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RESEARCH PAPERS

Biochemical Changes in the Spoilage of Apple by *Aspergillus niger*

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***Aspergillus niger* was found to be responsible for the post harvest spoilage of apples. After infection the free reducing sugars were found to be decreased accompanied by an increase in the activities of FDPaldolase, aconitase and isocitrate dehydrogenase. The keto acids were also found to be increased. There was no significant difference in the amylase activity but the cellulase activity was found to be increased and that of protease decreased.**

Apples are known to be affected[1-6] in the pre-harvest conditions, but post-harvest preservation, transit and marketing is also a challenging problem. Present study focusses attention on the spoilage of apples by the development of black spots on the surface of the fruits which cause lot of wastage and reduce its marketing value. Attempts were made to find out the causative agents of such a spoilage of apples and to examine the biochemical changes associated with such a spoilage and methods by which it can be controlled.

Methods and Materials

Isolation of culture from infected apples:: The infected part of the apple was cut and streaked on saborauds plates. The healthy part was also streaked as a control. The plates were incubated at 30°C for 72 hr. There was no growth in the control plates but the fungal growth obtained from the infected tissue was *Aspergillus niger*.

Effect of different antifungal agents on the growth of Asp. niger: The methods used were the same as described earlier for *R. bataticola* from mango tissues[7].

Artificial development of black spots in apple by Asp. niger: Spore(10^8) suspension of the mould isolated from infected fruit was injected into healthy apples and incubated at 30°C till the development of brown spots. Controls with injection of normal saline did not show the symptoms of the disease whereas the inoculated ones showed the development of disease symptoms.

Preparation of cell-free extracts from apple tissues: Thirty per cent apple extract was made in phosphate buffer (0.1M) of pH 7.0 containing polyvinyl pyrrolidone (0.15 g/g tissue) at 0-5°C using a chilled mortar and pestle. The pH of the extract was adjusted to 7.0 whenever necessary. The extract was centrifuged at 5000 × G for 15 min and the supernatant was used as crude cell-free enzyme preparation.

Assay of free reducing sugars, protein invertase and amalyse: Assay methods were the same as mentioned by Assnani *etal*[8] and chhatpar *etal.*[9]

Determination of keto acids: Keto acids were determined according to the method described by Friedman[10].

Assay of enzymes: Aconitase assay was carried out as described by Anfinsen.[11] A unit of aconitase is defined as the amount of enzyme which brings about decrease of 0.01 O.D. at 240nm/min under assay conditions.

Isocitrate dehydrogenase was assayed according to the method described by Ochoa[12]. A unit of isocitrate dehydrogenase is defined as the amount of enzyme which brings about increase of 0.01 O.D. at 30°C/ min.

Protease activity was assayed according to the method of Ong and Gaucher[13]. A unit of enzyme activity is defined as the amount of enzyme which causes the decrease of 0.01 O.D. at 37°C/hr.

The cellulase was assayed according to the method described by Miller[14]. A unit of cellulase is defined as the amount of enzyme which liberates 1 mg of reducing sugar at 37°C/hr.

FDP aldolase was assayed according to the method of Sibley and Lehninger[15].

A unit of FDP aldolase is that amount which is responsible for an increase of 0.01 O.D. at 540 nm at 37°C.

Results and Discussion

During infection of apples by *Aspergillus niger*, free reducing sugars were found to be decreased in the infected tissues which may be due to the utilization of sugars by mould or due to the differential rates of synthesis and or degradation involving enzymes like invertase, amylase, cellulase or other TCA cycle enzymes. There

TABLE 1. BIOCHEMICAL CHANGES IN THE HEALTHY AND INFECTED TISSUES OF APPLE

Apple tissue	Free reducing sugars (g%)	Invertase (sp. act.)	Amylase (sp. act.)	FDP aldolase (sp. act.)	Aconitase (sp. act.)	Isocit. dehy. (sp. act.)	Mono carboxylic Keto acids (mg%)	Dicarboxylic keto acids (mg%)
Healthy	10.2	0.30	1.5	3.7	1.17	46.8	41.3	3.93
Infected	8.0	0.23	1.53	6.8	3.11	57.1	56.3	16.6

was no significant change in the amylase activity whereas invertase activity was found to be lower in the affected tissues (Table 1).

FDP aldolase, aconitase and isocitrate dehydrogenase were found to be much higher in the infected tissues indicating that respiration rate may be higher leading to an increase in the catabolism of free reducing sugars, the levels of which were found to be lower in the infected tissues. According to Farakas and Ziraly[16] it is a general mechanism in infected tissues to have higher rates of respiration. Increased respiration rate also has been observed in potato tuber tissues after infection with *Giberella* sp.[17].

Since FDP aldolase, aconitase and isocitrate dehydrogenase activities were found to be higher, attempts were made to examine whether keto acids were also higher. Monocarboxylic and dicarboxylic keto acids were found to be higher in the infected tissues. Protease activity was lower in the infected tissues (Table 2).

Many plant pathogens produce cellulolytic and pectic enzymes which suggests that these enzymes degrading cell walls of host tissues are important agents in pathogenesis. The affected tissues of apple also showed higher cellulase activity as compared to healthy tissues. This may suggest the cellulolytic nature of the mould. Several plant pathogens like *Rhizoctonia solani* (infectious to bean), *Colletotrichum trifoli* (infectious to alfa-alfa) have also been found to be highly celluloytic[18]

Beccari[19] successfully used vitamin K_3 for the preservation of bananas and inhibition of the growth of *Gleosporium musarum*. This can also be tried with apples.

TABLE 2. CELLULASE AND PROTEASE ACTIVITIES FROM HEALTHY AND INFECTED TISSUES OF APPLE

Apple tissue	Cellulase (sp. activity)			Protease (sp. act)
	CMCase activity	FPA	Cotton activity	
Healthy	0.32	0.27	0.21	22.13
Infected	1.34	1.16	1.05	11.28

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Studies on Dehydration of Ber (*Ziziphus mauritiana* Lam.) Fruit

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Studies on dehydration of different varieties of ber showed that 'Katha', 'Umran', 'Bagwari' and 'Chhuara' varieties are good for drying. Fruits having golden yellow to reddish brown colour were found superior for drying. The optimum blanching time needed was 2 min for 'Ilaichi', 4 min for 'Bagwari' and 'Chhuara' and 6 min for 'Katha' and 'Umran'. Sulphuring at the rate of 150 g/8 kg of fruits (3 hr burning) was considered optimum. The rate of browning increased during storage for 6 months at room temperature (21-38°C). All the varieties except 'Ilaichi' were found acceptable organoleptically.

The ber (*Ziziphus mauritiana* Lam.) is an important fruit of North India. The tree bears heavily and regularly, and brings good return to the grower. In another paper,[1] preparation of beverage from ber fruit was described. Sun-drying and dehydration of ber fruit are described in this paper.

Materials and Methods

Eight varieties viz., 'Katha' from Ram Garh and 'Bagwari' from Chomu area of Rajasthan; 'Umran', 'Chhuara' and 'Ilachi' from Bahadur Garh area of Punjab; 'Karaka' from Varanasi, 'Mundia Marhara' and 'Narma' from Etah area of Uttar Pradesh were used in these studies. The characteristics of these varieties have been described earlier[2-7].

Maturity stage of the fruit was determined on the basis of their external colour, such as immature or greenish, mature or golden yellow and ripe or reddish brown.

The ber fruit was washed and subjected to pretreatments. Blanching for 6 min was done using boiling water. Lye treatment was carried out by dipping the fruits in cold as well as in boiling sodium hydroxide solution of suitable strength[8,9]. Pricking was done using a specially devised cushion of pins fixed on a piece of wood. Length-wise slitting was made with a knife. Wooden chamber (90 × 60 × 90 cm) provided with a glass window on one side was used for sulphuring. The fruits were loaded on wooden trays made of slats at the rate of 6-9 kg per sq m of tray area and exposed to burning sulphur fumes for 3 hr.

Dehydration was done in a cross flow cabinet drier with a tray load of 8 kg/sq m at 60 ± 5°C and air flow rate of 1.2 to 1.8 m/sec. The final moisture content reached was about 14-17 per cent. Sun drying was also done separately for comparative studies.

The appearance of the fruit was evaluated by visual observation. The average weight of a fruit was calculated from the weight of 100 fruits. The pulp to stone ratio was also determined.

Moisture was determined by drying at 55° to 60°C.[9] Reducing and total sugars were estimated by Lane and Eynon's method[10]. Ascorbic acid was determined by titrimetric method[11]. Sulphur dioxide content was determined by Monier William's method as modified by Shipton[12] and equilibrium relative humidity (E.R.H.) by Wink's method[13]. Non-enzymatic browning was measured by the method of Hendel *et al*[14]. The dried flesh of the fruit was soaked in 100 ml of 50 per cent ethanol for 24 hr, filtered and the colour measured at 420 nm using Spectronic 20 colorimeter. The absorbance is expressed in terms of original material by multiplying with the dilution factor.

The reconstitution of dried ber was done by boiling in water for different periods. Organoleptic quality was assessed by a panel of seven judges using Hedonic scale[15]. Storage life was determined by packing the dried product in 400 gauge polyethylene bag which is kept in a lever top biscuit canister (capacity 5 kg) and stored at room temperature (21-38°C).

Results and Discussion

The physico-chemical characteristics of the ber varieties used are given in Table 1. Considering the total soluble soilds and acidity, the varieties 'Karaka', 'Mundia Marhara', 'Narma', 'Chhuara', 'Bagwari' and 'Ilaichi' are good for table purposes. For drying, 'Katha' and 'Umran' were found to be superior.

TABLE 1. PHYSICO-CHEMICAL CHARACTERS OF BER FRUITS

Characters	Katha	Bagwari	Umran	Chhuara	Ilaichi	Karaka	Mundia Marhara	Narma
Appearance	Golden Yellow	Yellow to reddish brown	Golden yellow	Greenish yellow	Yellow to reddish brown	Yellow to reddish brown	Greenish yellow	Light green
Av. fruit Wt. (g)	18.50	16.00	21.00	12.50	3.60	23.00	22.00	17.50
Pulp/stone ratio	25.00	13.30	19.60	11.30	24.80	—	16.70	12.90
Moisture (pulp) (%)	74.33	77.92	77.81	76.42	73.97	86.60	83.13	79.30
°Brix at 20°C	21.40	18.00	22.70	17.20	24.70	11.80	13.00	16.80
Acidity as anhydrous citric acid (%)	0.10	0.11	0.29	0.35	0.22	0.31	0.22	0.25
Reducing sugar (%)	4.54	5.94	4.38	3.72	3.91	5.88	4.00	3.90
Total sugars (%)	19.65	16.17	14.84	16.23	16.98	9.97	11.10	14.90
Ascorbic acid (mg %)	97.76	126.46	150.99	146.69	129.41	103.50	174.60	146.50

Blanching: Blanching time needed in boiling water for complete inactivation of the enzyme was 6 min for 'Katha' and 'Umran', 4 min for 'Bagwari' and 'Chhura' and 2 min for 'Ilaichi'. This variation in blanching time may be due to the difference in size, texture and composition of the fruit.

Pre treatment: To improve the uptake of SO_2 and to reduce the drying time, lye peeling of the fruit using cold or hot lye was attempted. The uptake of SO_2 ranged from 5159 to 7068 ppm. The colour of the dried product was not satisfactory and lye peeling affected the weight loss in dried product. Drying time was not influenced by lye peeling. Hence, further studies were carried out only with blanched fruits. Data on SO_2 uptake and retention after drying are given in Table 2. Sulphuring at the rate of 150 g/8 kg of fruit (3 hr burning) was found optimum.

Drying rates: Using a cabinet drier with a tray load of 8 kg of fruits/sq m. and temperature of 60±5°C drying curves drawn for 'Umran', 'Chhuara', Ilaichi', 'Katha' and 'Bagwari' varieties are shown in Fig. 1.

TABLE 2. EFFECT OF SULPHURING ON ABSORPTION AND RETENTION OF SULPHUR DIOXIDE IN BER (VAR) UMRAN.

Sulphuring (g/8 kg fruit)	Time of exposure (hr.)	Sulphur dioxide (moisture free basis) Absorption (ppm)	Retention after drying (ppm)	Retention (%)
100	3	6086	673	11.5
150	3	8528	1509	17.7
150	17	9678	1902	19.7
200	3	8732	1256	14.4

Similar trend was observed with other varieties also. The total drying time needed was 32 hr for 'Umran', 24 hr 'Katha', 20 hr for 'Chhuara' and 'Bagwari' and 18 hr for 'Ilaichi'. Ten days were required to sun dry the fruits to the same level of moisture content. The air temperature during sun-drying ranged from 30° to 43°C.

Sun drying and dehydration: Sun drying resulted in complete loss of ascorbic acid, less retention of SO_2 and imparted darker colour to the dried product as compared to the dehydrated fruit (Table 3). The product obtained from mature and ripe fruits dried by either of the methods was not much liked by panelists.

Equilibrium relative humidity (ERH): The initial moisture content of the dehydrated ber (var. 'Katha)

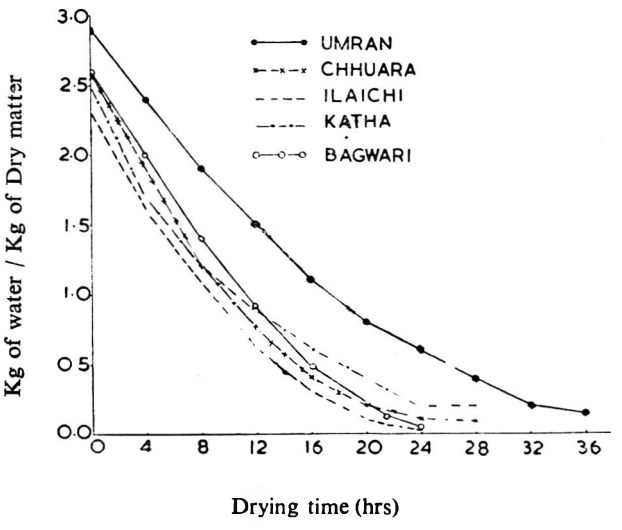

Fig. 1. Drying curve of ber fruit

TABLE 3. EFFECT OF MATURITY ON THE QUALITY OF DRIED BER (VAR) UMRAN

Stage of maturity	Drying method	Moisture (%)	SO_2 (ppm)	Sugars		Ascorbic acid (mg %)	Acidity (%)	Browning (O.D. at 420 nm)	Increase in wt. (%)	Colour	Organoleptic quality (score)
				Reducing (%)	Total (%)						
Immature	Sun drying*	16.7	50	21.4	53.4	—	1.5	10.5	59.5	Dark brown	5.0
(Greenish)	Dehydration	14.3	374	22.7	55.6	60.1	1.2	5.5	58.8	Pale straw	5.4
Mature	Sun drying	15.7	179	20.6	57.1	—	1.4	8.4	57.9	Reddish brown	6.3
(Golden yellow)	Dehydration	15.7	183	22.8	51.8	77.6	1.2	5.8	59.5	Light brown	5.6
Ripe-	Sun drying	16.7	67	20.4	56.3	—	0.9	7.1	57.9	Reddish brown	6.7
(Reddish brown)	Dehydration	17.5	191	19.3	60.4	56.5	0.6	4.7	56.0	Light brown	6.2

The air temperature during sun drying was 30-43°C

used in this study was 14.3 per cent. The optimum ERH for this product was found to be 75 per cent. considering the over all organoleptic quality of the product including the colour, texture and flavour (Table 4 and Fig. 2). Mould growth was observed at a relative humidity of 81 per cent and above.

Reconstitution: When flesh was reconstituted in boiling water for 5 min the increase in weight was 51 per cent, but the whole fruit took 50 min for 40 per cent increase in weight. Pre soaking the dried flesh in water for 2 hr further increased the weight to 60 per cent. Thus, soaking the dried flesh in water for 2 hr prior to boiling in water for 5 min give the best reconstituted product. The reabsorption of water in different varieties increased in the following order: 'Katha', 'Umran', 'Ilaichi', 'Bagwari' and 'Chhuara'.

Storage studies: Changes during storage at room temperature (21-38°C) of ber dried after blanching and sulphuring equilibrated to different moisture levels are given in Table 5. The retention of SO_2 was maximum in 'Ilaichi' (55.8 per cent) and minimum in 'Katha' (5.8 per cent). There was complete loss of ascorbic acid in all the varieties except 'Ilaichi'. Maximum browning in dried product during storage was observed in 'Katha', followed by 'Bagwari', 'Chhuara' and 'Ilaichi;' browning was slight in 'Umran'. All the varieties were organoleptically acceptable except 'Ilaichi' probably due to its higher SO_2 content.

