and for the production of alcohol and single cell protein from whey. Both lactose fermenting and non-lactose fermenting yeasts have been isolated from different dairy products.[1,2] *Candida pseudotropicalis*, a lactose fermenting yeast, has been isolated from yoghurt[3] and from camembert cheese[4] along with other lactose fermenting yeasts such as *Saccharomyces fragilis*, *Saccharomyces lactis*, *Torulopsis sphaerica* and *Brettanomyces* species. The results of a study of the incidence and characteristics of lactose fermenting yeasts in milk products collected from Bangalore city, India, have been reported in this note.

Samples of cream (3), unsalted *desi* butter (4) and *dahi* (5) were procured from the market while cheese-whey samples (4) were obtained from NDRI, Bangalore. All the samples were plated using malt extract agar (MEA) of pH 3.5 and the plates were incubated at 30°C

TABLE 1. ISOLATION AND IDENTIFICATION OF YEAST FROM MILK PRODUCT

Milk Product	Sample No.	Yeast & mold count/ml.	No. of isolates examined	No. of non-lactose fermenting isolates	No. of lactose fermenting isolates	Identification
Cream	1	4,500	5	5	0	
	2	80,000	9	8	1	
	3	128,000	14	13	1	
Butter	1	39,000	5	3	2	*Candida pseudotropicalis*
	2	8,500	9	7	2	
	3	43,000	5	4	1	
	4	7,000	8	8	0	
Dahi	1	50	3	3	0	
	2	45	4	4	0	
	3	202,000	16	16	0	
	4	108,000	11	11	0	Non-lactose fermenting yeasts were not identified
	5	8,100	10	10	0	
Cheese-whey	1	50	5	5	0	
	2	40	4	4	0	
	3	70	7	7	0	
	4	90	9	9	0	

for 48 hr. After determining yeast and mold count, selected colonies (about 10 per cent of the colonies present in the plate) were picked and transferred to malt extract broth. The cultures were purified using standard procedures. The purified isolates were maintained in MEA slants. Individual isolates were streaked on MEA and their colony characters and cell morphology were noted. Pellicle and ring formation were observed in malt extract broth. The spore forming ability was assessed by growing the cultures on sodium acetate agar slants, incubated at 30°C for 7 days.[5] Fermentation characteristics were assessed by growing the organism in fermentation basal medium and observing production of acid and gas after 7 days.[6] Auxanographic method was followed for the detection of assimilation of sugars and nitrate.[6] The ability of the cultures to use alcohol as the sole carbon source was determined by growing them in medium containing ammonium sulphate (0.1 per cent), KH_2PO_4 (0.1 per cent), $MgSO_4 7H_2O$ (0.05 cer cent) and alcohol (3 per cent, v/v). Acid production of the isolates was noted by plating the cultures in calcium carbonate-yeast-glucose agar and observing the dissolution of calcium carbonate around the yeast colonies.[6]

All the samples contained yeasts and molds with the viable counts ranging from 40 to 128,000 cells/ml. It was interesting to note that the cheese-whey samples contained very few organisms. The majority of the colonies were found to be yeasts as confirmed by microscopic examination. All the isolates were first checked for lactose fermenting ability. None of the yeasts isolated from *dahi* and cheese whey were found to be lactose fermenting type (Table 1). Among the 28 isolates obtained from cream, only 2 isolates were capable of fermenting lactose. Of the 27 isolates obtained from butter, 5 were found to ferment lactose. All the 7 lactose fermenting isolates produced cream to yellowish white, soft and smooth colonies on MEA. Microscopic examination revealed that the cells had oval shape, and showed budding with no ascospore formation. All the isolates formed thin ring on the surface and sediment at the bottom in broth cultures. They fermented and assimilated inulin, lactose, glucose, galactose, sucrose and raffinose. None fermented or assimilated maltose and potassium nitrate. Only two isolates (obtained from cream) utilized ethanol as sole source of carbon. Acid production was observed in three isolates only. Based on these characteristics, all the seven isolates were identified as *Candida psuedotropicalis*.

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SOME NON-TOXIC MATERIALS AS WHEAT PROTECTANTS AGAINST *RHIZOPERTHA DOMINICA*

Five non-toxic materials, silica gel, aluminium silicate, pyrophyllite, talc and neem seed kernel powder were studied for comparative efficacy and persistence against *Rhizopertha dominica*. Silica gel, pyrophyllite and talc provided 100 per cent kill of the insects in wheat, exposed to these materials for a month. Silica gel proved the best and neem (*Azadaracta indica L.*) seed kernel powder least in preventing internal infestation of the grains. The loss observed in grains treated with silica gel was 13-15 times lower than in the control. The persistence of non-toxic materials was in the order of silica gel, aluminium silicate, neem seed kernel powder, talc and pyrophyllite.

