EXTENT OF MICROBIAL CONTAMINATION IN ICECREAM PREPARED AND PURCHASED FROM DIFFERENT SOURCES

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A C K N O W L E D G E M E N T

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I INTRODUCTION

Ice cream looked upon as a luxury not so many years ago is now regarded as a staple item of every day diet. Apart from its food value the production of ice cream forms an useful outlet for surplus milk and dairy products. (Arbuckle, 1972).

The popular dessert eaten in and out of home designated as forzen dessert include ice cream, ices, sherbets etc. (Peckham, 1960).

Ice cream has been called "the great American dessert" (Potter, 1960). It is basically a combination of milk products with the addition of one or more of the following ingredients egg, water, gelatin, vegetable colouring and flavouring. The mild products used may be cream, butter fat or milk in one f its various forms. (Lowe, 1955).

It is made by freezing pasteurised milk with agitation to incorporate air and ensure uniformity of consistency (Arbuckle, 1972).

According to Lowe (1955), Ice cream is more a complex system than milk or cream. It is not only in an emulsion but also a foam and in addition a system of ice crystals.

Milk has been referred to as the most nearly perfect "food for man". Its nutritive value is reflected by its chief constituents namely protein, carbohydrate, fat minerals etc. (Foster, 1958).

Milk forms a very good medium for growth of micro-organisms. The presence of the non pathogenic bacteria in milk is usually not a serious matter unless they cause the milk to putrefy and develop undesirable flavours or conditions (Frosbisher, 1965).

Pelczar (1974) states that considering the variety of food substances and the methods by which it is handled during processing it is apparent that practically all kinds of micro-organisms are potential contaminants. In spite of the safe and wholesome food supply bacteriological quality of many foods is variable, and carry pathogens causing food borne illness (Longree 1972).

Fruits and nuts, egg products and a number of sweetening agents along with other materials cause the contamination of the ice cream (Foster, 1958).

The majority of the outbreaks of infectious diseases are traced to the product manufactured by small vendors and in few cases it has been traced to contaminated ice cream itself (Arbuckle, 1972).

Typhoid and Bacillary dysentery are some of the principle diseases transmitted along with diseases of upper respiratory tract, infections, and septic throat. (Burdon, 1958).

Pasturisation of all the mixes is compulsory because this process destroys all pathogenic or disease producing bacteria thereby safeguarding the health of the consumer (Arbuckle, 1972).

Freezing is the most effective method of preservation. The effect is to retard the physical chemical and biological changes (Salle, 1966). In freezing a cream mixture the aim is to maintain the smoothness. This is generally done in an ice cream freezer. (Eva Medved, 1973).

After mixing and pasturising, the ice cream is frozen in either batch or continuous freezers. (McWilliams 1966).

The entire combination or ice cream mix is pasteurized by heating to 150°F to 165° F for 30 minutes and then homogenized and cooled quickly to about 40°F before it goes to the freezer where the temperature is maintained below 2θ°C (Arbuckle, 1972).

Almost every state has a set mixture for the fat content in ice cream but these vary. The permitted standards are emulsifier, not exceeding 0.5 per cent by weight, milk fat not less than 10.0 per cent, protein not less than 3.5 per cent and total solids not less than 36 per centp(The Prevention of Adulteration Act 1954, 1977).

A standard recipe is one which has been tested and proved to have a balanced formula as well as the correct instruction of preparation. In addition it produces a specific number of measured servings called portions. (Lane, 1966). Standardized procedures are used to make most economical use of man power materials and time available and the other safety (Brown, 1960).

The study was taken up because among frozen desserts ice cream is the most popular and equally liked by young and old.

The aim of the study is to find out the extent of popularity of ice cream, commercial ice cream mixes available, and to assess the quality of the popular commercial ice cream in Coimbatore City by microbial analysis. Standaridsation of ice creams and it's cost analysis are another aspect of the study.

II REVIEW OF LITERATURE

The review of literature concerning the study 'The Quality Assessment of Popular Ice creams in Coimbatore City' has been discussed under the following aspects.

A. Definitions, ingredients, nature and compositions

B. Flavouring and colouring materials.

C. Mix processing, pasteurization, homogenization, and freezing

D. Packaging, hardening and sales outlet

E. Quality, cost and contamination.

A. Definitions, ingredients, nature and compositions:

Acceptance can be defined as an experience or feature of experience characterised by a positive attitude, preference liking, for a specific food item states, Amerine et al (1965).