Acknowledgement

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TABLE 4. EQUILIBRIUM RELATIVE HUMIDITY AND MOISTURE CONTENT IN DEHYDRATED BER (VAR. KATHA)

Relative humidity (%)	Days required to reach equi.. moisture	Equilibrium moisture (%)	Remarks
40	53	3.43	Very hard
53	35	4.98	Very hard
63	30	9.47	Slightly hard
75	17	17.25	Texture and flavour good
81	23	21.55	Soft, slightly free water on the surface and mouldy after 35 days
84	—	—	Mouldy after 21 days
90	—	—	Mouldy after 14 days

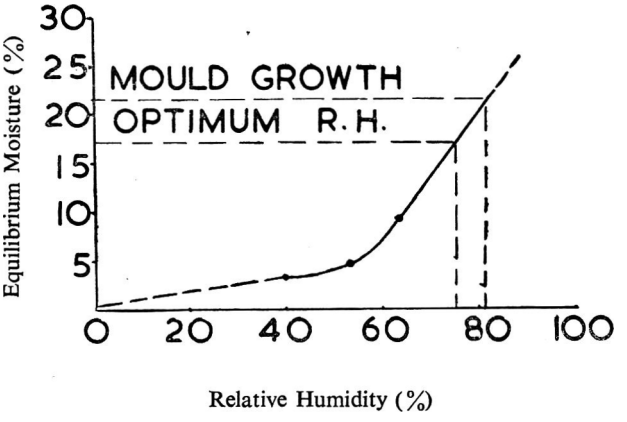

Fig. 2. Humidity – moisture equilibrium curve for Dehydrated ber (Var. Katha) at room temp.

TABLE 5. CHANGES IN DEHYDRATED BER STORED AT ROOM TEMPERATURE (21-38°C)

Varieties	Moisture content (%)	Storage period (months)	SO_2* (ppm)	Ascorbic* acid (mg%)	Browning (O.D. at 420 nm)	Organoleptic rating
Katha	14.3	0	1305	39.7	3.2	Like slightly
		6	76	—	9.1	,,
Bagwari	16.0	0	883	34.4	6.4	
		6	164	—	11.7	,,
Umran	13.2	0	530	142.9	7.7	,,
		6	133	—	10.9	,,
Chhuara	11.4	0	1369	81.5	7.7	,,
		6	346	—	13.4	,,
Ilaichi	14.4	0	1438	64.1	9.9	Neither like nor dislike
		6	803	8.1	16.5	Dislike slightly

*Moisture free basis

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Bacteriological Quality of Black Pepper in Retail Stores in a Canadian City

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The bacteriological quality of black pepper sold in eight spice specialty stores in Toronto was studied, and compared with pepper processed by industry. Coliforms exceeding 1,100/g and enterococci ranging from 53,000 to 215,000/g were found in samples from five of the eight stores. ***Escherichia coli, Klebsiella pneumoniae, Acinetobacter calcoaceticus*** **and** ***Streptococcus faecalis*** **were isolated and biochemically characterized.**

Black pepper is imported into Canada from India, Brazil and Sarawak. Most of it is marketed by a few large companies who sterilize it with ethylene oxide, package it under sanitary conditions and routinely monitor its bacteriological quality. Pepper has been implicated as the cause of contamination and spoilage in meat products[1,2], soups[3] and pickles[4], but after being processed by industry it is regarded as bacteriologically

safe. However, many metropolitan areas, of which Toronto is an example, have a growing ethnic community who purchase comparatively large quantities of black pepper from small retail outlets specializing in spices. It is suspected that many of these retailers import pepper directly and market it without sterilization.

Coliforms and other bacteria of public health significance have been recovered from ground black pepper at retail outlets in both India[5,6] and the United States[7], but it was not stated whether these studies applied to the products of large industries or small specialty stores. Enteropathogenic strains of *Escherichia coli* have been recognized as the causative organisms in certain food poisoning outbreaks[8]. As a measure of preventing foodborne infections, Litchfield[9] suggested avoiding the use of food ingredients that have high coliform counts, but black pepper used as an ingredient of beef patties has recently been shown to contain coliforms and faecal streptococci[10]. The present study was undertaken to compare the bacteriological quality of black pepper being sold in Toronto with similar products prepared by one major spice company. The recommendations of the ICMSF[11] were used as a guide in drawing conclusions, These specifications state that the *E. coli* count should be less than 1,000/g, and that the total number of bacteria should not exceed 1,000,000/g.

Materials and Methods

All 22 retail samples of black pepper were obtained as 200g sealed packets from eight spice stores in Toronto. Using official method M-1.0 of ASTA[12], 20 samples of 200g each were obtained in sterile sealed paperbags from a major spice company based in London, Ontario. The industrial samples represented two lots. Five samples were obtained from each lot before sterilization with ethylene oxide and five after. The moisture content of the retail samples was determined by the toluene distillation method as described by the ASTA[12]. Standard plate counts were made on a 10g sample unit of each sample according to the official microbiological methods (M-2.0 of the ASTA)[12] using All Purpose Medium with Tween 80 (APT) (Baltimore Biological Laboratories—BBL). Coliforms were estimated in the retail samples both by Most Probable Number (MPN) method (M-3.1) using EC medium (Difco) in place of BEB broth, and by direct plating on Violet Red Bile Agar (VRB) (BBL) (by method M-3.0 of ASTA)[12]. A loopful of broth from a representative LT tube positive for gas production, and a loopful of broth from a representative EC tube positive for gas, were streaked on MacConkey agar (Difco). Three groups of colonies were recognized based on size, shape and colour. Five typical looking colonies from each group were subcultured on the same medium and biochemically characterized using the API-20E system (API Laboratory Products Ltd., 4008 Corre Vertu, St. Laurent, P. Q. H4R 14V). Enterococci were enumerated on KF streptococcal agar (BBL) and biochemical characterization was based on Bergey's Manual[13]. The haemolytic behaviour of gram-negative isolates and enterococci was studied using blood agar with trypticase soy agar base (BBL).

Results and Discussion

The total number of aerobic and indicator bacteria contained in 22 retail samples of black pepper are presented in Table 1. Aerobic bacteria ranging from a million to 115 million/g were present in 10 samples that were either whole black pepper or ground black pepper. All of these 10 samples would have been rejected under International Commission on Microbiological specifications for Food (ICMSF) quality specifications. Aerobic plate counts for samples derived from a major industry before and after sterilization with ethylene oxide are presented in Table 2. More than half of the retail samples examined were comparable to unsterilized industrial spices in their aerobic bacterial content; while seven retail samples derived from two sources were comparable to sterilized samples from industry. The rest of the retail samples had counts ranging between 10^4 and 10^6 and would be considered as 'marginal'. Whole white pepper and white pepper powder were less contaminated than whole and ground black pepper.

Indicator bacteria were present in five ground black pepper samples (Table 1). Coliforms, faecal coliforms and enterococci were detected in these samples. The total coliform population exceeded 1,100/g by the MPN method, and up to 4,000/g by the direct plate count method. The enterococci in these samples ranged from 53,000 to 215,000/g. As far as is known, this is the first time that black pepper has been shown to contain an abundance of enterococci. Biochemical characterization of representative isolates of enterococci revealed that all were betahemolytic *Streptococcus faecalis*. Since *E. coli* is most indicative of faecal pollution it was deemed desirable to determine the incidence of this particular organism in the coliform population. As shown in Table 1, two of the five samples derived from two different sources contained *E. coli* in excess of 1,100/g while the other 3 had lesser numbers. The occurrence of *E. coli* from these two sources was subsequently rechecked and confirmed by procuring additional samples.

A study of peppercorns as they entered port in North America[14] showed that coliform bacteria were absent; hence our study indicating their presence in retail level samples in spice specialty stores is indicative of contamination during processing and retail packaging by the

TABLE 1. BACTERIOLOGICAL QUALITY OF RETAIL SAMPLES OF BLACK AND WHITE PEPPER

Form of black pepper	Sample No.	Moisture (%)	Number of bacteria/g				
			Total aerobes	Coliforms (MPN)	Coliforms (VRB)	Faecal coliforms (MPN)	Faecal streptococci
Black pepper (whole)	1	11.8	15.4×10^6	0	0	0	0
	2	12.4	115.0×10^6	0	0	0	0
	3	12.2	75.0×10^6	0	0	0	0
	4	10.8	7.0×10^4	0	0	0	0
	5	10.4	1.0×10^2	0	0	0	0
Black pepper (ground)	1	10.9	7.0×10^1	0	0	0	0
	2	12.9	8.4×10^1	0	0	0	0
	3	10.5	0	0	0	0	0
	4	9.9	15.5×10^6	0	0	0	0
	5	12.3	25.3×10^6	>1,100	1.8×10^3	150	2.15×10^5
	6	12.0	1.3×10^5	0	0	0	0
	7	9.7	9.5×10^6	>1,100	1.5×10^3	20	6.6×10^4
	8	11.2	96.0×10^6	0	0	0	0
	9	9.2	9.3×10^5	0	0	0	0
	10	13.7	20.0×10^6	>1,100	2.9×10^3	460	8.5×10^4
	11	12.0	16.0×10^6	>1,100	4.0×10^3	>1,100	5.3×10^4
	12	11.9	11.8×10^6	>1,100	1.8×10^3	>1,100	1.4×10^5
White pepper (whole)	1	12.9	0	0	0	0	0
	2	11.9	0	0	0	0	0
	3	12.4	9.6×10^4	0	0	0	0
White pepper (ground)	1	12.3	3.9×10^4	0	0	0	0
	2	11.5	3.8×10^3	0	0	0	0

retail handlers. Although there was an earlier report of coliforms in small retail packages[15], the current industrial practice of sterilization of a spice followed by routine surveillance minimizes such contamination.

TABLE 2. BACTERIAL QUALITY OF INDUSTRIAL SAMPLES OF BLACK PEPPER

Black pepper var.	Lot no.	Aerobic bacteria/g	
		Before E_2O_2 treat.	After E_2O_2 treat.
Lampong	18328	20×10^6	30.0×10^3
		73×10^6	2.5×10^3
		51×10^6	0
		42×10^6	5.2×10^3
		54×10^6	41.0×10^3
Tellicherri	00008	46×10^6	13.0×10^3
		26×10^6	6.0×10^2
		41×10^6	5.0×10^2
		6.1×10^6	2.0×10^2
		8.0×10^6	6.0×10^2

Results are from 5 replications

Although a direct health hazard could be attributed to the coliforms and *S. faecalis* present in pepper, biochemical characterization of the gram-negative, isolates revealed the presence of *E. coli*, *Klebsiella pneumoniae* and *Acinetobacter calcoaceticus* var *anitratus*. All these were beta-haemolytic, and the *E. coli* strain was indole positive which may indicate human origin. Their haemolytic nature coupled with their possible human enteric origin, makes their occurrence a rather serious implied health hazard. Furthermore, *Acinetobacter* is known to be an opportunistic pathogen.

In view of the occurrence of bacteria which imply health hazards, the retail processing and packaging of black pepper by the spice specialty stores in Toronto is a matter of concern.

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Preparation and Microbiological Evaluation of Bactopeptone from Shrimp Waste

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Scope for the utilisation of shrimp head waste for the production of bactopeptone has been investigated. Hydrolysate from the head portion of *Penaeus indicus* prepared by papain treatnmet was found to support the growth *S. faecalis* and *L. mesenteroides* (P-60) on par with oxoid peptone at 1.0% level. The process adopted for the preparation of the peptone-like product, its chemical composition and microbiological evaluation with *Lactobacilli* have been reported.

Ever since Tarr[1] has suggested that it would be quite feasible and more economical to obtain peptone from fish muscle and fishery wastes instead of meat, several reports have appeared regarding the usefulness of fish peptones as microbiological media[2-4] and commercial production has also been reported in recent years. In continuation of the earlier work at this Institute[5,6] on hydrolysates from fish muscle, we have studied the possibility of utilising fishery wastes instead so as to help in waste utilisation and protein recovery. To start with it was proposed to prepare a peptone like product from shrimp head waste which is readily available in large quantities with the advent of the shrimp processing industry on modern lines. A preliminary account of the studies undertaken with the peptone from shrimp waste obtained by papain treatment and its microbiological evaluation employing *Lactobacilli*, known for their stringent requirements for growth, has been presented in this study along with the data on the chemical characteristics of the product.

Materials and Methods

(*a*) *Preparation of shrimp waste hydrolysate:* Shrimp head waste from *Penaeus indicus* was obtained from a processing unit and 5-kg lots were employed for the preparation of peptone. The raw material was suspended after mincing in tap water in 1:1 ratio and the procedure described by Sen *et al.*[2] was adopted for obtaining a hydrolysate with suitable modifications based on preliminary trials for obtaining the maximum yield and desirable physical characteristics. Papain (B.P.C. obtained from Enzychem Laboratories Ltd., Yeola,) was employed at 0.2 per cent level and butylated hydronyanisole (BHA) (1 g) dissolved in alcohol and ethylenediamine tetraacetic acid (EDTA) (10 g) were added to the mince along with chloroform and toluene. Phosphoric acid (2N) was added initially and at intervals to maintain the pH at 6.5 to 7.0 and digestion was carried out for 4 hr. at 45-50°C. The suspension was then quickly brought to boil and held for 10 min for enzyme inactivation and sterilisation. After separation from the undi-

gested residue toluene was added as a preservative and the supernatant was filtered after keeping overnight to obtain a clear pale yellow hydrolysate containing 4 to 6 per cent of total solids. It was first concentrated in vacuum to a thick syrup containing 20-25 per cent of total solids and vacuum dried at 55°C to obtained the final product employed for chemical analysis and microbiological tests.

(*b*) *Chemical analysis:* Shrimp waste peptone obtained by the above procedure was analysed chemically after preparing a 5 per cent aqueous solution. Total nitrogen was estimated by micro-Kjeldahl digestion and distillation and ∝-amino nitrogen was estimated by the Pope and Stevens method[7]. Proteose nitrogen was determined by Zinc sulphate (saturated) precipitation as described by Winton & Winton[8]. Primary proteose fraction was estimated by employing half saturated zinc sulphate as recommended in Oxoid manual[9]. Ash content and petroleum ether extract as an index of the fat content were also determined in the final product and procedures followed at this Institute[10] were adopted for the determination of calcium and phosphorus content. Chitin and free hexosamine were also determined in final product by acid hydrolysis with 6 N HCl (12 hr. at 100°C)[11]. Tryptophan content of the hydrolysate was estimated after alkaline hydrolysis (120°C for 5 hr) by the modified colorimetric method of Spies[12]. (Table 1) Proximate composition of the raw material was also determined after drying at 100°C to constant weight to work out the percentage of recovery of the total nitrogen content of the raw material.

(*c*) *Microbiological evaluation:* The shrimp head hydrolysate sample was compared for its growth promoting activity with Oxoid peptone in identical concentrations in the enrichment medium of following composition.

Peptone	10 g
Bacto-yeast extract	2 g
Glucose (anhydrous)	20 g
Sodium acetate (anhydrous)	20 g
* Salt solution 'A'	5 ml
* Salt solution 'B'	5 ml
Distilled water	1000 ml

* Barton-Wright[13]

The above medium was boiled to dissolve the ingredients and the pH was adjusted to 7.0. It was filtered through Whatman No. 44 filter paper and 7 ml were put in corning test tubes and sterilised in an autoclave for 15 min at 12 p.s.i.

Cultures of *Streptococcus faecalis* and *Leuconostoc mesenteroides* (P-60) were inoculated into the medium described above and incubated at 35°C for 18-20 hr and the cultures obtained were centrifuged aseptically and washed thrice with sterile physiological saline (0.85 per cent). The cells were resuspended in 5.0 ml of sterile saline and 0.05 ml of the inoculum was added to each tube of the enriched medium in triplicate and incubated at 35°C for 24 hr. Samples were taken at intervals of time and the turbidity measured at 660 mμ in Spectronic-20 colorimeter. The data obtained have been expressed in terms of optical density values obtained by calculation.

Results and Discussion

In the absence of any process for conversion into a well defined industrial by-product, shrimp processors have so far been discarding the waste material or converting it in some places into a fish meal substitute. Shrimp meal can neither serve as a full substitute for fish meal in poultry feeding[14] nor it can be considered as a better material for preparing chitosan[15]. Production of glucosamine from shrimp waste has also been attemped[16].

The present study is the first attempt made to utilise shrimp waste for producing a microbiological medium. Earlier workers considered that microbiological media developed from fishery resources could serve more as supplements for growth and as enrichment media than as complete media. It is, therefore, encouraging to note that from the data given in Table 3 that peptone prepared from shrimp head waste is comparable to high quality 'Oxoid' peptone. These findings are in agreement with those of Stephens *et al*[17], although they have followed the autolysis process for obtaining shrimp waste hydrolysate.

The chemical compositions of shrimp head hydrolysate and Oxoid peptone are given in Table 2. Total

TABLE 1. CHEMICAL COMPOSITION OF HYDROLYSATE FROM SHRIMP HEAD WASTE EMPLOYED AS BACTOPEPTONE SUBSTITUTE

	Shrimp head hydrolysate	Oxoid Peptone
Moisture (%)	5.73	—
Total nitrogen (%)	13.07	13.26
Primary proteose N (as % of total N)	11.71	6.25
Proteose N (as % of total N)	32.38	32.29
∝—amino N (as % of total N)	29.85	20.04
Ash (%)	7.87	6.90
Fat (%)	0.16	0.1
Calcium (%)	0.25	0.13
Phosphorus (%)	0.56	0.70
Chloride (NaCl %)	1.65	3.1
Tryptophan (%)	0.48	0.52
Chitin/Hexosamine (%)	0.64	—

TABLE 2. PROXIMATE ANALYSIS OF SHRIMP HEAD WASTE

	Sample I	Sample II
Moisture (%)	63.69	70.86
Ash (%)	23.22	25.64
Crude protein (%)	45.97	45.25
Chitin (%)	22.78	—
Fat (%)	6.0	3.64

Values are on dry basis

nitrogen content of shrimp head peptone is a little lower than the ISI requirement of 14.0 per cent but similar to that of Oxoid peptone. Recovery of nitrogen present in the raw material was found to be 45-50 per cent which may be considered satisfactory as some of the nitrogen present in the raw material is present in the shrimp shell protein forming a complex with chitin. Although autolysis process employed by Stephens *et al*[17]. yielded a hydrolysate equal in microbiological growth promoting activity, a higher yield (total solids 4.3 per cent as against 2.4 per cent) was obtained by papain digestion. Cost of the enzyme added did not materially enhance the cost of production. Overall yield of the peptone was found to be 5-7 per cent of the raw material.