Among 1000 species of known insect pests of storage, *Rhizopertha dominica* causes extensive damage. Toxicants, though effective against storage pests are not being widely used on account of their residual effect. Various workers[1-4] have evaluated the non-toxic materials as grain protectants. Use of inert materials in place of toxic materials is advantageous in many ways especially from the health point and the cleaning processes such as sieving and washing adopted by house wives are sufficient to separate these materials. The present investigation was undertaken to study the control of *R. dominica* in 'HD 2009' variety of wheat with commonly available non-toxic materials like aluminium silicate, neem seed kernel powder, pyrophyllite, silica gel and talc under ambient conditions in Hissar.

The test insect, *R. dominica* was reared at a temperature of 33±2°C and at a relative humidity of 70-80 per cent as described by Solomon.[5] Test materials which were dusts or powders, passing through 30 mesh sieve were used at 1 to 2 per cent level (1 and 2g/100 g of wheat) against 5 to 10 day old *R. dominica*. Wheat and non-toxic materials were mixed well in a test tube.

Twenty insects, 5-10 day old were introduced into the treated tubes and open ends of the tubes were covered with muslin cloth. Five tubes for each material alongwith 5 control tubes were placed in a BOD incubator maintained at required temperature and relative humidity. Observations on comparative efficacy were recorded after one month which were based on the percentage mortality of the insect and per cent loss based on the number of grains infested and weight of the damaged grains. For persistence studies, 30 g of samples were drawn from treated grains at 10 day intervals for first 30 days and at 20 days, thereafter. Percentage mortality was recorded after 72 hr.

Data in Table 1 indicate that all the non-toxic materials except neem seed kernel powder provided good protection against *R. dominica*. The results with silica gel are in agreement with those of Khare and Agarwal[3] and Chiu[1] who reported crystalline silica to be the most effective of the six dusts, namely, magnesium carbonate, amorphous silica, crystaline silica, bentonite, talc and walnut shell powder against granary weevil in rice. Results obtained with neem seed kernel powder are in agreement with those achieved with neem parts against larvae of *Tribolium castaneum*, *Tribolium granarium* and adults of *R. dominica*.[1]

TABLE 1. MORTALITY OF *R. DOMINICA* IN GRAINS TREATED* WITH NON-TOXIC MATERIALS

Material	% kill at indicated levels		Mean
	1%	2%	
Al. silicate	83.33 (61.18)	90.00 (70.24)	85.00 (65.71)
Neem seed kernel powder	55.00 (27.36)	63.33 (36.76)	59.16 (32.06)
Pyrophyllite	99.90 (88.19)	99.90 (88.19)	99.90 (88.19)
Silica gel	99.90 (88.19)	99.90 (88.19)	99.90 (88.19)
Talc	99.90 (88.19)	99.90 (88.19)	99.90 (88.19)
C.D. at 5%			(11.44)

Figures in parentheses are means of angular transformation.
*Exposed for one month.

TABLE 2. EFFECT OF VARIOUS NON-TOXIC MATERIALS AS WHEAT GRAIN PROTECTANT AGAINST *R. DOMINICA*•

Material	Level tried (%)	Av % infested grains		Av treatment mean	
		Number	Weight (g)	Number	Weight (g)
Al silicate	1	0.91 (5.30)	1.07 (5.64)		
	2	1.53 (7.22)	1.11 (5.35)	1.22 (6.26)	1.09 (5.99)
Neem seed kernel powder	1	1.82 (7.95)	1.38 (6.92)		
	2	2.49 (9.03)	1.47 (7.03)	2.15 (8.49)	1.43 (6.97)
Pyrophyllite	1	0.90 (6.80)	0.33 (4.66)		
	2	0.38 (3.70)	0.57 (4.68)	0.64 (5.19)	0.45 (4.57)
Silica gel	1	0.19 (2.92)	0.28 (3.55)		
	2	0.05 (2.06)	0.05 (2.25)	0.12 (2.49)	0.16 (2.90)
Talc	1	0.57 (4.48)	0.67 (5.00)		
	2	0.52 (4.41)	0.71 (5.10)	0.54 (4.44)	0.69 (5.05)
Control	1	1.34 (8.14)	1.58 (8.11)		
	2	2.31 (7.17)	2.53 (6.37)	1.82 (7.66)	2.05 (7.24)
C.D. at 5%				(1.87)	(2.16)

Figures in parentheses are means of angular transformation.

•Exposure period is one month.

Silica gel was found to be the best and neem seed kernel powder the least effective in controlling the loss due to lesser grain borer (Table 2). Silica gel treatment resulted in 13-15 times more reduction in grain damage than in control. Neem seed kernel powder being a poor antifeeding agent[4] against *R. dominica* can gave similar results as that of Girish and Jain.[4] The order of persistence was silica gel>aluminium silicate>neem seed kernel powder>talc>pyrophyllite (Table 3). In general, higher concentrations showed better performance. Jotwani and Sircar[2] reported that the protection offered to wheat seeds against *R. dominica* was about 321 days, when treated with neem seed kernel powder.