Icecream may be defined as a partly frozen foam with air content of 40-50 per cent by volume (Berger, 1976).

Pearson (1962), defines icecream as a "frozen product of cream milk or skimmed milk or any other combination there of or of milk products with sugar or without the addition of pure gelatin or pure vegetable gums".

A standard recipe may be defined as a written formula for producing a food item of a specified quantity and quality for use in a particular establishment. Kotas and Davis, (1973).

Food acceptability depends on the intergrated approach of the five senses state Lowe, (1965).

A standard recipe states Peckham, (1964) is one in which the amounts and proportions and consistency produce a high quality product. The U.S., F.D.A definitions and standards of Identity of forzen desserts Anon, (1966) specify the optional ingredients of ice cream from the following groups: Dairy ingredients, sweetening, flavour and others.

Arbuckle, (1976), and Goyal et al.(1972) observed that when fat content is less than 4 per cent the product tends to be coarse, icy, and weak, when it is above 12 per cent the product becomes rich and less palatable.

Doan and Keeney, (9165) found that milk fat contributes to a good quality ice cream with subtle flavour.

Jenness and Patton, (1959) outlines gravity separational and centrifugal methods of manufacture of anhydrous milk fat. King, (1955) states that in an ice cream fine dispersions of fat form milk fat globules whose surface become hydrophobic and becomes partly or wholly demulsified.

Klotes and Leeder, (1963, 1966) studied several factors affecting the destabilization of fat, and found that, homogenization, temperature, pressure, acidity and emulsifier, among various other factors.

According to Knightly, (1959) during the process of freezing the fat globules begin to agglomerate due to agitation, churning and concentration.

Sherman,(1961, 1965) emphasises that small fat globules had a positive effect on viscosity.

Doan and Keeney, (1965), Arbuckle,(1969) state that milk fat is an important ingredient as the use of correct percentages to balance the mix properly to satisfy the legal standards.

Arbuckle, (1966), Brants,(1969), Hall and Hedrick, (1966) stated that considerable amounts of MSNF are being used in the manufacture of very good quality ice cream.

Arbuckle, (1969) states that with the use of low heat, medium heat and high heat MSNF, the flavour characteristics of the ice cream from mixes in which low heat MSNF was used were more desirable than from high heat MSNF.

Arbuckle, (1967) states that butterfat mix blends, products were of poor quality but could be improved at levels of 50 percent replacement of cream.

Cosgrove, (1967) found that storage life of butterfat mix was 9-12 months.

Tamsma and Bell, (1967), Bell,(1959) and Arbuckle and Bell, (1963) showed the effects of concentrated sweetened cream on mix and finished product properties, and state that fat had better storage qualities than frozen creams of butter.

Weidner, (1967) gave the compositions of four types of butterfat mix products-fat, sucrose blend with butter, butter-oil, and fat sucrose - MSNF blend.

Zeimer et al (1962) from his survey states that commercial buttermix powders had poor storage life and produced unacceptable flavours.

Webb and Johnson, (1965) state that the inorganic and organic substances in milk produce the effects in accordance with the proportion and the concentration in which they occur.

Both air and water have an important role in the complicated physicochemical system which ice cream represents and is described by Dean and Keeney, (1965) as containing a gas (air) dispersed in a liquid (water), a solid or a mixture of liquid and solid.

Arbuckle, (1963) cited the use of emulsifier materials on properties and fat globules stability control, through the use of mineral salts as an important factor in influencing the handling characteristics of ice cream.

Arbuckle,(1963), Keeney, (1958) stated that certain emulsifiers tended to destabilize fat through the use of animal salts as import ant factor in influencing certain characteristics of ice cream.

Bassett, (1969) explained the action of two types of synthetic emulsifiers used, the polyoxyethylene sorbitans monoleate and polyoxyethylene tristearate as one type and the other type as glycerol monostearate.

Doan and Keeney,(1965) and Moss,(1955), state that emulsifiers impart desirable structural characteristics like heavier body, enable it to be extruded in any shapes and used as thickening, suspending agents.

Keeney,(1958) stated that certain emulsifiers tended to destabilize the butter fat thusaccelerating churning.

Bayer,(1965) evaluated a number of commercial stabilizers and found that most produced desirable results.