α-amino nitrogen level in shrimp waste hydrolysate was 20 per cent which satisfies requirement in peptones employed as microbiological media. Fat content of the product is quite low (0.16 per cent) and defatting may not be needed to obtain a fully soluble product free from turbidity. Special precautions would, however, be necessary to prevent discolouration due to fat oxidation during processing since samples without the addition of antioxidant developed rancidity and discolouration during storage. Another aspect is the low residue (0.64 per cent) of chitin/hexosamine as impurity in the final product compared to the data reported by Stephens *et al*[17]. Calcium and phosphorus contents of the shrimp waste peptone deserve some attention in view of the need for pH adjustment by addition of acid during digestion. Shrimp head waste has high autolytic activity and the pH of the mince employed for digestion was highly alkaline (8.0) which is to be lowered to acidic range for prevention of microbial spoilage. Use of HCl for pH adjustment results in a high ash content mostly made up of calcium from the shell and continuous addition of acid was also found to be necessary. Phosphoric acid was used to avoid a high calcium level in the hydrolysate and near neutral pH was chosen for digestion to minimise the addition of acid. Phosphate content of the hydrolysate in this case was, however, within the required range. Tryptophan content of the hydrolysate was also estimated as it forms very often the limiting amino acid in microbiological media. Samples analysed by chemical and microbiological assay showed its level within the range of 0.48 to 0.88 per cent. Studies on the total amino acid pattern and the overall chemical composition are in progress.

TABLE 3. GROWTH PROMOTING ACTIVITY OF PEPTONE FROM, SHRIMP WASTE AS MEASURED BY OPTICAL DENSITY

Time (hr.)	Peptone from shrimp waste		Oxoid peptone	
	L-mesentroides P-60	*S. faecalis*	*L-mesentroides* P-60	*S. faecalis*
0	0.003	0.003	0	0.012
16	0.921	0.956	0.946	1.000
20	0.956	0.978	0.956	0.991
24	1.032	1.018	1.056	1.009

In addition to the study of growth promotion with test organisms, microbiological evaluation included standards prescribed by the ISI for Indole production, Methyl Red Test and testing for the absence of fermentable carbohydrates. Indole production was more marked with shrimp waste peptone as compared to a commercial sample (B.D.H.) and Methyl Red Test gave a similar result. These tests were positive with *E. coli* and negative with *Aerobacter aerogenes*

It may be concluded that there is a good scope for the utilization of shrimp waste for the preparation of microbiological media.

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Studies on Separation of High Pungent Oleoresin from Indian Chilli

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The low pungency and high colour of the Indian chilli (*Capsicum annuum*) oleoresin precludes its use in pharmaceuticals and is also the main reason for its very low export. Studies have shown that adsorption chromatography can be made use of for fractionating pungency and colour constituents. Bulk of the pungency and colour are concentrated in the pericarp and even here there is concentration of each in different zones. Results have shown promise for a method for preparation of high pungency, low colour fraction required by the pharmaceutical industry. As by-products a colour fraction free from pungency and chilli seed oil are obtained.

One of the important spices used very widely throughout the world is chilli. India is a major producer of chilli and most of the Indian chillies belong to the *Capsicum annum* species and this also constitutes the major commercial variety used in food flavouring[1].

The principal colouring matter in chilli is the carotenoid pigment, capsanthin. Others present are carotene, capsorubin, zeaxanthin and cryptoxanthin. The pungent principle is capsaicin, $C_{17}H_{27}O_3N$, which is a substituted benzylamine derivative and its analogues, nordihydrocapsaicin, dihydrocapsaicin, homocapsaicin and homodihydrocapsaicin also contribute to the total pungency[2-17]. Capsaicin has significant physiological action which is used in many pharmaceutical preparations like balms, linaments and ointments for cold, sorethroat, chest congestion etc. It also finds use in cosmetics like prickly heat powders and skin ointments where capsaicin is said to act as an effective counter irritant and chemical scratcher. Capsaicin is also reported to have carminative, tonic and sitmulative properties[18].

In the world market, three types of products are in vogue. They are (*i*) oleoresin red pepper with medium pungency and high colour, (*ii*) oleoresin capsicum with very high pungency and low colour, and (*iii*) oleoresin paprika with very low pungency and very high colour. The commercial Indian varieties yield only product conforming to oleoresin red pepper and this must be the reason for its poor export performance. The possibility of extraction of an oleoresin with 500,000 scoville heat units has already been reported by extracting only the pericarp[19]. But the oleoresin thus obtained will have a very high colour value and also the process will not be economical.

In recent times, the importance of natural colour has increased. The present investigation is intended to see whether it is possible to obtain a good separation of high pungency fraction and a colour fraction free of pungency. This will enable the production of a pungent oleoresin fraction with over one million scoville heat units meeting the world demand and at the same time the process could become economically viable because of the recovery of colour and seed oil as by-products. Instead of natural colour, a low pungency high colour fraction comparable to paprika oleoresin can also be prepared.

Materials and Methods

Chilli samples were obtained from the market. Destalked chilli was heated to 50°C for 2 hr and broken

in a blender and the pericarp and seeds were separated by sieving and winnowing in small batches. In bigger batches, chilli was broken in a cutting pinmill before separation into various fractions. Large scale separation of pericarp into dissepiment rich pericarp and residual fraction was carried out by a combination of grinding and mechanical separation at the central Food Technological Research Institute, Mysore.

In the analysis of different parts of two types of whole chilli, viz. 'Mundu' and 'Jwala', the dissepiment was separated by hand picking.

Extraction of oleoresin from chilli pericarp: The chilli pericarp was powdered in a grinder or cutting mill or plate mill to 30 mesh and extracted with ethylene dichloride by cold percolation giving overnight contact time. In the separation of high pungent fraction of chilli oleoresin by column chromatography alumina grade III (Brockman scale) was used as adsorbent. Material to adsorbent ratios were 1:5 and 1:10. Petroleum ether (60-80°C), hexane, ethanol and acetone were used as eluents. The colour fractions were eluted with hexane or petroleum ether and the pungent fractions eluted or extracted by triturating the adsorbent containing the pungent principles with acetone or ethanol.

Capsaicin content of the fractions were estimated by the method developed by Mathew *et al*[20]. The pungency of fractions was also estimated as scoville units[9] and colour value by E.O.A. methods[21]. C.Z. USU 2 spectrophotometer and spectronic-20 were used for estimation of colour and capsaicin content.

Results and Discussion

The whole chilli consists of 40 per cent pericarp containing an inner sheath known as dissepiment (present to the extent of 2 per cent of the whole chilli), 56 per cent seeds and 4 per cent stalks. The pericarp contains almost all of the pungency whereas the chilli seeds contain only traces of pungency with a capsaicin content of 0.005 per cent. The pungency of the pericarp is mostly concentrated in the dissepiment. Table 1 shows the analysis of two types of chilli for their different parts and the comparative pungencies and colour in the pericarp and dissepiment portions. It was considered beneficial to extract the oleoresin from pericarp only. The capsaicin content of chilli oleoresin ranged from 2.5 to 3 per cent. Correspondingly, the capsaicin content of pericarp oleoresin varies from 4.5 to 5.5 per cent. Also the yield of oleoresin is variable from 6.5 to 10 per cent. The various fractions of pericarp were extracted with ethylenedichloride by cold percolation. Table 2 shows the results of extraction of different samples.

TABLE 2. EXTRACTION OF PERICARP WITH ETHYLENEDICHLORIDE

Samples	Extractives (%)	Extractives	
		Colour value	Capsaicin (%)
Market sample I (whole pericarp)	7.2	39,650	7.5
Market sample II (whole pericarp)	6.4	34,892	5.5
Mysore sample (pericarp freed of dissepiment)	6.5	28,010	5.0
Dissepiment rich pericarp	7.8	18,910	26.5

It is evident from Table 2 that the pungency of the pericarp enriched with dissepiment (this high pungency fraction represents about 20 per cent of the total pericarp) is increased about 5 fold with corresponding decrease in the residual fraction.

Column chromatography of pericarp oleoresin was done over grade III neutral alumina and grade III basic alumina in a material to adsorbent ratio of 1:5 and 1:10 with initial elutions of colour fractions with solvents like petroleum ether, hexane, ethylene dichloride, etc. and subsequent extractions of alumina with ethanol or acetone. It was found that a 1:5 ratio of oleoresin to adsorbent of grade III neutral alumina and initial elutions with hexane or petroleum ether and subsequent extraction of capsaicin with ethanol was found to be most satisfactory for separation of colour and high pungency fractions of chilli pericarp oleoresin. Table 3 gives data of the experiments carried out by this method.

It can be deduced from the results that in the case of neutral alumina, the colour fraction which on an average represents 75 per cent of the total extractives, has a colour value which is nearly 1 to 2 times that of capsaicin

TABLE 1. ANALYSIS OF DIFFERENT PARTS OF WHOLE CHILLI

Chilli variety	Stalks (%)	Seeds (%)	Pericarp (%)	Dissepiment (%)	Pericarp		Dissepiment	
					Capsaicin (%)	Colour value	Capsaicin (%)	Colour value
Mundu	6.2	55.6	36.7	1.5	0.17	39,650	6.6	5,978
Jwala	5.1	49.7	42.1	3.1	0.58	41,480	7.7	6,100

TABLE 3. COLUMN CHROMATOGRAPHY OF THE CHILLI PERICARP OLEORESIN (CAPSAICIN CONTENT IN THE ORIGINAL CHILLI PERICARP OLEORESIN—7.5)

Weight of oleoresin (g)	Adsorbent	Material: adsorbent	Eluent	Colour fraction			Capsaicin fraction		
				Solvent collected (ml)	Weight (g)	Colour value	Weight (g)	Colour value	% capsaicin
1	Basic alumina Gr. III	1:10	EDC	60	0.7014	38,430	0.1518	5,490	48.4**
1	Basic alumina Gr. III	1:10	Benzene	50	0.6380	31,720	0.2034	1,830	35.8
1	Neutral alumina Gr. III	1:10	Pet. ether (60-80°)	56	0.6842	45,750	0.0934	12,200	79.5‡
1	Neutral alumina Gr. III	1:5	Hexane	5	0.5182	35,380	0.2186	18,910	33.3
				10	0.1332	41,480			
1	Neutral alumina Gr. III	1:5	Hexane	10	0.4180	28,016	0.2778	20,130	27.0*
				8	0.1754	35,380			
5	Neutral alumina Gr. III	1:5	Hexane	125	3.4806	34,282	0.8048	27,450	33.1*
5	Neutral alumina Gr. III	1:5	Pet. ether (60-80°)	75	3.3214	32,940	0.791	43,310	33.8*
				30	0.2748	45,140			

*Capsaicin fraction extracted with ethanol from the adsorbent; **Capsaicin fraction extracted with ethylene dichloride from the adsorbent; ‡ Capsaicin fraction eluted with ethylene dichloride from the adsorbent.

fraction. The colour fraction was completely free of capsaicin and all the pungency was concentrated in the capsaicin fraction which showed a capsaicin content of about 30 per cent. When the material to adsorbent ratio is 1:10, though the yield of the pungency fraction as eluted by ethylene dichloride is relatively low, the capsaicin value has increased two fold with a corresponding decrease in the colour value. This could be attributable to the purity of the capsaicin fraction by way of better separation of colour fraction from pungency fraction and better retention of impurities of the material in the column itself.

All this will leave a major portion namely seed which constitutes 56 per cent of the chilli, effective utilisation of which is very important. The chilli seeds separated from pericarp by air classification was powdered and extracted with ethylene dichloride. It gave an oil yield of 19 per cent containing 0.024 per cent capsaicin. The oil can be used as edible oil for pickles and for cooking purposes.

The results indicate that this method is very encouraging for preparation of high pungency, low colour fraction required by the pharmaceutical industry. The colour fraction was found to be suitable for colouring tomato ketchup. While it is possible to allow colour in the high pungency fraction, the colour fraction should be totally free of capsaicin as otherwise this will alter the taste characteristics of food materials in which they are used as colour.

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Pressure Parboiling of Paddy without the Use of Boiler*

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A modified pressure parboiling process which does not require a separate boiler was developed so as to suit the rural needs. The equipment consists of a pressure vessel with a small water tank at the bottom. The steam required for developing the pressure can be generated by heating the water in the tank by placing the whole equipment over a husk fired furnace. The equipment can be made mobile and transported to rural areas where parboiling of paddy can be done immediately after harvest, as this does not require boiler inspection or trained personnel for maintenance and totally avoids the cost of a boiler. The rice produced by this parboiling unit is of a uniform light golden yellow shade.

Pressure parboiling of paddy[1] has now been well accepted by the industry. One of the problems in its adoption in rural areas is the requirement of a boiler. Even a small boiler costs Rs. 10,000-20,000 and in addition requires licence, frequent inspection and trained staff for maintenance.

In view of this, a pressure parboiling system suitable for small units that can be set up in villages was developed. By adopting this, freshly harvested paddy with 20-22 per cent moisture can be parboiled directly, saving the cost and time needed for drying the paddy. The deteriorative changes which occur during drying and storage of freshly harvested paddy are also avoided.

Description of the equipment and process

The equipment consists of a pressure vessel, with an inclined perforated bottom, having a water tank at the bottom with a capacity of 20 l. The vessel is mounted over a paddy husk fired furance.

The top of the pressure vessel, which holds the paddy, is either dome shaped or conical and sealed at the top by a hinged door which is steam tight. The hinged door is for feeding water and paddy. It can be easily sealed by a screw bolt which can be tightened with a box spanner. The pressure vessel is provided at the top with a pressure gauge indicating up to 2.5 kg/cm^2 and a steam outlet valve. The perforated bottom of the pressure vessel is inclined at 45° on one side, to facilitate easy discharge of parboiled paddy through a discharge door with proper gasketting. The fuel used is paddyhusk.

The holding capacity of the prototype installed at P.P.R.C. Tiruvarur is 2 quintal. Most of the heating surface of the furnace is directly below the water tank so that the heat is utilised to the maximum in heating the water. This arrangement also helps to avoid overheating of paddy.

The furnace used is of the husk fired type with a proper grating to permit a good in-draft of air to facilitate proper burning of the husk and the production of maximum amount of heat. The effluent gases are led through a chimney of 20 cm in diameter and about 6 m height.

The discharge door and the area of the bottom plate immediately near the discharge point have to be thoroughly insulated at the bottom, as the heat from the furnace may cause roasting of some grain (Fig. 1).

Water is led by a hose pipe into the parboiling vessel until it starts overflowing through the water overflow pipe which is then closed. The furnace is lighted using paddy husk as fuel. When the steam starts coming from the steam exhaust valve at the top of the pressure vessel, the feed door is opened and paddy is fed in and water is let in until it fills top level of paddy. The water is kept for 5 min and then drained through the water over flow pipe. This operation helps in removing of intergranular air and filling the intergranular space with water. The top hinged-door is closed tight. The steam exhaust valve is kept open and the heating continued. Generally it requires 15 min for generation and occupation of steam inside the vessel. After the open steaming has been done for the period of 15 min, the steam-exhaust valve is closed. The valve is partially closed and pressure is allowed to be gradually built up to 0.33 kg/cm^2 and maintained for 15 min. The steam exhaust valve is then

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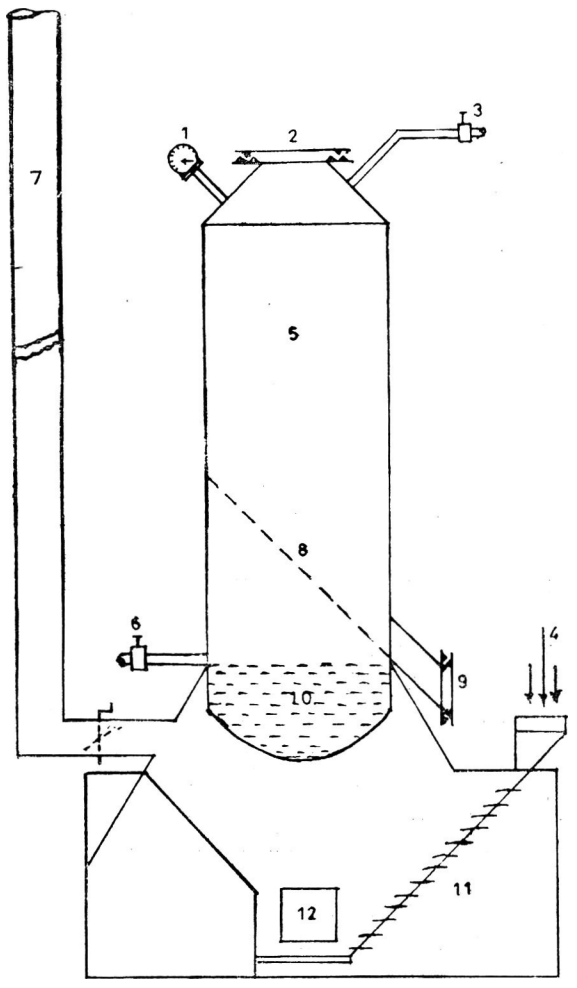

Fig. 1. Pressure Parboiling Unit without use of Boiler

1. Pressure gauge
2. Paddy & water inlet
3. Steam outlet
4. Husk Feed Hopper
5. Pressure chamber
6. Water over flow pipe
7. Chimney
8. Perforated Bottom
9. Paddy Discharge Door
10. Water Tank
11. Grate for furnace
12. Ash Door

completely closed and the pressure raised to 1.76 kg/cm^2 at which pressure the paddy is held for 7 to 10 min. At the end of the operation, the steam exhaust valve is opened partially until the pressure drops to about 0.21 kg/cm^2 and the paddy discharged at this pressure through the bottom discharge door. When bulk of the paddy is discharged and the pressure drops to zero, the top feeding door is opened and the paddy discharge is completed. The entire operation of parboiling takes 75 min.