As the particle size is reduced from 10 to 1 μ, the effectiveness increases.[6] The size of the tested silica gel was 0.1 μ and hence this may be one of the reasons for its effective action against *R. dominica*. Silica gel having good abrasive ability and being comparatively harder

TABLE 3. PERCENTAGE KILL OF *R. DOMINICA* IN GRAINS TREATED WITH VARIOUS NON-TOXIC MATERIALS AT DIFFERENT INTERVALS

Material	Percentage kill at indicated interval (days)				
	10	20	30	50	Mean
Al silicate	42.50 (42.56)	48.83 (44.40)	20.83 (25.18)	81.33 (14.31)	30.34 (31.61)
Neem seed kernel powder	4.99 (10.79)	11.70 (16.07)	3.75 (10.53)	2.50 (6.18)	5.74 (19.86)
Pyrophyllite	4.99 (11.13)	6.90 (12.21)	2.50 (6.47)	1.67 (4.61)	4.02 (8.60)
Silica gel	92.03 (77.97)	89.37 (73.97)	74.43 (60.45)	38.00 (38.10)	73.54 (62.63)
Talc	11.33 (19.31)	10.85 (13.97)	3.37 (9.07)	1.67 (4.60)	6.80 (11.74)
C.D. at 5%		(11.06)			(5.51)
Av. interval mean	31.17 (32.35)	33.04 (33.12)	20.98 (22.34)	10.50 (13.56)	
C.D. at 5%		(4.94)			

Figures in parentheses are means of angular transformation.

than other materials tested could absorb or in some way disrupt the water resistant epicuticle and thus promote water loss and hence cause quicker death. The insecticidal action of silica gel due to its sorptive properties was reported by Majumder and Venugopal.[7]

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DECAMETHRIN RESIDUES FROM TEA LEAVES AND THEIR TOXICITY TO HOUSEFLIES

Decis, a 2.8% emulsion of decamethrin, was sprayed on tea leaves in the field and toxicity of the residues to houseflies was determined periodically upto 7 days, by topical application. From the data, concentration of decamethrin in tea leaves was calculated using the toxicity curve obtained from using decamethrin as standard. The results indicate a rapid fall, both in toxicity and concentration of decamethrin, suggesting thereby that it was not persistent under humid climatic conditions. The decrease in concentration of decamethrin was upto 79.5% in 6 days.]

Decamethrin, one of the most potent recently developed insecticide was first synthesized by Elliot *et al.*[1] in 1974 as a single pure isomer (m.p. 100°). It is highly

toxic to several important crop pests at dosages of 5-20 g/ha.[2] In view of its high toxicity to insects, there is a need to define its stability and degradation mechanism under a variety of conditions. Many reports on the degradation of decamethrin on the leaf surface, glass, silica gel, soil and water are available both under laboratory and field conditions.[2-5] From these reports, it is evident that the photodegradation products of decamethrin are less toxic than decamethrin itself. The persistance of decamethrin on leaf surfaces and in food commodities is, therefore, of great concern, since it prevents use of food commodities for human consumption. The results of our work on the toxicity of decamethrin residues from tea levaes to houseflies are reported here.

Technical grade decamethrin (99 per cent) was obtained from Roussel Uclaf Procida, Paris (France). This was used in preparing the standard curve of decamethrin toxicity against 3-4 days old female houseflies (Fig. 1.). Decis, a 2.8 per cent emulsion concentrate (EC) of decamethrin, which was used for spraying on tea leaves, was supplied by Hoechst Pharmaceuticals Limited, Bombay (India).

The experiment was conducted at Borbhetta Field Experimental Station, Assam, which has a hot humid climate. The relative humidity varied from 83 to 92 per cent and the average temperature was 28.99°C during the experimental period. The experimental area consisted of three blocks. A, B and C each having four plots; each plot was 150 sq. metres. Decis was sprayed in blocks A and B on a 13 year old tea crop at the rate of 11.2 g and 16.8 g per hectare (active ingredient) respectively. The block C, which was 100 m away from the control received no decamethrin. Each plot consisted of 135 bushes. Green leaves (two and a bud) were plucked from each plot after 1, 2, 4 and 7 days of application of Decis. The samples were prepared by CTC (crushing, tearing, curling) method.

For toxicity studies 5 to 6 g tea leaves were soaked in 30 ml of acetone for 24 hr, and the extract separated. The residue was washed five times with 15 ml of acetone. The combined extract was concentrated to a known volume and applied topically to 3-4 days old female houseflies using an agla micrometer syringe[6]. The mortality counts were taken after 24 hr (Fig. 1.).