The steam requirement has been worked out on the basis of the water consumed during the operation of the plant. It was found that the water level is always constant in the water tank before and after the completion of the parboiling process and hence the actual steam generated is from the water available in the intergranular space of the grains which is found in the range of 125 to 150 kg of steam per tonne of paddy depending upon the varieties of paddy used. This gives a saving of about 25-35 per cent of steam consumption compared to the hot soaking method in the modern rice mills besides avoiding the necessity for a separate boiler.

In the case of moist paddy (20 to 27 per cent moisture) after feeding to the pressure vessel, a quantity of 15 to 20 kg of water is added for 200 kg of moist paddy in addition to the water level being maintained in the tank.

From nearly 20 trials carried out, it was found that the colour of the rice produced by this process is of uniform light golden yellow shade. The advantages of the process are (1) the need for a boiler which costs atleast Rs. 10,000-50,000 is fully avoided. The need for boiler licence and inspection and technical staff for maintenance are not necessary. (2) A cheap fuel like paddy husk which is a by-product of a rice mill and other agrowastes can be used. The surplus heat from the chimney can be used for drying the paddy. (3) The cost of the plant is low and is possible to install in the farm or in small mills, (4) Freshly harvested paddy just after threshing can be parboiled directly avoiding the cost and effort of drying and storage. The quality of the product also improves. (5) The unit can be made as a mobile one so that single unit can work in a number of places near the harvesting area. (6) The plant is simple which does not require motive power such as electric motors. (7) This type of unit will offer employment to rural workers. (8) An important factor is that if such unit is used in a conventional mill with soaking tanks, the capacity of such a mill can be doubled. Quality of the product is uniform. As the moisture content of the paddy at the time of discharge is 23 to 25 per cent the time for sun-drying is reduced considerably. This factor also helps in increasing the outturn.

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Influence of Soaking and Steaming on the Loss of Simpler Constituents in Paddy

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The water soluble constituents formed and present in paddy grains get leached out into soak water. These simpler compounds were formed in increasing quantities as soaking was prolonged. These compounds were lost during soaking and steaming resulting in loss of dry matter. The microbial activity and seed activity might contribute to this loss as microorganisms proliferate and seeds remain viable during soaking.

Dry matter loss during soaking of paddy in parboiling is a common phenomenon and is significant in cold soaking[1]. Paddy grains contain free sugars and amino acids[2]. It was reported that sugars and phenolic compounds leach out into soak water[3,4]. The present paper reports the formation of low molecular weight compounds like sugars and amino acids during soaking and the role of microflora of soak water in effecting loss on soaking and on steaming.

Materials and Methods

'ADT 8' paddy harvested during January 1977 was shelled in a laboratory model Satake sheller and the resulting brown rice was polished (5-6 per cent polish) in a McGill miller No. 1. 120 g each of paddy, brown or milled rice was soaked in 180 ml of distilled water in a 250 ml cylinder with or without 0.5 per cent sodium fluoride as an antimicrobial agent. At intervals, the soak water was analysed for reducing sugars[5] and amino nitrogen[6]. The total microbial count in soak water was determined by the standard dilution plate technique.

The influence of soaking on the levels of these constitutents in paddy, brown and milled rice was determined in samples of known quantity (about 3 g) taken in cheese cloth and soaked in cylinders as above. At intervals samples were withdrawn, ground and extracted in hot 80 per cent ethanol and the reducing sugars and amino nitrogen contents were estimated and expressed over the original dry matter taken[7]. Husk and bran were also soaked separately for 72 hr and the changes in these constitutents were determined.

The loss of dry matter at different stages of parboiling, viz. after soaking and after steaming was determined in 100 g paddy lots, by drying in an oven at 105°C to constant weights and comparing with the dry weight of raw paddy in duplicate. For pressure parboiling, the paddy was rinsed with water for 5 min and then steamed at 5 lb for 20 min followed by 25 lb pressure for 5 min. For cold soaking method, paddy was soaked for 72 hr and then open steamed for 10 min. Along with the 100g lots, samples of about 3 g taken in cheese cloth were also soaked and steamed and the changes in constituents determined. The total phenol content was estimated following the method of Bray and Thorpe[8].

Results and Discussion

During soaking of paddy, brown and milled rice, reducing sugars and amino acids were released into soak water. The reducing sugars in soak water from brown and milled rice were relatively higher than that from paddy (Table 1). The sugar level in soak water increased after 12 hr and then declined followed by an increase at later stages of soaking. Paddy grains contain free sugars[9], free amino acids[10] and water soluble hemicelluloses[11]. The free sugars present in the grains might have got diffused into soak water in the initial stages of soaking. During this period the microbial growth was not prolific (Table 4) and probably hence the sugars accumulated. As the microbial growth gained momentum a decline in sugar level was observed which might be due to utilisation of sugar by the microbes. The level of this constituent in brown and milled rice also diminished with the increase in soaking time whereas in paddy the reducing sugars increased at advanced stages of soaking (Table 2). The sugars formed got leached out into soak water more rapidly in brown and milled rice than in paddy where the intact hulls and testa might retard the permeation of these compounds. The level of sugars was relatively higher when soaking was in the presence of antimicrobial agent, (NaF) suggesting that microbes were

TABLE 1. RELEASE OF REDUCING SUGARS AND AMINO NITROGEN INTO SOAK WATER FROM PADDY, BROWN RICE AND MILLED RICE

Treatments	Sampling time (hr)				
	0	12	24	48	72
*Reducing sugars**					
Paddy+NaF	—	0.023	0.003	0.120	0.566
Brown rice+NaF	—	1.421	0.995	0.699	1.080
Milled rice+NaF	—	1.385	0.434	0.794	1.027
Paddy	0.0	0.063	0.009	0.023	0.098
Brown rice	0.0	0.988	0.063	0.049	0.296
Milled rice	0.019	0.882	0.104	0.210	0.187
*Amino nitrogen***					
Paddy+NaF	—	0.077	0.098	0.062	0.306
Brown rice+NaF	—	0.447	0.551	1.004	1.023
Milled rice+NaF	—	0.343	0.360	0.279	0.449
Paddy	0.0	0.054	0.045	0.058	0.106
Brown rice	0.0	0.237	0.759	1.042	1.223
Milled rice	0.031	0.254	0.304	0.285	1.489

*mg/ml of soak water in glucose equivalents
**mg/ml of soak water in glutamic acid equivalents

not utilizing the sugars. Paddy grains contain enzymes that hydrolyse starch, protein, fat, etc. and these quiscent seed enzymes might get activated on soaking. Paddy grains remain metabolically active under water and tend to germinate although they do not establish as seedlings when soaked in bulk. This indicates that the life activity of the grains remain functional during soaking and hence seed enzymes would act on complex substrates releasing simpler compounds. Some hydrolysis might also be due to the action of microorganisms.

TABLE 2. CHANGES IN THE REDUCING SUGARS AND AMINO NITROGEN CONTENT IN PADDY, BROWN AND MILLED RICE DURING SOAKING

Treatments	Sampling time (hr)				
	Before soaking	12	24	48	72
*Reducing sugars**					
Paddy+ NaF	—	1.598	1.888	2.678	2.819
Brown rice+NaF	—	0.983	2.358	1.948	2.721
Milled rice+NaF	—	0.649	1.135	1.011	1.506
Paddy	1.329	0.818	0.478	1.169	1.958
Brown rice	1.848	1.436	0.164	0.575	0.606
Milled rice	1.363	0.268	0.041	0.269	0.248
*Amino nitrogen***					
Paddy+NaF	—	0.400	0.600	1.083	0.871
Brown rice+NaF	—	0.652	0.435	0.749	0.907
Milled rice+NaF	—	0.316	0.280	0.535	0.389
Paddy	0.539	0.423	0.575	0.871	0.659
Brown rice	0.774	0.218	0.253	1.088	0.835
Milled rice	0.681	0.049	0.414	0.524	1.374

*mg/g in glucose equivalents; **mg/g in glutamic acid equivalents

TABLE 3. CHANGES IN THE REDUCING SUGARS AND AMINO NITROGEN IN HUSK AND BRAN OF ADT 8 PADDY AFTER SOAKING

Constituents	Husk		Bran	
	Before soaking	72 hr after soaking	Before soaking	72 hr after soaking
Reducing sugars*	0.950	1.784	9.951	3.558
Amino nitrogen**	2.272	3.255	4.157	5.471

Values are on dry basis
mg/g in glucose equivalents; mg/g in glutamic acid equivalents

Amino nitrogen was also excreted into soak water, more on soaking brown rice than paddy or milled rice. A decrease observed in grains in the initial stages of soaking might be due to the escape of free amino acids present in the cellular pools. At later stages of soaking an increase in amino nitrogen was observed which was relatively higher in brown and milled rice than in paddy. The increase observed at later stages of soaking might have arisen from the (*i*) proteolysis by protcases of seed and/or microbes and (*ii*) synthesis by microbes. Brown and milled rice soaked in water also contained higher levels of amino nitrogen than paddy.

Husk soaked separately also showed an increase in the reducing sugars and amino nitrogen content (Table 3). In the case of bran there was a reduction in the reducing sugars after soaking. On the other hand amino nitrogen increased. The reduction in sugars in soaked bran might be due to leaching into water while the increase in amino acids might be due to proteolysis. This indicates that changes might occur in husk and bran layers besides endosperm when whole paddy is soaked in water.

TABLE 4. TOTAL MICROBIAL COUNT IN SOAK WATER OF PADDY, BROWN AND MILLED RICE

Treatments	Fungi ($\times 10^4$/ml)				Bacteria ($\times 10^6$/ml)			
	Sampling time (hr)							
	0	24	48	72	0	24	48	72
Paddy+NaF	—	25	45	55	—	10	40	450
Brown rice+NaF	—	20	35	25	—	10	39	510
Milled rice+NaF	—	5	25	25	—	15	70	600
Paddy	65	10	25	25	26	12	375	675
Brown rice	70	25	15	20	13	19	200	855
Milled rice	60	100	40	20	20	7	514	1840

The grains harbour a variety of epiphytic and endophytic microflora[12]. These organisms proliferate upon soaking. The population of filamentous fungi decreased while the bacterial population increased (Table 4). Desikachar *et al*[13]. also found a decrease in fungi and an increase in bacterial counts in soak water. These organisms, might be partly responsible for the hydrolysis and proteolysis resulting in their monomeric forms that are leached out into soak water.

The formation of simpler compounds in paddy not only resulted in soaking loss but also in steaming loss. Soaking of paddy resulted in an increase in total and reducing sugars, amino nitrogen content and free phenolic compounds and steaming caused a reduction in these constituents (Table 5). In pressure parboiling where soaking in water was avoided there was a slight reduction in sugars and a slight increase in total phenol content. However, the amino nitrogen content remained almost unaltered. The rinsing of raw paddy through water circulation for 5 min prior to steaming would have leached the soluble sugars from paddy to certain extent and some amount of these constituents could have also been lost in subsequent steaming. The condensate water collected from the steaming tanks of cold soaked paddy was also found to contain these constituents (unpublished).

Vellanki[14] also reported that losses occurred in over steaming of paddy. Paddy grains contain free amino acids, free sugars, free phenolic compounds and water soluble hemicelluloses[4,9,11]. These water soluble compounds were lost during soaking and also during steaming. Paddy grains also contain organic acids[15] which might get volatalised and lost during steaming. In the present study it was observed that steaming caused a definite loss in dry matter. These losses vary with the variety and the level of water soluble constituents formed during soaking. A method devoid of soaking of paddy in water like pressure parboiling would avoid this loss.

TABLE 5. CHANGES IN CERTAIN CONSTITUENTS * AND LOSS OF DRY MATTER IN RAW, PRESSURE PARBOILED AND COLD SOAKED PARBOILED PADDY

Particulars	Raw paddy	Pressure parboiled paddy	Cold soaked paddy	Cold soaked parboiled paddy
Total sugars	517.81	500.88	550.05	234.48
Reducing sugars	75.73	53.60	191.97	157.89
Amino nitrogen	70.55	70.40	82.59	55.59
Total phenols	39.12	42.81	49.84	31.75
Loss of dry matter (%)				
'ADT 31' paddy	—	0.88	2.48	2.89
'CO 33' paddy	—	0.27	2.55	2.62
'IR 20' paddy	—	0.08	1.87	2.23
'CO 25' paddy	—	0.48	2.30	2.64

*mg/100 g of raw paddy

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Tannin Composition of Sal *(Shorea robusta)* Seeds

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Deoiled sal seed powder (DSP) contains tannins (10-12%), starch (30-40%) and proteins (10-12%). The relatively high percentage of tannins, which contribute for the toxicity were chemically examined. Major tannins are of hydrolysable nature and constitute as the esters of gallic and ellagic acid mainly. Gallic acid and ellagic acid were isolated and characterized. Column chromatography of ethyl acetate extract gave ethyl gallate as an artifact which was characterized spectroscopically. Paper chromatography showed tannic acid and the types of phenolics present.

The seeds of sal (*Shorea robusta* Gaertin) have about 62 lakh tonnes per annum potential in India as shown by the data collected by us. Analysis of deoiled sal powder (DSP) utilizing the standard[1-5] methods showed the presence of proteins (10-12 per cent)[1], starch (30-40 per cent)[2,3] in addition to tannins (10-12 per cent)[4,5], in accordance with earlier observations[6]. The other constituents being crude fibre, inorganic salts, moisture and minor unidentified components. The non edible nature of the DSP has recently been confirmed by Gandhi *et al.*,[7] in feeding experiements with albino rats. The relatively high levels of tannins in DSP were considered responsible for the toxicity. We undertook the chemical examination of DSP tannins particularly hydrolysable tannins. Toxicity due to relatively high percentage of tannins in DSP may be interpreted either because of their known astringent nature caused by the inactivation of enzymes due to the precipitation of proteins or by their interference with the metabolic system by oxidation-reduction process by acting as "true antioxidant or an oxygen-scavenger".

Astringency as determined[5] by precipitation of blood protein was found to be 10.2 per cent. Experiments for hydrolysis showed that major tannins are of hydrolysable nature, which constitute the main phenolic portion of DSP.

Methods and Results

Following a general procedure for the extraction of polyphenols, DSP was soxhlet extracted with ethyl acetate. The combined ethyl acetate extract was concentrated (30°C) and fractioned by maceration with acetone. The precipitated yellow solid was repeatedly macerated with methanol. The light yellow solid obtained was recrystlalised with pyridine to give yellow shining needless with m.p. >360°C. Its IR spectrum as KBr pallet showed the presence of chelated and non-chelated hydroxyls (3400, 3200 cm^{-1}), a lactone carbonyl (1722) and aromatic (1655, 1590) groups, while UV gave the absorption at λmax 362 and 257 nm. It was identified as ellagic acid by comparision with its authentic sample, prepared[8] by persulphate oxidation of gallic acid, and by preparation of its acetate. The concentrated methanolic mother liquor was found to be a complex mixture of phenolics by its examination on TLC and paper chromatography. It was therefore, chromatographed over a column of silica gel (60-120 mesh). Elution with methanol-chloroform (2:98) gave a solid, which on crystallisation from methanol gave yellow flaky needles, with m.p. 157-158°C. It was found homogeneous on TLC (methanol: chloroform 8:92). It gave bluish-green ferric reaction, its IR (cm^{-1}) showed the presence of hydroxyls (3450, 3300), carbonyl (1700) and aromatic (1615, 1530) groups. NMR (acetone $-d_6$) showed the presence of an ethoxy group (δ 1.32 for 3H and 4.25q for 1H, each J=7Hz) along with the presence of two aromatic protons (7.62). Its mass spectrum showed M^+ at m/e 198 and UV 222 and 275 nm absorption. It was therefore, assumed as ethyl gallate. Further elution of the column with 5 per cent methanol-chloroform gave another compound, which has been assigned as 2-(2-iminoaceticacid)-3-(2H)-benzofuranone[9].

At this stage, it was felt that since some of the naturally occurring gallotannins containing depside linkages, digalloyl-or trigalloyl-on alcoholysis[10] give the corresponding ester of gallic acid. In the case of the present tannins it was felt that in case it contains depside linkages, ethyl acetate during extraction might have attacked the linkage and that may account for the isolation of ethyl gallate as an artifact by trans esterification.

In the light of this and for the known sensitiveness of tannins, the method of isolation was modified. The sal seed powder was extracted with 20 per cent aqueous acetone at room temperature. The brown acetone extract was directly filtered in ethyl acetate. Upper ethyl acetate layer was separated. Lower aqueous layer on concentration and maceration with methanol gave ellagic acid[11]. Concentration of ethyl acetate extract

TABLE 1. EXPLANATION OF THE SPOTS IN FIG. 1

Spot	Colour (intensity) in $K_3Fe(CN)_6$–$FeCl_3$	Colour on paper	In ammonia	With KIO_4	Diazotized benzidine	$AlCl_3$	UV (λmax)
1	Bluish-black (Very intense)	Light yellowish	Dark yellow	Red colour turns brown in in 40-60 sec.	Golden brown (intense)	Pale-yellow (light green flourscent in UV)	370,260, 228, compound+Sod. Ethoxide 368(s) 280, 220 (mm)
2	Bluish-black (Very intense)	Faint yellow	Light yellow	,,	Light brown	—	—
3	Bluish-black (Intense)	Very faint yellow	Faint yellow	,,	Light brown	—	—
4	Bluish-black (Intense)	Colourless	—	Red colour turns brown in 10-15 min.	Dull brown	—	—
5	Bluish-black (Mild intense)	Colourless	—	,,	Dull brown	—	—
6	Bluish-black (Mild intense)	Colourless	—	,,	Dull brown	—	—
7	Bluish-black (Faint)	Colourless	—	,,	Yellowish-brown	—	—

on flash evaporator at 30°C gave a brown liquid. It was macerated with petroleum ether to remove fat and waxes. Paper chromatography of the defatted ethyl acetate extract showed the presence of ellagic acid[11], gallic acid[11] and tannic acid, the latter two isolated by maceration of the extract with dry ether, while maceration with methanol gave the ellagic acid. The ethyl acetate extract (A) obtained was examined by two dimensional chromatoaraphy on Whatmann paper No. 3 using aqueous acetic acid (6 per cent) and butanol-acetic acid-water (4:1:5) as the solvent systems for first and second direction respectively. The chromatogram on development with ferric chloride showed the pattern depicted in Fig. 1. the description of which is shown in Table 1. The ethyl acetate extract (200 mg) was hydrolysed with sulphuric acid (5 ml, 20 per cent) by heating at 100° for 2 hr. The suspended brown solid on chromatography showed the absence of either gallic or ellagic acid. At this stage it could be said that ethyl acetate extract (A) contains no hydrolysable gallo-or ellagic tannins. Further the structure of the seven components (Fig. 1) were not studied for the time being as they look to be flavonolic in nature. It can be concluded that the hydrolysable tannins of DSP are mainly of gallo-and ellagic tannins type.

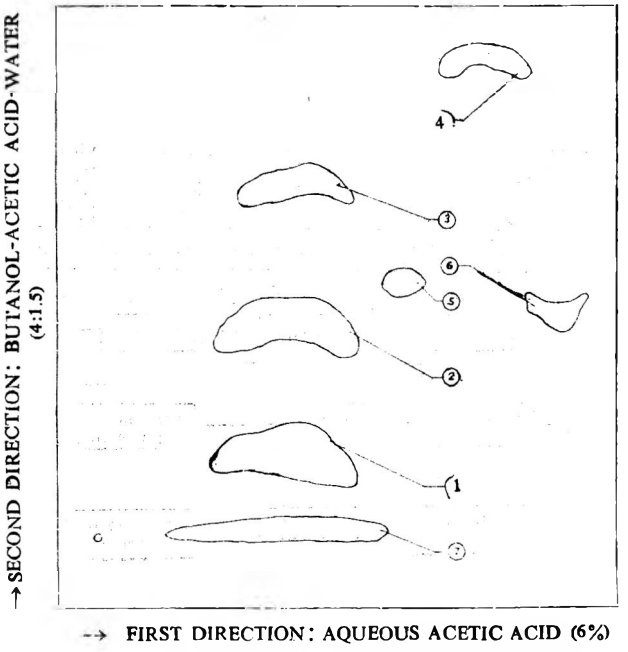

Fig. 1. Two dimensional Chromatography of the ethyl acetate extract of sal seed powder

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Development of Concentrated Meat Gravies

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A process and formulations for the preparation of concentrated meat gravies has been developed. Organoleptic and sensory evaluation of the products has been carried out during storage. Ex-factory cost per can of Mutton Kashmiri, the richest formulation, was Rs. 6.00.

Concentrated meat gravies are convenience products which contain ingredients like vegetables, green curry stuff, spices and oil. Little quantity of meat is also incorporated to enhance the flavour. Use of such products avoids collection, metering and preparation (cleaning, cutting, frying, grinding, etc.) of individual items. The product is to be cooked with equal quantity of meat in a domestic pressure cooker for 20-25 min. The product could also be used as bread spread, garnishing steaks, an adjunct with rice, chappaties, idli, etc. It can also be used in metropolitan cities, factory messes, college hostels, army messes, etc. Development of six different formulations of canned concentrated meat gravies is reported. The products were tested for organoleptic qualities. Scaling up trials and cost of the product have also been worked out.

Materials and Methods

Raw materials like mutton, vegetables (tomatoes, onions and *palak*), green curry stuff (green chillies, coriander leaves, ginger, garlic and mint), spices (cloves, cardamom, nutmeg, turmeric, red chilli powder) and others (poppy seeds, cashew nuts, red cherries, eggs and dals) were procured from the local market. Curds, 16-18 hr old, was used. Refined oil was used in the formulations.

A number of recipes[1] have been processed into meat gravies of which Mutton Kashmiri, Mutton Moghalai, Mutton Neelagiri Koorma, Mutton Palak, Mutton Coconut Curry and Mutton Dhanasakh chosen for systematic investigation were prepared by following cooking methods. The quantities given in Table 1 are all on precleaned and ready to use basis. The different recipes were prepared using mutton or bone stock, obtained by pressure cooking bones with some quantity of water. The solids contributed by bone stock was adjusted at the same level as that contributed by meat.

Major steps involved in the preparation are: (*i*) cleaning, preparation of materials and deboning of meat and cutting into chunks (5-7.5 cm), (*ii*) cooking and frying of ingredients, (*iii*) mincing and mixing of all ingredients, (*iv*) finishing, (*v*) formulation correction, (*vi*) preheating to 80-85°C, (*vii*) filling into MPJ laquered cans (301 × 309), seaming and retorting, and (*viii*) cooling and labelling.

Samples were stored at -10°, 25-30° and 37°C to determine adequacy of processing and shelf life by organoleptic and sensory evaluation methods. Meat curry was prepared by mixing mutton chunks (1 per cent salt added) with an equal quantity of gravy and cooking at 15 psig for 25-30 min. The curry was offered to a panel of judges for organoleptic evaluation. The judges were asked to evaluate the samples of curry for colour, flavour and general acceptance by giving scores on hedonic scale[2] of 1 to 9. The total scores were taken into consideration for assessing acceptability and shelf life. The sample kept at -10°C served as a standard of

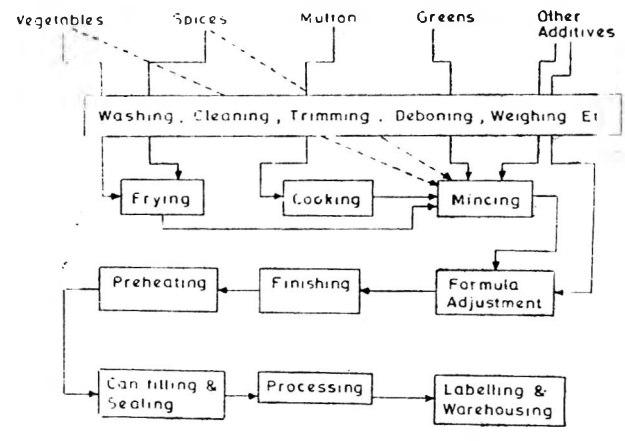

Fig. 1. Flow Diagram for the Manufacture of concentrated Meat Gravies

TABLE 1. INGREDIENT COMPOSITION (G) OF 6 SELECTED GRAVIES

Ingredient	Mutton Kashmiri	Mutton Moghalai	Mutton Neelagiri Koorma	Mutton Palak	Mutton Coconut Curry	Mutton Dhanasak
Mutton (deboned)	1000	1000	1000	1000	1000	1000
Egg	—	454	—	—	—	—
Coconut	—	—	800 (dry)	800 (dry)	1200 (wet)	120
Refined oil	1600	1600	2000	2000	1760	—
Onion (trimmed)	1600	2400	1400	1400	2000	3044
Tomato	1200	1400	—	1760	1040	577
Spinach	—	—	1208	1280	—	577
Sweet potato	—	—	—	—	—	577
Brinjal	—	—	—	—	—	577
Potato	—	—	—	—	—	577
Ginger	120	240	200	200	160	39
Garlic	40	40	120	120	80	39
Coriander leaves	160	160	560	560	136	240
Green chillies	120	576	120	120	120	39
Mint	—	—	96	96	—	39
Dalinx	—	—	—	—	—	80
Clove	16	24	16	16	16	—
Cinnamon	—	16	16	16	16	—
Cardmom	1.5	1.0	1.6	1.6	—	—
Coriander seeds	—	—	16	16	16	—
Cumin seeds	—	—	—	—	—	39
Turmeric	16	40	40	40	16	39
Shajeera	—	—	—	—	—	39
Red chilli powder	—	40	—	—	32	60
Kashmir chilli „	80	—	—	—	—	—
Nut meg	4	—	—		—	—
Cashew nut	400	800	400	400	—	—
Poppy seeds	400	400	240	240	—	—
Red cherries	400	—	—	—	—	—
Curds	726	1200	1120	1120	—	—
Masur dal	—	—	—	—	—	79.8
Mung dal	—	—	—	—	—	79.8
Bengal gram dal	—	—	—	—	—	79.8
Salt	227	200	200	240	240	164
Water	4000	4000	—	—	—	1710
Total	10160	11550	9600	12000	7000	15920

comparison. The evaluation was carried out at monthly intervals for a period of one year.

Results and Discussion

Batch sizes were small (25 cans) during standardisation of finishing technique, adequacy of heat processing by measurement of heat penetration[3] and commercial sterility[4]. The consistency of the gravy depends on the solids and emulsification at the filling temperature. Breaking of emulsion or separation of solids should not occur during filling of the gravy into the cans. This would occur if the finishing has not been done properly. Usually the formulation correction required at this stage is total solids, because proper emulsification is achieved during finishing. No significant variation in the consistency and total solids was noticed during filling of the gravy from the jacketted kettle into the cans till about 80-85 per cent was finished.

TABLE 2. VACUUM, HEAD SPACE, pH AND PROXIMATE CHEMICAL COMPOSITION

Characteristics	Mutton Kashmiri	Mutton Moghalai	Mutton Neelagiri Koorma	Mutton Palak	Mutton Coconut	Mutton Dhanasak
Vacuum (in.)	5.50	4.00	4.50	4.50	4.50	4.0
Head space (cm.)	1.10	0.90	0.40	0.30	1.00	0.30
pH	5.70	5.40	5.00	4.80	5.00	5.00
Moisture (%)	68.02	68.76	51.97	59.95	55.38	74.58
Ash (%)	2.48	2.34	3.01	2.41	3.69	2.29
Fibre (%)	1.62	1.44	1.82	0.90	2.69	0.43
NaCl (%)	2.02	2.16	1.75	1.45	3.35	1.77
Fat (%)	19.46	19.43	33.71	26.75	27.98	4.48
Protein (%)	5.34	4.17	5.18	4.10	4.86	5.09
Carbohydrate (%) by diff.	1.06	1.70	2.66	4.46	2.05	11.38

TABLE 3. ORGANOLEPTIC SCORES OF CANNED CONCENTRATED MEAT GRAVIES STORED AT DIFFERENT TEMPERATURES FOR ONE YEAR

Products	Initial	-10°C	25-30°C	37°C
Mutton Kashmiri				
Colour	7.6	7.7	8.0	7.7
Flavour	7.1	7.6	7.8	7.3
Acceptability	7.2	7.4	7.8	7.4
Mutton Moghalai				
Colour	7.6	7.2	7.3	7.3
Flavour	7.4	6.5	6.2	6.8
Acceptability	7.5	6.7	6.5	7.0
Mutton Neelagiri Koorma				
Colour	6.2	7.0	7.0	6.8
Flavour	7.0	6.7	6.6	6.3
Acceptability	6.0	6.7	6.5	6.2
Mutton Palak				
Colour	6.2	7.4	7.4	7.4
Flavour	6.2	7.2	7.2	7.2
Acceptability	6.2	7.2	7.2	6.0
Mutton Coconut Curry				
Colour	7.3	7.7	7.7	7.5
Flavour	7.0	6.5	6.8	6.0
Acceptability	7.0	6.6	6.8	6.0
Mutton Dhanasak				
Colour	6.0	7.8	7.8	7.6
Flavour	5.2	7.0	7.0	6.8
Acceptability	4.7	7.0	7.0	7.0
Mutton Bone Kashmiri				
Colour	7.5	7.4	8.0	8.1
Flavour	7.6	7.8	7.5	7.6
Acceptability	7.5	7.3	7.5	7.5

The characteristics of canned products like vacuum, head space, pH and proximate composition[5] are given in Table 2. The most striking feature was the low vacuum in the can inspite of the filling temperature. The head space differered from product to product because all the cans were filled to constant weight. The moisture, protein, fat, ash, chloride and fibre content of representative batches of the six different products have also been estimated.

Organoleptic evaluation during standardisation of the product consisted of offering the curry prepared using the concentrated gravy to a panel of judges drawn from the staff of the Institute. The organoleptic scores (Table 3) indicate that there was a definite maturation and improvement during storage in the case of Mutton Kashmiri. In general there was no marked difference between the gravy stored at 25-30° and 37°C. The latter tended to have a lower score for acceptability. The product stored at 25-30°C up to 18 months was acceptable. No feathering of the can was noticed during this period.

Detailed sensory evaluation of the product, Mutton Kashmiri, was carried out to study:

(*i*) Quality of meat curry prepared using the canned meat gravy and canned meat curry of the same composition.

(*ii*) Whether frying of spices, one of the unit operations in large scale preparation of the canned meat gravy, could be eliminated.

(*iii*) Whether cost reduction could be achieved by using meat trims and bone stock obtained by cooking bones.

(*iv*) Batch to batch variation.

(*v*) Quality retention during storage at 25-30°C and accelerated storage at 37°C.

The concentrated gravy was cooked with mutton

chunks and the resultant gravy was separated from the mutton chunks. The cooked chunks were rinsed with an amount of hot water equivalent to half the weight of the separated gravy to recover the adhering gravy. The separated gravy and the rinse were mixed thoroughly and used for evaluation using a discriminative and communicative panel of judges to avoid any variation in the response due to the texture of meat. The panelists were asked to judge the aroma of the gravy as a combination of spices admixed with or blended with mutton aroma.

The results indicated that:

(*i*) The curry prepared using the canned concentrated gravy was comparable in quality to the canned curry of the same composition.

(*ii*) Meat gravy prepared after frying of spices was significantly inferior to the product prepared without frying of spices in terms of spice aroma blended with meat aroma. In terms of overall acceptability, frying or no frying did not make any difference indicating that the operation of frying spices was optional.

(*iii*) Meat trims and bone stock could be used in preparation of the product instead of using meat chunks without causing any difference in quality.

(*iv*) No significant batch to batch variation in quality was observed.

(*v*) The canned gravy stored at 25-30° and 37°C were comparable to the fozen stored (–10°C) sample up to one year.

The cost data worked out at the prevailing rates given in Table 4 show that the ex-factory cost per can would be Rs. 6.00. The cost involved for the other five recipes are lower than that for Mutton Kashmiri. Many other recipes also could be processed as concentrated meat gravy and canned.