The results of toxicity studies with decamethrin residues from tea leaves were subjected to probit analysis[7]. The regression equation obtained was used to draw the probit kill *vs* concentration graph. These are presented in Fig. 2. The LD_{50} values calculated from the regression equation are given in Table 1. These values show an increase with time indicating there by gradual fall in toxicity. It is reported that mixtures of decamethrin photoproducts from solution and solid phase reactions are much less toxic than decamethrin. Fresuming that the toxicity of the residues was mostly

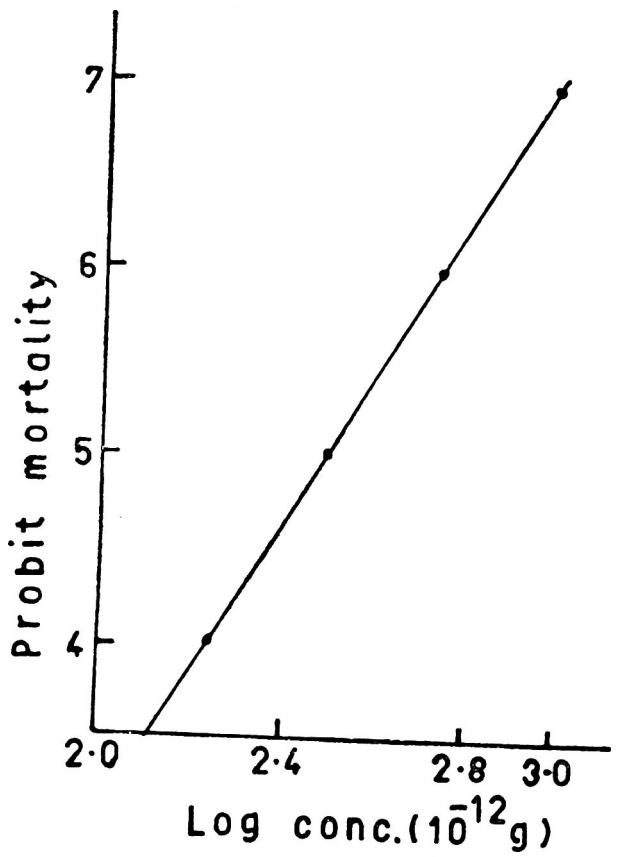

Fig. 1 Toxicity curve for standard decamethrin.

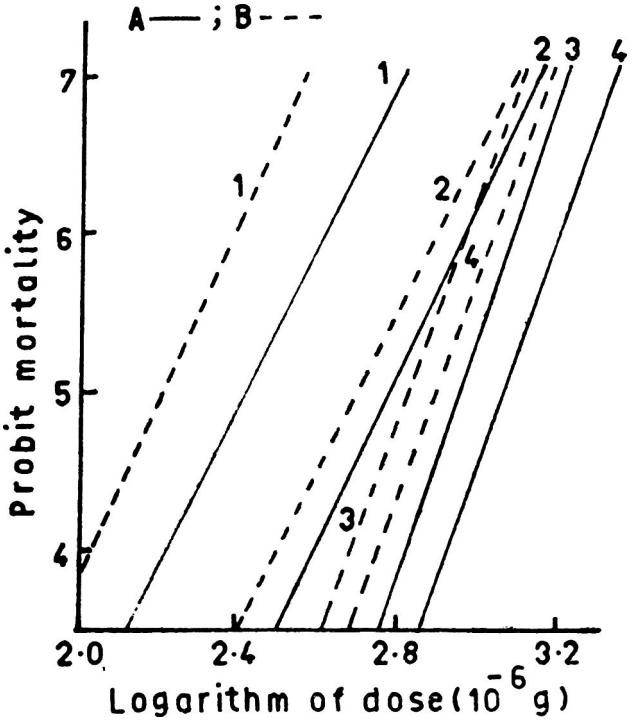

Fig. 2. Toxicity of decamethrin residues from tea leaves to houseflies.

TABLE 1. TOXICITY OF DECAMETHRIN RESIDUES FROM TEA LEAVES TO HOUSEFLIES*

Treatment	Dose (ml/ha)	Time of sampling (days)	LD_{50} (g tea leaves per fly)	Decamethrin residues (Bioassay) (ppm)
A-1	400	1	275.4	1.1290
B-1	600	1	169.8	1.8286
C-1	—	1	—	Nil
A-2	400	2	631.0	0.4920
B-2	600	2	524.8	0.5916
C-2	—	2	—	Nil
A-3	400	4	944.1	0.3288
B-3	600	4	707.9	0.4386
C-3	—	4	—	Nil
A-4	400	7	1202.0	0.2583
B-4	600	7	831.8	0.3732
C-4	—	7	—	Nil

Decis emulsion concentrate used was 2.8% in all cases
*—Average of four replications each of 25 insects
C-1, C-2, C-3 and C-4 represent control.

due to decamethrin *per se*, the concentration of decamethrin residues in tea leaves was calculated by comparing LD_{50} of the sample with that of standard decamethrin. For example, the LD_{50} for A_4 and B_4 are 1202 g and 831.8 g per fly respectively (Table 1). The LD_{50} for standard decamethrin is 0.3105 ng/fly (Fig. 1). This means 1202 g of A_4 and 831.8 g B_4 will contain 0.3105 ng of decamethrin. Concentration of decamethrin in all samples was calculated similarly and the results are presented in Table 1. These results indicate 77.13 and 79.55 per cent loss of decamethrin from A and B blocks, respectively during a period of six days. Barlow *et al.*[8] working on degradation of decamethron in Ugandan soils observed an half life of 10 days at 80 per cent relative humidity. Ruzo *et al.*[3] observed under green house and field conditions 70.66 per cent and 93.99 per cent loss of decamethrin respectively from cotton leaves in two weeks. These workers suggested that the decamethrin loss observed in their work was either due to volatilization or degradation on the cotton leaf surface. Likewise, it is probable that the fall in toxicity of decamethrin residues from the tea leaves, observed in the present study may be due to its degradation, volatilization or photoisomerization to less toxic trans-isomer. The rate of loss of decamethrin appears to be little more in the present studies than that observed by Ruzo *et al.*[3] This may be due to higher tropical temperature.