TABLE 4. RAW MATERIAL COST FOR PRODUCTION OF ONE TONNE OF MUTTON KASHMIRI*

Ingredients	Rate/kg. (Rs.)	Quantity (kg.)	Total cost (Rs.)
Mutton (as carcass)	10.00	200 (100)	2000.00
Onion	0.70	185 (166)	129.50
Tomatoes	1.00	120	120.00
Poppy seeds	6.00	40	240.00
Cashew nuts	30.00	40	1200.00
Red cherries	18.00	40	720.00
Green curry stuff	5.00	64 (44)	320.00
Spices	87.00	11	957.00
Refined oil	10.00	160	1600.00
Curds	2.00	75	160.00
Salt	0.50	21	10.50
			7446.50

Ex-factory cost of Mutton Kashmiri
(*Production at* 1 *tonne per day*)

Total ingredient cost	Rs.	7446.50	
Market fluctuations (at 15%)		1116.98	8563.48
Labour charges for 424 man hr (at Rs. 10/8 man hr)		530.00	
Services (steam, electricity, water		300.00	
Cans (at Re. 1 per can)		3125.00	3955.00
Cost of raw materials/can (at Rs. 8563.48/3125 cans)			2.74
Cost of labour, services and container/can (at Rs. 3955.00/3125 cans)			1.26
Cost of factory building, machinery etc. per can			1.00
			5.00
Profit at 20%			1.00
Cost per can			6.00

*3125 cans (301 × 309) of 320 g net weight.
Figures in paranthesis indicate the quantity obtained after cleaning

Acknowledgement

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Effect of Pre-chill Processing on Keeping Quality of Smoked Hams

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Smoked hams were prepared by pre-and post chill methods with dry curing. There were no significant differences in proximate composition and bacterial load of the pre-and post-chill uncured hams. The pH of pre-chill uncured hams was significantly ($P < 0.01$) higher than that of post-chill uncured hams. pH, proximate composition, chloride, nitrite and FFA contents and curing and smoking losses, organoleptic and visual qualities did not differ in the two types of hams. The pH was not significantly correlated with the duration of storage at refrigerated temperature. There was positive significant correlation ($P < 0.01$) between FFA contents and bacterial load on one hand and the duration of storage at the refrigerated temperature on the other hand. Both types of hams were stored without deterioration upto 4 days at room temperature and upto 36 days at 2-4°C.

In conventional process of preparing smoked hams, a caracass is chilled for 24 hr in a cooling chamber. This cooling time which is supposed to improve the quality of meat, adds considerably to the time and equipment needed for the process. Efforts have been recently made to eliminate the process of chilling altogether[1-5]. These studies have indicated that processed pork of excellent quality could be produced without chilling the carcasses. As Indian palate is different, it was thought desirable to investigate whether avoiding of chilling in the preparation of smoked ham would appeal to the consumers of this country.

Materials and Methods

Six large white Yorkshire sows of approximately equal age weighing 125 to 140 kg were slaughtered by the conventional method. The hams from two sides of a carcass were randomly assigned to either pre-or post-chill processing.

In pre-chill processing the hams were removed immediately post-slaughter, skinned, trimmed of superficial fat and deboned. The hams were then cut into 500g pieces and dry cured. A dry cure mixture developed in our laboratory (containing salt, 45g; sugar, 30g; sodium nitrate, 1.86g; sodium nitrite, 0.15g; ascorbic acid, 0.45g; and sodium phosphate dibasic 5g.) was used at the rate of 82.5 g/kg of ham. Half the quantity of cure was applied immediately after the pieces were cut. The remaining cure was applied after the pieces were stored in refrigerator at 2° to 4°C for 24 hr. The ham pieces were then cured for 2 days in refrigerator. After curing, the pieces were desalted for one hour under tap water. The water was allowed to drain off for 30 min. at room temperature. The pieces were then weighed and smoked for 7 hr after raising the temperature gradually to 55-60°C. Saw dust was used for generating smoke. The pieces were cooled, vaccum packed in polythene bag and weighed. The curing and smoking losses were determined.

In post chill process the hams were chilled for 24 hr at 2° to 4°C and cut into pieces and cured as detailed above.

Pieces from corresponding parts of *biceps femoris* muscle in pre-chill and post-chill hams were obtained before curing and after smoking for determining pH, proximate constituents and bacterial load.

Chloride, nitrite, free fatty acid (FFA) content and organoleptic qualities of corresponding pieces of smoked ham prepared by both the processes were determined on the day the smoking was completed. The remaining pieces of pre-and post-chill processed hams were stored either at room temperature or in the refrigerator (2° to 4°C). The pieces stored at room temperature (around 15°C) were sampled every 2 days for determination of pH, FFA, bacterial load and organoleptic qualities. These parameters were determined in respect of pieces stored in a refrigerator at 4 days intervals. For organoleptic and visual appraisal the smoked ham pieces were cooked at 15 lb-pressure for 20 min in an autoclave and then rapidly cooled for 2 hr in refrigerator. They were cut into equal size slices of 3.5 to 4.0 mm thickness and were served.

TABLE 1. THE COMPOSITION, pH AND BACTERIAL LOAD OF PRE— AND POST-CHILLED UNCURED HAMS

Process	Moisture (%)	Protein (%)	Ether extract (%)	Ash (%)	pH	bacterial load (log)
Pre-chill	73.7	20.5	4.47	0.95	6.37	5.18
Post-chill	73.5	20.6	4.50	1.01	5.93	5.24
Significance	NS	NS	NS	NS	**	NS

**Significant at $P < 0.01$
NS—Not significant.

The organoleptic scores were based on 7 point scale while the visual appraisal scores were based on 4 point scale. The method suggested by Kemp and Longlois[6] was used for scoring.

Moisture, protein, ether extract, ash, chloride and nitrite contents were estimated according to the standard procedures[7]. For determination of bacterial load, pour plate method suggested by Cruickshank[8] was followed. For estimation of free fatty acids (FFA) fats were extracted with chloroform from 25 g of well minced muscle after treating with 50 g of anhydrous sodium sulphate[7].

Fisher's 't' test was used to test the significance of the difference between the two treatment means. The regression of pH, FFA and bacterial load on duration of storage was determined[9]. The scores for organoleptic evaluation were analysed as for factorial experimental unit and the results of various chemical determinations were analysed by factorial design with one observation per experimental unit[10]. Significance was tested at $p=0.05$ unless mentioned otherwise.

Results and Discussion

No significant differences were observed in moisture, protein, ether extract, ash and bacterial load of uncured hams immediately after slaughter (pre-chill) and after 24 hr of chilling (post-chill). The pH of the post-chill hams was significantly ($P<0.01$) lower (Table 1). As would be realized, low pH of the post-chill hams would be due to formation of lactic acid by anaerobic glycolysis in the muscles during storage.

When pre-and post-chill hams were subsequently cured, smoked and various quality attributes of smoked hams were determined it was found that the pre-and post-chill smoked hams did not differ significantly in proximate composition, nitrite, chloride, FFA, pH, bacterial load, and curing and smoking losses. Smoking of cured hams reduced the bacterial load (Table 1 and 2). Organoleptic scores of the taste panel have been summarized in Table 3. The processing of hams either by pre-chill or post-chill method did not make any significant difference to the various attributes under study on zero day. The scores given to the two types of hams were lower than the maximum scores in respect of flavour, juciness, saltiness and overall satisfaction. The difference was particularly large in respect of tenderness. It would have been desirable to compare these smoked hams with some standard material. Probably it is absence of such standards for comparision that the scores are lower than the maximum. Generally the panel members rated them as excellent and indistinguishable. Similar observations were made in respect of firmness, aroma and general appearance.

The type of processing did not show any significant influence on pH, FFA, bacterial load and any of the organoleptic and visual appraisal scores under study on the fourth day of storage at room and refrigerated temperatures. On the 4th day the bacterial load of the smoked hams stored at room temperature were significantly ($P<0.01$) higher than that stored in the refrigerator. Still the bacterial load of the hams kept at room temperature was lower than 1×10^7 maximum considered safe for human consumption[11]. The hams stored at refrigerated temperature were adjudged to have significantly ($P<0.01$) better flavour than the hams stored at room temperature. The other attributes were not affected by storage temperature (Table 5).

There was highly significant correlation between

TABLE 2. INFLUENCE OF PRE AND POST-CHILL PROCESSING ON CERTAIN PARAMETERS IMMEDIATELY AFTER SMOKING OF SMOKED HAMS

Process	Moisture (%)	Protein (%)	Ether extract (%)	Ash (%)	Nitrite (ppm)	Chloride (%)	FFA (%)	pH (%)	Bact load@ (log/g)	Curing loss (%)	Smoking loss (%)
Pre-chill	62.2	28.6	3.37	5.76	8.77	4.40	0.44	5.76	4.76	2.85	23.72
Post-chill	62.2	28.3	3.74	5.75	8.11	4.02	0.49	5.90	4.80	2.66	23.42

Values are the average of 3 observations. @ values expressed as log number per gram smoked ham. None of the values are significantly different.

TABLE 3. ORGANOLEPTIC AND VISUAL APPRAISAL SCORES OF SMOKED HAMS STORED FOR VARIOUS DURATIONS

Parameters	Process	Room temp		Duration of storage (days) at refrigerated temp					
		0	4	4	12	20	28	36	44
Flavour[1]	Pre-chill	6.42	5.95	6.54	6.44	6.56	6.31	6.16	6.41
	Post-chill	6.31	6.29	6.50	6.41	6.20	6.42	6.62	6.41
Juciness[1]	Pre-chill	6.04	5.87	6.00	6.18	6.04	5.92	5.75	5.82
	Post-chill	6.00	6.08	5.95	6.00	5.68	5.88	5.79	6.29
Tenderness[1]	Pre-chill	5.88	6.03	6.37	6.22	5.96	6.15	5.66	5.76
	Post-chill	6.04	5.88	6.16	5.74	5.88	6.07	5.83	5.76
Saltiness[1]	Pre-chill	6.26	6.12	6.29	6.52	6.40	6.08	5.95	6.29
	Post-chill	6.11	6.33	6.50	6.15	6.24	6.08	6.08	6.41
Overall Satisfaction	Pre-chill	6.11	5.91	6.29	6.22	6.16	6.08	5.66	5.82
	Post-chill	6.11	6.20	6.21	5.89	6.24	6.07	5.75	6.35
Firmness[2]	Pre-chill	3.19	3.20	3.25	2.85	3.00	3.04	3.12	2.94
	Post-chill	3.23	3.25	3.17	3.00	3.08	3.07	3.00	3.00
Colour[2]	Pre-chill	2.88	3.00	2.62	2.85	3.00	2.65	3.00	3.00
	Post-chill	3.11	3.08	2.75	2.78	2.56	2.84	2.58	3.23
General appearance[2]	Pre-chill	3.07	3.25	3.29	3.04	3.32	3.08	3.12	3.23
	Post-chill	3.19	3.29	3.37	3.04	2.96	3.15	3.04	3.41
Aroma[2]	Pre-chill	3.11	3.17	3.29	3.15	3.40	3.27	3.21	3.23
	Post-chill	3.26	3.25	3.52	3.15	3.20	3.26	3.17	3.17

1. The maximum score was set at 7.
2. The maximum score was set at 4.

TABLE 4. COEFFICIENT OF CORRELATION (r) AND REGRESSION COEFFICIENTS (b) BETWEEN DURATION OF STORAGE IN DAYS (INDEPENDENT, VARIABLE) AND VALUES OF PARAMETERS FOR PRE AND POST-CHILL HAMS (DEPENDENT VARIABLE)

	pH		FFA %		Bacterial load	
	Pre-chill	Post-chill	Pre-chill	Post-chill	Pre-chill	Post-chill
Coefficient of correlation (r)	0.369	0.345	0.790**	0.787**	0.977**	0.971**
Regression coefficient (b)	0.003	0.003	0.039**	0.043**	0.049**	0.049**

** Significant at $P < 0.01$

TABLE 5. MEANS AND STANDARD ERROR OF SELECTED PARAMETERS IN SMOKED HAMS IN 4 DAYS OF STORAGE AT REFRIGERATOR AND ROOM TEMPERATURE

Storage	pH	FFA %	Bact load (log)	Flavour	Juciness	Tender-ness	Saltiness	Over all satisfac-tion	Colour	Firm-ness	Aroma	General appear ance
Refrig temp.	5.91	1.69	4.81	6.52	5.98	6.27	6.39	6.25	2.69	3.25	3.42	3.33
Room temp.	5.95	2.38	5.23	6.12	5.98	5.89	6.23	6.06	3.06	3.23	3.21	3.27
Significance	NS	NS	**	**	NS	NS	NS	NS	NS	NS	NS	NS

1. Values are average of 6 observations the other values are average of 48 scores.

** Significant at $P<0.01$.

bacterial load obtained in pre-and post-chill treatments and duration of storage. The regression analysis of bacterial load and duration of storage gave the following equations: $Y=4.474+0.049\ X$ for pre-chill and $Y=4.528+0.049\ X$ for post-chill process. Y stands for bacterial load while X indicates duration of storage. Both the equations gave excellent fit ($r=0.977$ and 0.971 for pre-chill and post-chill, respectively). There was no significant correlation between pH and duration of storage for both pre-chill and post-chill process. FFA however, increased with duration of storage in pre-chill ($r=0.790$) and post-chill ($r=0.787$) processess (Table 4).

The hams stored at room temperature developed fungus growth by the 4th day while those stored at 2 to 4°C were free from fungus upto 36 days. It was, therefore concluded that smoked hams could be stored up to 36 days, at refrigerated temperature, (2-4°C) and upto 4 days at room temperature in winter season at Jabalpur.

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Colorimetric Determination of Dimethoate by Quantification of Cholinesterase Inhibition

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A simple, sensitive and rapid colorimetric method is developed for quantification of dimethoate (0, 0-dimethyl-S (N-methylcarbonoylmethyl) phosphorodithioate) and its oxygen analogue employing pig liver acetone powder as enzyme source and Fast Blue B as chromogenic salt. Inhibition could be detected at nanogram concentration and amounts ranging from 50 to 1000 ng dimethoate can be estimated, after converting it into its oxygen analogue.

Quantification of cholinesterase (ChE) inhibition for determination of organophosphorus pesticides, reported earlier by thin layer chromatography[1,2], potentiometry[3,4], fluorometry[5] and gas liquid chromatography[6] were found to be more sensitive than non-enzymatic methods[7-9]. As these methods are either cumbersome or require sophisticated equipments, attempts have been made to simplify the procedures further for determination of organophosphorus pesticides on ChE inhibition technique colourimetrically by one of the authors for methyl parathion[10] which was found to be rapid and sensitive at nanogram concentration. In the present investigation is reported a simple and sensitive colorimetric method for the determination of dimethoate (0, 0-dimethyl-S (N-methyl carbonoylmethyl) phosphorodithioate) and its oxygen analogue using Fast blue B as chromogenic salt. Pig liver acetone powder was used as enzyme source which can be used instantly. The present colorimetric method which can be carried out within 30 min including the preincubation time of the reaction mixture was found to be sensitive and suitable and may find application in forensic, clinical and residue analysis.

Materials and Methods

All chemicals were of analytical grade. Dimethoate (95 per cent) (0, 0-dimethyl-S- (N-methylcarbanoylmethyl) dithiophosphate) was obtained from Rallis India Ltd., Bombay, India. The oxygen analogue of dimethoate was obtained by the oxidation of dimethoate

with bromine vapour on thin layer chromatographic plate and repeatedly extracted in acetone as reported earlier[2,10,11]. Pig liver acetone powder was homogenised in ice cold distilled water and was used immediately as enzyme source[10].

ChE assay: One millilitre of the reaction mixture consisted of 200 μg of enzyme, 20 μm of barbital-HCl buffer pH 7.4 and 1 to 10 μg of either dimethoate or 100 to 1000 ng of oxygen analogue of dimethoate in acetone (0.01 to 0.1 ml). Controls contained acetone and distilled water in the place of pesticides. The reaction mixtures were preincubated for 10 min at 28°C with the pesticide. After this preincubation, 1.0 μm of 1-naphthyl acetate (Sigma Chemical Co., USA) in 0.01 ml of acetone and 0.2 ml of 0.4 per cent Fast Blue B (Sigma Chemical Co., USA) in distilled water were added, and the mixture was incubated for one more min. The enzymatic reaction was stopped by the addition of 4.0 ml glacial acetic acid and the samples were allowed to stand for 10 min. at room temperature. The magenta colour complex formed due to the diazo coupling reaction between 1-naphthol and diazonium salt (Fast Blue B) was measured at 540 nm in a Spectrophotometer and the corresponding amount of 1-naphthyl acetate metabolized was referred from a standard graph. The per cent ChE inhibition was calculated by normalising the control ChE activity to 100 per cent.

Dimethoate and its oxygen analogue in fortified paddy samples were estimated following cleanup technique[12].

Results and Discussion

The initial velocity of the enzyme reaction was, studied with respect to time, substrate and these factors were appropriately choosen for assaying the pig liver ChE activity. Tne amount of acetone was kept to minimum volume of 0.1 ml in a total volume of 1 ml of reaction mixture. Addition of acetone upto 0.1 ml is without effect. The percent cholinesterase inhibition was determined at various concentrations of dimethoate and its oxygen analogue (Table 1). A linear relationship was observed between pesticide concentration and ChE inhibition. A straight line obeying Beer's law, could be obtained and this was used as a calibration curve for determination of dimethoate and its oxygen analogue residues. The results showed that the oxygen analogue of dimethoate is a more powerful inhibitor than its parent compound. This is to suggest that better sensitivity of the method could be achieved by converting organophosphorus residues into their respective oxygen analogues. Pig liver acetone powder is preferred as it can be used instantly and can be stored indefinitely. It is more advantagenous than enzyme sources from live animals[1,2] whose procurement and isolation delays estimation.

The present colorimetric method is more sensitive than other colorimetric methods[7-9] based on non-enzymic reaction whose sensitivity ranges from 50 μg to 1 mg. In this method the residual concentrations at nanogram level can be estimated. This would obviate the usage of sophisticated instruments like GLC, spectrofluorometry, etc., Dimethoate residues in fortified paddy samples were estimated (Table 2) and-the present colorimetric method was found to be suitable.

TABLE 1. CHOLINESTERASE (%)[a] INHIBITION *vs* DIMETHOATE AND ITS OXYGEN ANALOGUE

Dimethoate oxygen analogue concn (ng)	ChE inhibition (%) Mean±S.D.	Dimethoate concn (μg)	ChE inhibition (%) Mean±S.D.
50	4.25±1.50	1	8.50±2.74
100	9.87±0.27	2	15.68±2.39
200	11.91±0.70	3	21.80±2.74
300	16.69±1.57	4	26.91±1.05
400	23.24±2.00	5	30.77±1.77
500	28.18±1.48	6	38.11±3.10
600	34.68±1.37	7	41.48±1.83
700	40.32±1.55	8	47.33±2.53
800	47.61±1.64	9	52.06±1.39
900	53.92±1.44	10	58.58±1.97
1000	61.26±1.77	—	—

Values are mean of 4 observations

a: 100% enzyme activity = 30 μm 1-naphthyl acetate metabolised /mg enzyme/hr.
ChE, Cholinesterase.

TABLE 2. ESTIMATION OF DIMETHOATE RESIDUES IN FORTIFIED PADDY SAMPLES

Amount of paddy (g)	Amount of Dimethoate fortified (μg)	Amount of Dimethoate recovered (μg) Mean±S.D.
50	5	4.92±0.06
50	7	6.85±0.1
50	10	9.8 ±0.15
50	15	14.9 ±0.1

Values are mean of 4 observations

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RESEARCH NOTES

BENZPYRENE IN SMOKED POULTRY

Controlling the time of smoking and reducing the rate of combustion by moistening the wood shavings, brought down the benzpyrene content in the smoke cured poultry below the permitted level of 0.002 ppm.

Meat and fish are still smoked using burning of hard woods. Smoke imparts desirable flavour and colour to the products and at the same time it contributes substantially to preservation by acting as an effective antioxidant, bacteriostatic and bactericidal agent, as well as providing a protective film on the surface of the smoked products.

Different levels of carcinogens have been found in smoked foods, the amount being related to many factors including method of smoke generation, temperature of combustion, oxygen from air supply, length of smoking time, density and temperature of smoke[1]. 3-4 benzpyrene is a useful indicator of the type of carcinogenic compounds present in the smoked food[2,3]. The objective of the present work is to establish conditions which will minimize the content of benzpyrene in smoke cured chicken meat.

The dressed poultry was salt cured and smoked as described earlier[4]. The smoking unit was provided with a smoke generating pit and ventilators to regulate flow of smoke, filters to eliminate tar and the dust particles in the smoke, suction pump to suck the smoke from the generating point and pass it on to the smoke chamber where the dressed poultry are hung, fans to facilitate the circulation of smoke in the smoke chamber and heating unit to bring the temperature of the smoke chamber to the desired level of 75-80°C[5].

Meat of smoked chicken (150g of both white and dark meat) was mixed thoroughly with double the quantity of anhydrous sodium sulphate. The hydrocarbons from the meat were extracted with benzene and methanol followed by separation of aromatic hydrocarbons from aliphatic ones by solvent partition between hexane and nitromethane and is completed by the partition between hexane and dimethyl sulphoxide. All the solvents were of reagent grade and each solvent was purified by treating with activated charcoal followed by distillation. Benzpyrene is then separated from other aromatic hydrocarbons by column chromatography, on a silica gel column by eluting with cyclohexane. Benzpyrene content was estimated by measuring the fluorescence in a fluorometer (using yellow filter) at excitation $\lambda = 381$ and plotting against a standard curve[5].

TABLE 1. BENZPYRENE CONTENT OF SMOKED POULTRY

Conditions of smoking	Benzpyrene (ppm)
7-8 hr free supply of air and dry wood shavings	0.032 – 0.063
3-4 hr free supply of air & dry wood shavings	0.002 – 0.021
3-4 hr restricted supply of air & moistened wood shavings	0.000 – 0.002

Results of three trials under each condition

It was observed in the study that when the products were smoked at 75-80°C for a longer period extending upto 7-8 hr with free supply of air into the generator (which causes increased combustion), benzpyrene concentration ranged from 0.032 to 0.063 ppm. (Table 1). In the subsequent batches of experiments the time of smoking was reduced from 7-8 hr to 3-4 hr at the same temperature of 75-80°C. The rate of combustion wass lowed by moistening the wood shavings and reducing the supply of air. Benzpyrene content in the final product was reduced considerably below the permitted level of 0.002 ppm (i.e. 0.002 mg/kg of the smoked product without affecting the flavour and lustre qualities of the product by the smoke and subsequent drying without smoke.

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STUDIES ON LAMB CARCASS TRAITS

Ninety four male lambs (79 'Muzaffarnagri' and 15 'Corriedale' halfbreds) were slaughtered and various carcass traits studied. Carcass traits did not differ significantly between the pure and crossbred lambs. The values for slaughter weight, dressing per cent and eye muscle area were found to be 26.2 kg, 56.3 and 10.8 cm^2 respectively. Leg was found to be heaviest among all the cuts followed by shoulder, loin, ribchop, breast, neck and flank. The phenotypic correlations among various carcass traits were positive and ranged from 0.13 to 0.94. Slaughter weight had high and positive correlation with all the carcass traits.

Evaluation and development of accurate measures of carcass appraisal are necessary to design breeding plans for improvement of mutton type sheep. No information is available on meat production potential of 'Muzaffarnagri', breed of sheep which is a major mutton type sheep of Northern India. The present investigation was, therefore, undertaken to study and evaluate the various carcass traits in 'Muzaffarnagri' sheep and its crossbreds with 'Corriedale'.

Data on various carcass traits were collected from the 94 male lambs of 'Muzaffarnagri' breed and its 'Corriedale' halfbreds which were born and reared under intensive feeding conditions till they attained 30 kg body weight or 9 months of age for slaughter at this Institute.

The records of individual lambs were adjusted for significant nongenetic factors and adjusted means, standard errors and Coefficients of variation were computed. The phenotypic correlations were estimated after Searle[1] among various carcass traits from the pooled data of both the genetic groups, adjusted for significant non genetic factors.

The adjusted means, their standard errors and coefficients of variation of various carcass traits in 'Muzaffarnagri' and its crossbred lambs alongwith pooled values are presented in Table 1. The variability in carcass traits between both the genetic groups was non significant, hence the pooled values were computed. From the Table 1, it was observed that the pooled values of slaughter weight, dressing per cent and eye muscle area have been found to be 26.2 kg, 56.3 and 10.8 Cm^2 respectively.

Higher dressing per cent was found in this breed in comparison to other Indian sheep breeds. This probably reflects better mutton potential of 'Muzaffarnagri' breed of sheep. Acharya[2] while reviewing the dressing per cent in Indian sheep breeds reported that it varied from 48.3 in 'Nali' to 50.3 in 'Sonadi' sheep when slaughtered at 6 months of age. Tiwari *et al.*[3] reported dressing per cent as 39.5 and 40.5 in 'Malpura' lambs when slaughtered at 6 and 9 months of age respectively. Mirajkar[4] has, however, obtained a higher dressing per cent of 58.1 in fattened lambs slaughtered at 18 months of age.

The mean pooled value of eye muscle area was found to be 10.8 cm^2 which was comparable to what has been reported in Bannur[5] and crossbred lambs.[6] Lower values of eye muscle area, have, however, been reported in non-Bannur[5] and Coimbatore lambs.[7] The variability in the mean eye muscle area in various studies indicates the degree of growth and development of skeletal tissue in the lambs at slaughter and to a great extent it has been attributed to differences in breeds. It can be concluded that 'Muzaffarnagri' sheep has great mutton potential.

TABLE 1. ADJUSTED MEANS, STANDARD ERRORS AND COEFFICIENTS OF VARIATION (C.V.) OF LAMB CARCASS TRAITS

	Purebred (n = 79)		Crossbreds (n = 15)		Pooled (n = 94)	
Carcass traits	Means ± S.E.	C.V.	Means ± S.E.	C.V.	Means ± S.E.	C.V.
Slaughter wt. (kg.)	25.6 ± 0.64	22.4	28.9 ± 1.34	17.9	26.2 ± 0.59	21.8
Dressing (%)	56.4 ± 0.24	3.8	55.5 ± 0.51	3.6	56.3 ± 0.22	3.8
Eye muscle area (Cm^2)	10.7 ± 0.32	26.7	11.6 ± 0.49	16.3	10.8 ± 0.28	25.2
Shoulder (%)	19.5 ± 0.17	7.5	19.4 ± 0.41	8.2	19.5 ± 0.15	7.6
Neck (%)	7.9 ± 0.16	17.7	7.8 ± 0.44	21.8	7.9 ± 0.15	18.3
Breast (%)	12.6 ± 0.14	9.9	11.7 ± 0.24	7.9	12.4 ± 0.13	10.0
Ribchop (%)	13.3 ± 0.18	11.9	14.4 ± 0.40	10.9	13.9 ± 0.17	11.8
Leg (%)	26.2 ± 0.24	8.1	26.0 ± 0.41	6.0	26.3 ± 0.21	8.0
Loin (%)	15.0 ± 0.19	11.2	15.3 ± 0.53	13.4	15.1 ± 0.18	11.5
Flank (%)	3.3 ± 0.08	21.6	3.9 ± 0.20	19.7	3.4 ± 0.08	22.0

n = number of observation

TABLE 2. PHENOTYPIC CORRELATIONS WITH THEIR STANDARD ERRORS AMONG CERTIAN LAMB CARCASS TRAITS

Carcass traits	Empty live wt. Mean ± S.E.	Dressed carcass wt. Mean ± S.E.	Eye muscle area Mean ± S.E.	Kidney fat Mean ± S.E.	Omental fat Mean ± S.E.
Slaugher wt.	0.92±0.04	0.94±0.38	0.62±0.08	0.71±0.08	0.63±0.08
Empty live wt.		0.13±0.06	0.62±0.08	0.81±0.06	0.83±0.06
Dressed carcass wt.			0.61±0.08	0.75±0.07	0.76±0.07
Eye muscle area				0.23±0.10	0.22±0.10
Kidney fat					0.13±0.06

It was observed that the leg was the major component of the chilled carcass weight (26.3 per cent) followed by shoulder (19.5 per cent), loin (15.1 per cent), ribchop (13.9 per cent), breast (12.4 per cent), neck (7.9 per cent) and flank (3.4 per cent). Almost similar trend in the cuts was observed in some of the Indian sheep breeds[7-9].

The phenotypic correlations among various carcass traits are presented in Table 2. Results reveal that all the carcass traits had positive correlations among themselves, ranging from low (0.13) for kidney fat and omental fat to high (0.94) for slaughter weight and dressed carcass weight. The slaughter weight had significantly high correlation with all the carcass traits. Stanley *et al*[10]. indicated that live weight due to its high association with carcass traits was a good predictor of carcass traits. A significantly high and positive relationship of hot carcass weight and slaughter weight with eye muscle area was also reported.[7,11] Our results are in close agreement with their findings. The slaughter weight thus appeared to be effective for selecting meaty carcasses as was indicative from its high association with carcass traits.

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A NEW BEVERAGE FROM DRIED BER (*Zizyphus mauritiana* Lam)

A ready-to-serve beverage containing 33.3% juice was prepared from dried ber (*Zizyphus mauritiana*) fruit after cooking and extracting the juice in a basket press. The juice had a pH of 3.75 and 19.6 °Brix with 0.56% acidity. The ber juice after processing at 80°C for 10 min stored well for 9 months at room temperature (20-38°C). The beverage was organoleptically acceptable.

The ber (*zizyphus mauritiana*) fruit is grown widely in the northern regions over an estimated area of about 24,457 acres.[1] No product has been prepared commercially though methods have been reported on the preparation of products like candy, canned and dried ber[2,3]. Studies carried out to prepare a beverage from dried ber are reported here.

One kilogram of washed dried ber of variety 'Katha' were cooked with 6 l. of water for 60-80 min and the cooked mass was extracted through a basket press. This procedure was adopted from Hoffman[4] who found that cooking the dried prune with water, helped maximum extraction of soluble solids and fruit colour. The extract was allowed to settle and the clear juice was separated.

The average yield of juice was 200 ml per 100 g of dehydrated fruit. The juice had a pH of 3.75; total

TABLE 1. COMPOSITION AND ORGANOLEPTIC EVALUATION OF BEVERAGES PREPARED FROM DRIED BER JUICE

Ber juice (ml)	Sugar (g)	Water (ml)	Citric acid acid (g)	°Brix (20°C)	Acidity (%)	Brix & acidity ratio	Organoleptic quality	
							Over all score	Rating
100	42	160	0.65	20.8	0.51	40.8	7.5	Like moderately
100	42	160	1.24	20.0	0.58	34.5	7.0	,,
100	27	170	0.34	15.6	0.38	41.1	6.0	Like slightly
100	27	170	0.94	16.0	0.45	35.6	5.5	Neither like nor dislike.

The juice content in the beverage was 33.3%.

soluble solids (TSS), 19.6° Brix and 0.56 per cent acidity as anhydrous citric acid. The juice possessed slight acrid taste, a typical dried ber flavour and reddish brown colour and as such it was not found acceptable. Therefore, a ready-to-serve beverage of different formulations was prepared (Table 1). Organoleptic evaluation using Hedonic[5] scale showed that a ready-to-serve beverage having 33.3 per cent juice and 20.8° Brix and an acidity of 0.51 per cent was liked moderately by the panel of ten judges.

To study the storage behaviour of the dried ber juice, it was heated to 80°C, filled into clean sterile bottles, sealed and processed in boiling water (100°C) for 10 min and cooled. During storage at room temperature 20-38°C) for 9 months there was slight decrease in TSS., the acidity and the pH remained constant. However, the colour of the juice was darker, the beverage prepared out of it was found organoleptically acceptable.

Author is grateful to Dr. R. N. Singh, earlier Head of the Division of Horticulture and Fruit Technology and Prof. Ranjit Singh, present Head of the Division, for their keen interest and encouragement during the course of investigation.

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STUDIES ON SOME ASPECTS OF INSTANTIZATION OF RICE

Instant rice has been preparared by (*i*) roasting followed by precooking and dehydration, (*ii*) stepwise gelatinization (*iii*) pretreatment with chemicals followed by step wise gelatinization, and (*iv*) high temperature pneumatic dehydration. Instant rice produced by stepwise gelatinization with or without roasting cooks in 5-6 min, whereas those subjected to high temperature pneumatic dehydration reconstitutes within 4-5 min in boiling water. Pretreatement with chemical did not show any beneficial effect in reducing the reconstitution time.

Precooked dehydrated rice having short reconstitution time and satisfactory storage life is a desirable item in Service rations especially at high altitudes. Attempts have been made to prepare processed rice with low reconstitution time[1-3]. The processed rice developed earlier had a reconstitution time of 8-10 min. It had a satisfactory storage life and was liked by the Service personnel. But further need was felt to reduce the reconstitution time of rice in conformity with other items developed for pack rations like mutton mince and pulses which took only 4-5 min for reconstitution. The various methods adopted to reduce the reconstitution time of rice is reported in this note.

Rice used was 'Bangara Sanna' variety procured from the Mysore market. The pretreatment adopted for rice prior to cooking and dehydration was essentially to bring about porosity in rice grains prior to processing[4]. The rice was adjusted to 14-15 per cent moisture and taken in an aluminium shallow basin and roasted uniformly to attain a temperature of about 90°C in 2.5 to 3 min. The rice was then soaked in cold water (1:1 by weight) for 8-10 min; cooked in autoclave at 5 psig for 5 min and dried in cabinet dryer at 60-70°C to about 5 per cent moisture.

In stepwise gelatinization, the rice was soaked in cold water (1:1 by weight) for 2hr after adding 0.3 per

cent glyceryl mono stearate–GMS (on wt. of rice) to soak water. Rice was then subjected to pressure cooking for 5 min at 10 psig. The cooked grains were brought to room temperature; spread uniformly over a tray and again water was added, (1:0.6 wt. of rice), mixed uniformly and allowed to get absorbed. It was further pressure cooked for 5 min at 10 psig. The cycle of adding water and pressure cooking was repeated for the third time under similar conditions except that water added in the third operation was in the ratio of 1:0.5 by wt of rice. The gelatinization is thus completed in stepwise manner in three stages. Finally the rice grains were spread over trays and dried in a cross-flow dryer at 70-75°C to about 5 per cent moisture.

The chemicals used for pretreatment are disodium phosphate, sodium tripolyphosphate, lactose, and sodium chloride. Various combinations (in per cent) are: 0.75 GMS; 0.3 GMS+0.3 disodium phosphate; 0.3 GMS+0.5 lactose; 0.3 GMS+0.5 sodium chloride; 0.3 GMS+0.5 lactose+0.3 disodium phosphate; 0.3 GMS+0.5 sodium tripolyphosphate; 0.3 GMS+0.5 sodium tripolyphosphate+0.3 sodium chloride. These were added to the cold soaking water and all operations including step wise gelatnization were done as mentioned above.