It could be concluded that under hot humid climate the photo-degradation of decamethrin on tea leaves is quite rapid and the possible mixtures of decamethrin photoproducts are much less toxic to houseflies than decamethrin itself.

The authors are thankful to Hoechst Pharmaceuticals Limited, India for conducting the field experiment and preparing the tea leaf samples for toxicity studies. Grateful thanks are also due to Dr. B.L. Amla, Director of the Institute, for his keen interest in the present investigation.

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BOOK REVIEWS

Nutrition Policy Implementation-Issues and Experience: Edited by Nevin. S. Scrimshaw and Mitchel. B., Wallerstein Plenum Press, New York and London, 1982; pp. 558; Price, $ 65.00

This excellent, thought provoking compendium is the out come of a workshop on nutrition policy and planning activities organised to assess what has been learned about the implementation of food and nutrition policies since the start of MIT's International Nutrition Planning Programme (INP), a multi disciplinary undertaking established in 1972, under an aid from the Rockfeller Foundation and the USAID issues the 211D programme. The actual conduct of research was undertaken at MIT with respresentatives from the Departments of Economics, Political Science, Urban Studies, Humanities and the like. The Workshop was co-sponsored by the Ford Foundation and the United Nation's University's World Hunger Programme.

The main aim of the Workshop was to identify and evaluate the progress achieved in specific programmatic areas during the 8 year period. Six key topics formed the bases for discussion: on the latest scientific evidence on the synergistic relationship between nutrition and infection, impact of nutrition on learning and behaviour, and on work performance, providing a rationale for investment in nutrition programmes, areas of food fortification; supplementary feeding and formulated food Integrated, multi sectoral, village level interventions, Small farm agricultural systems, food conservation and post-harvest food losses and food price controls and consumers subsidies were the areas discussed at length.

Research experts in the different fields presented detailed papers on the different areas. The discussions were initiated by equally qualified and eminent researchers and nutrition scientists. The presentations, deliberations and summaries have been brought out in this volume on nutrition policy. An array of stratagies have been suggested depending upon the individuality of the problem and that of each nation. The publication points out that nutrition policy in any country can be developed only with a multisectoral approach, the major interacting sectors being, health. social sciences, agriculture, economics, rural development, housing, water supply and education. The components of national nutrition policy should be the felt needs of the community and its implementation should encompass the grass-root functionaries and top-level committed policy makers. It is easy to think out policies and much information is available to do so. But the actual need today is proper implementation of the policy. The publication brings out clearly the fundamental difficulties encountered in food and nutrition policy making. First hand information on the do's and don'ts of policy making is provided for and the deliberations focus attention on the lack of international attention on the interlace between policy and planning on the one hand, and between programme implementation and operation on the other.

The conclusion reached was a plea to the social and physical scientists alike and to those in policy analysis and programme administration, to identify the ingredients for successful nutrition programme implementation in the near future and to disseminate speedily the knowledge to make difference in policy making and its proper implementation. The book is an excellent resource material for all administrators, researchers and social scientists in the multisectoral areas of nutrition policy implementation. It carries a fund of valuable information on the current issues and problems existing in different countries under varied situations.

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THE AVINASHLINGAM COLLEGE OF HOME SCIENCE COIMBATORE

Selected Markets for the Essential Oils of Lime, Lemon and Orange: By S R J. Robbins, Report No. G-172, Tropical Development and Research Institute, London March 1983: pp vii+99 Price £ 3/-.

Selected Markets for the Essential Oils of Lemongrass, Citronella and Eucalyptus: By S. R. J. Robbins, Report No. G-171, Tropical Development and Research Institute, London, March 1983; pp vii+91; Price £ 2.80.

The citrus oils are very important group of essential oils, particularly on account of their application in the fast-growing soft drinks industry. The first of the above two reports deals with the essential features of current supply and demand of lime, lemon and orange oils. Also, the report highlights the developing trends and their implications for producers in developing countries, both actual and potential. The report is divided into six sections and three appendices. The subjects covered in these section are principal sources, description, production, processing usage, imports and exports, impact of synthetics and legislation. The appendices include statistical tables, specifications for these oils and the addresses of firms handling or trading in citrus oils.