In the high temperature pneumatic dehydration, rice was soaked in cold water (1:1.5 by wt) for 30 min, with 0.75 per cent glyceryl mono stearate (on wt. of rice) being added to soak water followed by steam cooking for 15 min and high temperature pneumatic dehydration at 160-170°C for 4-5 min in a specially designed pneumatic dryer. Residual moisture was removed by drying to about 5 per cent moisture in a fluidized bed dryer at 70°C for 30 min.

Moisture, fat, total proteins, crude fibre and ash were determined by AOAC methods[5]. Reducing and total sugars were determined by AACC method[6]. Cooking characteristics were determined as per the method reported earlier[7]. *In vitro* digestibility of rice grains was measured by the amount of maltose liberated and amount of nitrogen rendered soluble by digesting the samples with pancreatin[8]. The available maltose was estimated by colorimetric method using 3,5 dinitro salicylic acid and measuring absorbance at 540 nm in Klett colorimeter[9]. Nitrogen was estimated by Kjeldhal's method. All values are expressed on 10 per cent moisture basis.

Quick cooking rices are normally precooked samples of rice which have been dehydrated under such condition to get porous texture in the finished product. This results in changes in physical dimension of rice kernels. Due to stepwise gelatinization and high temperature pneumatic dehydration, substantial changes occur to the dimensions of rice kernel. These are given in Table 1.

TABLE 1. PHYSICAL CHARACTERISTICS OF INSTANT RICES

Rice samples	Wt. of 100 kernels (g)	Length (mm)	Breadth (mm)	L/B ratio	Bulk density (g/ml)
Instant rice based on stepwise gelatinization	1.42	7.91	1.17	6.76	0.53
Instant rice based on high temperature pneumatic dehydration	1.39	8.17	2.95	2.77	0.40
Raw rice	1.48	5.25	2.10	2.50	0.86

The length and breadth of rice kernels increase as a result of instantization. In the case of rice based on stepwise gelatinization the kernel gets elongated substantially and also there is simultaneously shrinkage in breadth and hence the ratio of length to breadth increases to a great extent. In high temperature pneumatic treatment, the kernel length and breadth both increase and hence there will not be much variation in the values of length to breadth ratio in the final product. The bulk density decreases as a result of instantization due to puffing of the grains. The rice kernel weight decreases slightly as a result of instantization due to the loss of soluble matter during processing.

The instant rices were organoleptically acceptable by a panel of judges selected from this laboratory. The texture and flavour of cooked grains are almost similar to cooked normal rice grains.

Instant rice developed based on preheat treatment followed by precooking and dehydration could be reconstituted in 5-6 min in boiling water. Tnis method has a problem of breakage of grains during initial roasting. Broken grains reduce the acceptability of cooked rice. Instant rice based on stepwise gelatinization also cooks in 5-6 min, but the breakage of grains during processing is less as compared to former method. Instant rice produced by high temperature pneumatic dehydration could be reconstituted in 4-5 min in boiling water or in 20 min in hot water when kept covered without any further application of heat or in 30 min by soaking in water at ambient temperature.

Pretreatment with chemicals did not bring about any marked improvements either in cooking time or in swelling number. Only sodium chloride either alone or in combination with other reagents enhanced the cooking time. The addition of glucose or fructose imparts lustre to some extent on the surface of the grains. Glyceryl mono stearate pretreatment prevents excessive stickiness and agglomeration of grains upon cooking.

The chemical composition of rice changes only marginally as a result of instantization.

The *in vitro* digestibility of rice increases by instantization. When treated with pancreatin at pH 6.8, at 50°C for 30 min it has been observed that nitrogen rendered soluble is 0.62 per cent in the case of instant rice based on stepwise gelatinization and 0.63 per cent in case of instant rice based on high temperature pneumatic dehydration as against 0.31 per cent in raw rice. Similarly, in the case of carbohydrate digestion it has been found that instant rice produced by stepwise gelatinization liberates 32.00 mg of maltose and instant rice subjected to high temperature pneumatic dehydration liberates 42.12 mg maltose per 100 mg rice as against 17.28 mg maltose liberated by raw rice.

The authors wish to express their grateful thanks to Dr. P. K. Vijayaraghavan, Director, of the Laboratory for his keen interest in this investigation.

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BOOK REVIEWS

The Markets for Mint Oils and Menthol: by P. Greenhalgh, Tropical Products Institute, London; pp. XI+170; 1979, Price: £ 3.80.

This report is one of a series in the publication of the Tropical Products Institute and designed mainly to help the developing countries to derive greater benefit from their plant resources. This longish report (171 pages spread over 10 chapters) discusses in detail the varied aspects of the three major mint oils—*Mentha piperita*, *Mentha arvensis*, *Mentha spicata* and Menthol derived from *Mentha arvensis*.

The first chapter outlines the botanical and other characteristics as well as the grading and uses of these oils and menthol in consumer products. Chapter 2 is on production and supply of mint oils/menthol. In chapters 3-6 the trends of imports and exports are analysed using international trade statistics. Chapter 7 discusses the major markets and their requirements. Prices of mint oils and menthol are outlined in Chapter 8. The trading structure is analysed in Chapter 9 along with a discussion of tariff levels. The final chapter looks at the future requirements for these products and some of the marketing difficulties likely to face new producer.

Mint is probably the world's third most important flavour after vanilla and citrus flavours. These three mint oils and menthol practically dominate this area, involving over $ 100 million in transaction each year. With the production of synthetic menthol increasing, the opportunity for increased production, *M. arvensis* oil (and Menthol) is becoming limited specially in view of the fact that the demand for these flavour oils and menthol (synthetic and natural) are fully met by current production.

The author concludes "Any new producer capable of producing *M. piperita* spearmint oils which can be substituted for any U.S. produced oils, will certainly find a ready market at an attractive price." Commercial quantities of *M. piperita* oil are being produced in U.P. Tarai region of India in the last few years. There is definitely great scope for increasing production of this oil not only for use in India but also for possible exports.

This report, well written and fully documented, should find a place on the shelf in all libraries, more so in such institutions which are engaged in propagating the cultivation of mint oils and/or their utilisation in flavours.

B. C. SUBBA RAO
HINDUSTAN LEVER LTD., BOMBAY.

The Markets for Selected Herbaceous Essential Oils: by S. R. J. Robbins and P. Greenhalgh; Tropical Products Institute, 56/62 Gray's Inn Road, London, April 1979, 60 pp. Price: £ 1.60.

This report presents an analysis and discussion of recent and present trends in and future prospects for herbaceous essential oils. With one or two exceptions herbaceous essential oils are no where produced in large quantities. They are invariably used in very small amounts in industrially prepared food products (canned soups and meats) and in various types of perfume/flavours. Some of these herbs themselves are being used for culinary purposes.

The herbaceous oils covered in this report include Rosemary, Dill (seed and weed), Marjoram, Origanum, Thyme and related products, Dalmation and Spanish Sage, Celeryseed Oil, Fennel Seed oil (bitter & sweet), Basil (sweet and Reunion type), Parsley (both from herb and seed), Bay (Laurel leaf oil, tarragon, chervil, savory and garlic oil. Each of these oils is discussed in detail with regard to their production from herbal matter (steam distillation/solvent extraction), the quality/flavour characteristics of the oils obtained from these, along with the producing countries, production statistics, consuming countries and potential markets.

Though this report is well written and documented, the utility of this in tropical countries like India is very limited. However, it should find a place in all the libraries of Agricultural Universities so that the universities can advise prospective growers of these herbs regarding the scope/limitations etc.

B. C. SUBBA RAO
HINDUSTAN LEVER LTD., BOMBAY.

Changing Dietary Patterns and Habits: by L. P. Vidyarthi, R. K. Prasad and V. S. Upadhyay, Concept Publishing Co., H. 13, Balenagar, New Delhi, 1979, 190 pp. Rs. 60/- ($ 12).

Very seldom does man eat all the potentially edible materials available to him. Often, his dietary pattern is influenced and/or determined by several ecological factors. The cultural pattern learned from parents and associates by subconscious observation over a long period of time classifies food items as appropriate and inappropriate foods. The relation between ecology and foods has been a subject of fascination for many socio-

logists and anthropologists. In this book, experienced anthropologists from Bihar have presented the results of a study on indigenous dietary habits of the people in the State. The main theme of the study is to identify and revive some old practices and recipes considered to be of importance.

The study was carried out in four different regions-including a tribal area of Bihar selected on the basis of linguistic and cultural characteristics. The book has five chapters and describes indigenous dietary habits and recipes, dietary patterns and habits of the people, changing dietary patterns and the intake standard (dealing with the quantitative aspects of the diet).

The important role played by economic, religious and social factors in determining the dietary pattern of the people of Bihar has been brought out. The authors have also presented high frequency and low frequency foods based on the preferences expressed by the community in the different regions. It is interesting to note that a considerable percentage of the community, accepted packed and ready-made foods. Detailed recommendations have been made to revive some old recipes. However, high cost of the ingredients of these recipes was one of the main reasons for the low frequency of consumption by the communities. Revival of these these recipes calls for concerted efforts and how far these are feasible remains to be seen.

The chapter on intake standard, mainly dealing with the quantitative aspects of the diets in the area, appears to rest on a rather weak base. Data have not been treated in depth as they should have been. It is not clear how the requirements for various nutrients in each region were worked out. It is also not indicated in the table whether the intakes are per caput or per consumption unit. The authors would have done well to verify some of the statements made, such as "unboiled rice contains more moisture than the parboiled rice and the latter has more carbohydrate".

The book includes a detailed glossary listing the various foods in the different regions of Bihar. A little more attention to proof reading particularly with regard to botanical names would have eliminated several errors that have unfortunately crept in.

In general, the report makes interesting reading, though at times some very common observations have been discussed at length. The high price of the book may restrict its wide use.

K. VIJAYARAGHAVAN
NATIONAL INSTITUTE OF NUTRITION, HYDERABAD.

Food Preparation hand Book: by Maryanna S. Cassady, Home Science Association of India, Avinashalingam College, Coimbatore, 1973, Price: Rs. 5-00.

This is a handy reference book dealing with food preparations, at industrial and cottage level, institutional level, and at home. There are 15 sections dealing with eggs, fats and oils, leavening agents, meats, etc. The section on food information which is sufficiently exhaustive deals with baking time, thickening and jellying agents, recipe formulation, substitution of ingredients, and such others.

SAROJINI K. DASTUR
C.F.T.R.I., MYSORE.

ASSOCIATION NEWS

Madras Chapter

The International Year of the Child, 1979, was celebrated by organising a two-day Symposium on "Food needs of infants and preschool children". This endeavour was generously supported by Govt. of India, Govt. of Tamilnadu and UNICEF.

The Symposium was inaugurated by His Excellency Sri Prabhudas Patwari, Governor of Tamilnadu. Mr. T. Glan Davis, Director, UNICEF, South Central Asia Region delivered the Special Address on the role of UNICEF in promoting nutrition and related activities of the children in the country. Mr. P. Murari, I.A.S. Secretary, Health & Family Welfare, Govt. of Tamilnadu participated in the Symposium and declared open the Exhibition. Sri S. Rajagopalan, President, AFST(I) Madras Chapter welcomed the gathering and Sri M. Srikrishna, Secretary proposed the vote of thanks.

The Symposium was organised in 3 major sessions with the following themes.

— Dietary needs of infants and preschool children

— Processing of foods suitable for infants and preschool children

— Marketing, distribution and promotion of foods suitable for infants and preschool children.

There were two lead papers for the first session. The first paper on "Dietary needs of infants upto one year" was presented by Dr. K. A. Krishnamurthy, Director, Institute of Child Health, Madras. The paper considered the nutritional needs of pregnant and lactating mothers and infants upto one year.

The second paper was on "Nutrition and dietary needs of child after one year" presented by Dr. Rajammal P. Devadoss, Principal, Home Science College, Coimbatore. The paper emphasised the need for proper nutrition education in elementary schools.

The Four lead papers presented in the second session were

— "Milk & milk based foods" by Mr. M. R. Chandra sekhara, Bombay

— "Weaning Foods" by Dr. H. S. R. Desikachar, Mysore

— "Food Mixes" by Dr. M. S. Narasinga Rao, Mysore

— "Bakery foods" by Dr. Jayaram, Bombay

The consensus was that there is a need to develop a low cost weaning food and at the same time preserve the traditional practice of breast feeding.

Dr. A. Srinivasan and Dr. Gopalan acted as Rapporteurs for this session.

The three lead papers presented in the third session were:

— "Marketing & Distribution" by Mr. G. S. Fernando, Bombay

— "Education" by Dr. Tara Gopaldas, Baroda

— "Extension" by Dr. H. W. Butt, Hyderabad.

The Symposium ended with the valedictory address by the Chief Secretary, Govt. of Tamilnadu.

ANNOUNCEMENT

Dear Member,

The new Bye-laws of AFST(I) come into effect from Ist January 1980. As per the Bye-laws, the membership fee should be paid on or before 31st March of each calendar year. All the members are requested to pay their membership fee as early as possible so that they may not miss any issue of our Journal.

The revised membership fee is as follows:

Mode of membership	Fee	Admission Fee
Life Member	Rs. 300-00	Rs. 2-00
Corporate Member	Rs. 300-00	Rs. 5-00
Members (Ordinary)	Rs. 20-00	Rs. 2-00
Affiliate Member	Rs. 30-00	Rs. 2-00
Student Member	Rs. 10-00	Re. 1-00

There is no change in the existing subscription rates.

It is also requested that the arrears, if any, may also be cleared.

HON. EXC. SECRETARY.

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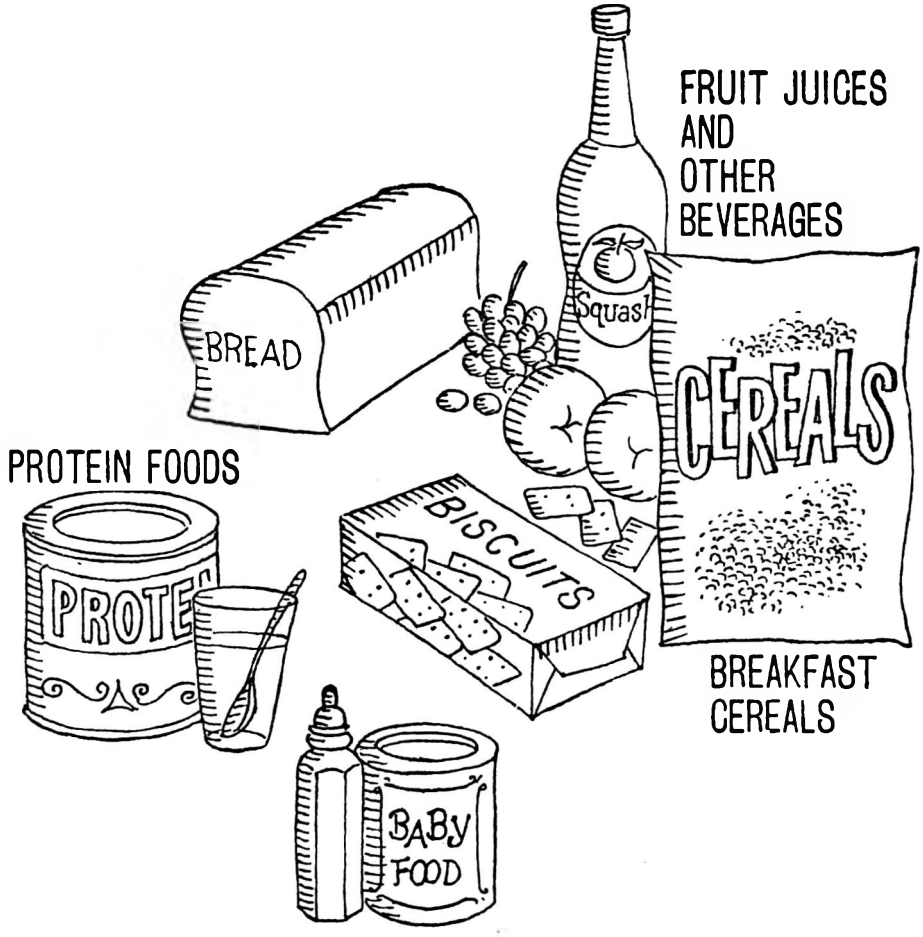

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1. Manuscripts of papers should be typewritten in double space on one side of the paper only. They should be submitted in **triplicate.** The manuscripts should be complete and in final form, since no alterations or additions are allowed at the proof stage. The paper submitted should not have been published or communicated anywhere.

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. Superscript and subscripts should be legibly and carefully placed. Foot notes should be avoided as far as possible.

4. **Abstract:** The abstract should indicate the scope of the work and the principal findings of the paper. It should not normally exceed 200 words. It should be in such a form that abstracting periodicals can readily use it.

5. **Tables:** Graphs as well as tables, 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. Nil results should be indicated and distinguished clearly from absence of data.

6. **Illustrations:** Line drawings should be made with *Indian ink* on white drawing paper preferably art paper. The lettering should be in pencil. For satisfactory reproduction, graphs and line drawings should be at least twice the printed size. Photographs must be on glossy paper and contrasty; *two 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 should be cited completely in each reference. Abbreviations such as *et al.*, should be avoided.

   In the text, the references should be included at the end of the article in serial order.

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

   (*a*) *Research Paper:* Menon, G. and Das, R. P., J. sci. industr. Res., 1958, **18,** 561.

   (*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:* As in (*c*).

   (*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.

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Research Papers

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