The essential oils of lemongrass, citronella and eucalyptus are considered as large-volume oils used in a very wide range of perfumery products and to a smaller extent in flavours. The second of the above report contains a review of recent market trends and their implications for the future of these essential oils and for both existing and potential producers. The report contains four sections and three appendices. The topics covered in these sections are description, uses, principal sources, production, marketing and trading structures for lemongrass oil, citronella oil and eucalyptus oil. Statistical tables, quality assessment and standard specifications for these oils, along with firms in the essentail oil trade are included in the appendices.

These two reports should serve as very useful guides for all those engaged in production, utilisation and marketing of essential oils. Also, these reports will be very valuable additions to the library used by research workers.

N. B. SHANKARACHARYA
C F T R.I., Mysore.

ASSOCIATION NEWS

Ludhiana Chapter

The Annual General Body Meeting was held on 18th June 1983 and the following Office-bearers were elected: *President*—Dr. K. S. Sekhon, *Vice-President*—Mr. O. P. Beerh, *Secretary*—Dr. K. L. Bajaj, *Jt. Secretary*—Dr. R. Pal Singh and *Treasurer*—Dr. K. S. Sandhu.

Poona Chapter

The Annual General Body Meeting was held on 30th June 1983 and the following Office-Bearers were elected: *President*—Dr. W. B. Date, *Vice-President*—Dr. (Mrs) P.P. Kanekar, *Secretary*—Mr. A. B. Seal and *Treasurer*—Dr. S. B. Bhosale.

Delhi Chapter

It has been decided to hold meetings on every Friday preceeding 2nd Saturday of the month at 5.30 pm in YMCA, Jai Singh Road, Delhi. Any member of AFST(I) who happens to be at Delhi on that day is welcome to attend the meeting.

Trivandrum Chapter

The Annual General Body Meeting was held on 15th July 1983 and the following Office-bearers were elected: President—Dr. C. Balagopalan, Vice-President—Mr. P. R. Rajendranathan Nair, Secretary—Mr. S. V. Ramakrishna, Jt. Secretary—Dr. N. S. Murthy, and Treasurer—Mr. N. Gopalakrishnan.

Calcutta Chapter

The 23rd Annual General Body Meeting was held on 18th April 1983 and the following Office-bearers were elected: President—Mr. K. R. Narasimhan, Vice-President—Dr. D. K. Chattaraj, Secretary—Dr. S. C. Chakravorty, Jt. Secretary—Mr. Amit Ghosh and Treasurer—Dr. S. K. Mukherjee.

Madras Chapter

The Annual General Body Meeting was held on 6th May 1983 and the following Office-bearers were elected: President—Dr. K. S. Holla, Vice-President—Prof. A. Srinivasan, Secretary—Mr. K. L. Sarode, Jt. Secretary—Mr. D. Ratna Singh, Treasurer—Mr. T. John Lazarus and Editor—Mrs. Malathi Mohan.

AFST(I) Headquarters

Has decided to organise the following two Colloquia at CFTRI, Mysore

1. *Aseptic Packaging of Food Products*

Half-a-day Colloquium in the forenoon of 28 November 1983,

2. *Current Trends in Ethanol Production*

One-day Colloquium on 16th January 1984

Only invited papers will be presented in the Colloquia. Interested persons may attend.

AFST (I) AWARDS FOR 1983

PROF. V. SUBRAMANYAN INDUSTRIAL ACHIEVEMENT AWARD FOR THE YEAR 1983.

The Association of Food Scientists and Technologists(I) has instituted this Award. Nominations for this award for the year 1983 are invited. The guidelines for the award are as follows:

1. Indian Nationals engaged in the field of Food Science and Technology will be considered for the award.
2. The Nominee should have contributed to the field of Food Science and Technology, for the development of Agro-based food and allied industries or to basic food science and technology with immediate prospect and/or future potential for industrial application.
3. The nomination should be proposed by a member of the Association. The bio-data of the candidate together with his consent should be given in detail including the work done by him and for which he is to be considered for the award.
4. The Awardee will be selected (from the names thus sponsored) by an Expert panel constituted for the above purpose by the Executive Committee.

Nominations along with bio-data and contributions should be sent by Registered Post, so as to reach Dr. S. C. BASAPPA, Honarary Executive Secretary, Association of Food Scientists and Technologists (India), Central Food Technological Research Institute Campus, Mysore-570 013, before 31st January 1984. The envelope should be superscribed as 'Nomination for Prof. V. Subrahmanyan Industrial Achivement Award'.

YOUNG SCIENTIST AWARD FOR THE YEAR 1983

Association of Food Scientists and Technologists (India), announces with pleasure the institution of the YOUNG SCIENTIST AWARD for distinguished scientific research and technological contributions to the field of Food Science and Technology.

The award consists of a cash prize of Rs. 1,000/- and a certificate.

Nomination for the Award is open to aspirants fulfilling the following conditions:

1. The candidate should be an Indian National below the age of 35 years on the date of application, working in the area of food science and technology.
2. The candidate should furnish evidence of either,
   (*a*) Original scientific research of high quality, primarily by way of published research papers and (especially if the papers are under joint authorship) the candidates own contribution to the work.

   OR

   (*b*) Technological contributions of a high order, for example in product development, process design etc., substantiated with documentary evidence.

The application along with details of contributions and bio-data (4 copies) may be sent by Registered Post, (envelope should be superscribed as 'Nomination for Young' Scientist Award') so as to reach Dr. S. C. BASAPPA, Hony Secretary, Association of Food Scientists and Technologists (India), CFTRI campus, Mysore-570 013, before 31 January 1984.

BEST STUDENT AWARD

The Association of Food Scientists and Technologists (India) has instituted a BEST STUDENT AWARD to be given every year to two students with distinguished academic record and undergoing Final Year Course in Food Science and Technology. The aim of the award is to recognise the best talent in the field and to ensure wider recognition of food science and technology as professional discipline.

There are two awards each comprising a cash award of Rs. 500/- and a certificate.

The candidates to be considered for the awards should fulfil the following conditions:

1. They must be Indian nationals
2. They must be students of one of the following:
   (*a*) M.Sc. (Food Science)/(Food Technology).
   (*b*) B.Tech., B.Sc. Tech., B.Sc. Chem. Tech., in Food Technology.
   (*c*) B.Tech., in food sciences
3. They should not have completed 25 years of age on 31st December of the year preceding the announcement when their names are sponsored.

Heads of Post-graduate Departments in Food Science and Technology may sponsor the name of one student from each Institution supported by the candidate's biodata, details starting from High School onwards, including date of birth and his post graduate performance to date (4 copies).

Nominations for the year 1983 may be sent by Registered Post, (the envelope should be superscribed as 'Nomination for Best Student Award') so as to reach Dr. S. C. BASAPPA, Hony. Exec., Secretary, AFST(I), Central Food Technological Research Institute Campus, Mysore-570 013, before 31 January 1984.

SUMAN FOOD CONSULTANTS TRAVEL AWARD 1983

The Association of Food Scientists and Technologists (India) has instituted a Travel Award in the name of "Suman Food Consultants" to Post-Graduate Degree/Diploma students in Food Science/Technology. The Award will be of Rs. 500/- which will enable the awardee to attend the Annual General Body Meeting and the Technical Seminar/Symposium of the AFST(I) in that year.

The selection of the Award will be based on an essay competition. The subject for the essay is "ROLE OF FOOD SCIENCE AND TECHNOLOGY IN RURAL DEVELOPMENT". Four copies of the essay are to be submitted to the AFST(I) office, Mysore before 31st January 1984. The essay may contain 15-20 pages of typed matter and be comprehensive. A certificate from the head of the department under whom the student is working should be enclosed along with the essay.

A REQUEST

Alumni of the Southern Regional Station of the N.D.R.I., Bangalore

Esteemed Alumni are requested to send their current/permanent address to the Hon. Secretary, Alumni Association, S.R.S. of N.D.R.I., Hosur Road, Adugodi Post, Bangalore-560 030. The membership list is being up-dated to facilitate mailing programme and Souvenir to be brought out to commemorate the Diamond Jubilee Celebrations which falls this year. Alumni are also requested to send before the middle of November 1983, suitable material for inclusion in the Souvenir especially items recalling their association with the Institute and the Dairy Industry. The material may be sent to Shri Satish Kulkarni, Hon. Editor, Alumni Association, Southern Regional Station, National Dairy Research Institute, Hosur Road, Adugodi Post, Bangalore-560 030.

NATIONAL SYMPOSIUM ON QUICK FROZEN FOODS

(Present Status and Prospects)

The venue of the Symposium will be:

Claridges Hotel, New Delhi

Last date for submission of papers has been extended to 1 October 1983 and all papers may be sent to Dr. J. S. Pruthi, Chairman, Symposium Committee & General Manager, M. S. Kold Hold Industries (P) Ltd., 7/28, Kirti Nagar, New Delhi-110 015.

ADDENDUM

Research note entitled *A note on the antibiotics sensitivity of E. coli isolated from the market milk of Ludhiana city* by S. S. Kahlon and V. K. Joshi published in *this Journal* 1983, Vol. 20, No. 2. 86-87.

In page 87, *Table* 2 *at the end of the table add*:

Source/type	Total isolates	No. of sensitive isolates to indicated antibiotics								
		E	K	O	S	L	V	I	X	C
Total	53	21 (39.62)	45 (84.90)	16 (30.16)	39 (73.58)	23 (43.38)	28 (52.83)	22 (40.14)	42 (79.24)	37 (69.80)

PUBLICATIONS

OF

THE ASSOCIATION OF FOOD SCIENTISTS & TECHNOLOGISTS (I)

(CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE CAMPUS, MYSORE)

1. **REVIEWS IN FOOD SCIENCE AND TECHNOLOGY—VOL. IV**
   Royal 8vo, hard bound, P. 255.
   Price: India **Rs. 8/-**
   Abroad: **$5 Surface mail**
   $8 Air mail.

2. **PROCEEDINGS OF THE SYMPOSIUM ON FATS AND OILS IN RELATION TO FOOD PRODUCTS AND THEIR PREPARATIONS**
   Demi-quarto, paper back, P. 155
   Price: India **Rs. 25/-**
   Abroad: **$8 Surface mail**
   $10 Air mail

3. **PROCEEDINGS OF THE FIRST INDIAN CONVENTION OF FOOD SCIENTISTS AND TECHNOLOGISTS**
   Demi-quarto, paper back, P. 123
   Price: India **Rs. 25/-**
   Abroad: **$8 Surface mail**
   $10 Air mail

4. **TECHNICAL DIRECTORY OF THE CONFECTIONERY INDUSTRY IN INDIA**
   Demi-quarto, paper back, P. 128
   Price: India **Rs. 25/-**
   Abroad: **$8 Surface mail**
   $10 Air mail

5. **PROCEEDINGS OF THE SYMPOSIUM ON STATUS AND PROSPECTS OF CONFECTIONERY INDUSTRY IN INDIA**
   Demi-quarto, calico bound, P. 135
   Price: India **Rs. 30/-**
   Abroad: **$8 Surface mail**
   $10 Air mail

6. **PROF. V. SUBRAHMANYAN COMMEMORATION ISSUE**
   Demi-quarto calico bound, P. 125
   Price: India **Rs. 30/-**
   Abroad: **$8 Surface mail**
   $10 Air mail

7. **PROCEEDINGS OF THE SYMPOSIUM ON BY-PRODUCTS FROM FOOD INDUSTRIES: UTILIZATION AND DISPOSAL**
   Demi-quarto, calico bound, P. 56
   Price: India **Rs. 30/-**
   Abroad: **$8 Surface mail**
   $10 Air mail

8. **PROCEEDINGS OF THE SECOND INDIAN CONVENTION OF FOOD SCIENTISTS AND TECHNOLOGISTS**
   Demi-quarto, P. 134
   Price: Paper back **Rs. 30/-**
   Calico bound: **Rs. 40/-**

INSTRUCTIONS TO AUTHORS

1. Manuscripts of papers (*in triplicate*) should be typewritten in double space on one side of bond paper. The manuscripts shouid be complete and in final form, since only minor corrections are allowed at the proof stage. The paper submitted should not have been published or data communicated for publication anywhere else. Review papers are also accepted.

2. Short communications in the nature of Research Notes should clearly indicate the scope of the investigation and the salient features of the results.

3. Names of chemical compounds and not their formulae should be used in the text. Superscripts and subscripts should be legibly and carefully placed. Foot notes especially for text should be avoided as far as possible.

4. **Abstract:** The abstract should indicate the principal findings of the paper. It should be about 200 words. It should be in such a form that abstracting periodicals can readily use it.

5. **Tables:** Tables as well as graphs, both representing the same set of data, should be avoided. Tables and figures should be numbered consecutively in Arabic numerals and should have brief titles. They should be typed on separate paper. Nil results should be indicated and distinguished clearly from absence of data, which is indicated by '—' sign. Tables should not have more than nine columns.

6. **Illustrations:** Graphs and other line drawings should be drawn in *Indian ink* on tracing paper or white drawing paper preferably art paper. The lettering should be in double the size of printed letters. For satisfactory reproduction, graphs and line drawings should be at least twice the printed size 16cms (ox axis) × 20cms (oy axis); photographs must be on glossy paper and must have good contrast; *three copies* should be sent.

7. Abbreviations of the titles of all scientific periodicals should strictly conform to those cited in the World List of Scientific Periodicals, Butterworths Scientific Publication, London, 1962.

8. **References:** Names of all the authors along with title of the paper should be cited completely in each reference. Abbreviations such as *et al.*, *ibid. idem*, should be avoided.

   The list of references should be included at the end of the article in serial order and the respective serial number should be indicated in the text as superscript.

   Citation of references in the list should be in the following manner:

   (*a*) *Research Paper:* Jadhav, S. S. and Kulkarni, P. R., Presser amines in foods, *J. Fd Sci. Technol.*, 1981, **18**, 156.

   (*b*) *Book:* Venkataraman, K., The Chemistry of Synthetic Dyes, Academic Press, Inc., New York, 1952, Vol. II, 966.

   (*c*) *References to article in a book:* Joshi, S. V., in the Chemistry of Synthetic Dyes, by Venkataraman, K., Academic Press, Inc., New York, 1952, Vol. II, 966.

   (*d*) *Proceedings, Conferences and Symposia Papers:* Nambudiri, E. S. and Lewis, Y. S., Cocoa in confectionery, *Proceedings of the Symposium on the Status and Prospects of the Confectionery Industry in India*, Mysore, May 1979, 27.

   (*e*) *Thesis:* Sathyanarayan, Y., Phytosociological Studies on the Calcicolous Plants of Bombay, 1953, Ph.D. Thesis, Bombay University.

   (*f*) *Unpublished Work:* Rao, G., unpublished, Central Food Technological Research Institute Mysore, India.

9. Consult the latest copy of the *Journal* for guidance.

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Research Papers

Research Notes

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