Glickman, (1963) states that the basic role of hydrophilic gums in stablizer product is to reduce the amount of free water in mix by binding or by immobilisation within a gel structure.

Glickman, (1969) states that sodium carboxymethyl cellulose met immediate approval after it was introduced as a stabilizer.

Glickman and Klose, (1968) state that most of the gums have been used as stabilisers but those for reasons of price or function have been replaced by alignates.

Moss, (1955), Sperry, (1955) and Tallman, (1958) considered stablizers for HTST pasteurisation and continuous processing. Moss states that the mixes processed by HTST pasteurisation required 25 per cent more stabilizers.

Palmer and Rothwell, (1965) indicated that the trend in prepared stabilizers was the use of a blend of stabilising materials.

Shipe et al. (1963) found that the effect of stabilisers on freezing characteristics of ice cream were associated with changes in viscosity and the rate of migration of solutes through dialising membrane.

Stainitz, (1958) formulated a stabiliser mixture of various gums by suspension in propylene glycol and glycerol monstearate for the use in liquid from of continuous systems.

Julien Neilson,(1974) compared the effect of five additives in an ice cream formula on free fat, overrun, and fat agglomeration and found that additives used may be classified as inactive, weakly active and active.

Keeney and Klosser,(1959) in explaining the dryness in icecream states that it is directly correlated with concentation, instability of fat and that greatest dryness and stiffness was obtained when maximum fat dumping was perceived.

Using a General Foods Texturometer, Klotes et al.(1966) examined samples of ice cream containing different sugar and air contents and related the parameters of hardness and cohesiveness. He found that hardness and gumminess decreased with increased overrun when as cohesiveness and adhesiveness increased.

Knightly, (1959) states that dryness and stiffness are due to least primary agglomeration of butterfat globules.

Doan and Keeney,(1965) described that the nature of the ice cream mix as essentially an oil in water type of emulsion.

Doan and Keeney,(1965) states that mix stability depended on the emulsion (fat) stability and colloid (protein) stability.

Maga and Keeney,(1965) support the election microscopic evidence of a liquid oil film at the air bubble surface and the hypothesis that is derived from unsaturated fat liberated from the fat globule during freezing.

Tanaka et al.(1972) used a constant speed penetrometer to evaluate the effect of different sugar and air contents on the apparent viscosity and yield value found that increased air content led to a decrease in both parameters measured.

Arbuckle,(1960) has reviewed the microscopic procedures and developed them further in order to measure the structure components in ice cream and found that at hardening room temperature - 30°C it was possible to measure ice crystals and air bubbles.

Buchheim et al.(1970) used the freeze fracture method with or without catechin to examine the structure of ice cream as it induces the least possible change in the specimen.

B. Flavouring and Colouring Materials

Arbuckle et al. (1961) used fruit concentrates and essence of seven different fruits. He found fruit concentrates and essence valuable and economical in flavouring.

Gould and Lindamood,(1964) stated that chocolate ice cream prepared with low cocoa fat containing products was generally superior to that prepared with fat liquours.

Gould and Tharp,(1962) conducted a survey of vanilla flavouring material used and obtained from 34 companies 392 flavouring materials grouped as pure, fortified, and imitation.

Guadagni,(1956) states that the factor affecting flavour of strawberry ice cream in selection of highly flavoured varieties and that a statisfactory flavour is achieved by adding the proper amount of high quality unsugared strawberry pure .

Merory, (1960) states that the food flavouring materials and ingredients, and the advancement of these is limited as there hasbeen a degree of secrecy in flavour technology.

Lazar, (1966) found that an acceptable flavour was obtained only with strawberry when freeze dried peaches, strawberries and bananas were studied.

Tracy, (1966) studied automated and highly mechanized operating methods and plant layout as a means of reducing cost for ice cream plants by grouping the size of dairy plants as those annually manufacturing 200,000 gallons and one million gallon.

D. Packaging and Hardening:

Arbuckle and Kramer, (1965) used simple procedure to determine how much of a variation normally occur from one filler and another between one container and from any one filler.

Pearson, (1963) states that pint packages immersed in liquid N_2 at - 320°F for 1 minute in rows of eight and kept in a hardening cabinet at -9°F produced good texture.

Stein et al. (1963) stated that hardening of ice cream by air blast at - 30°F to -50°F does not need a conveyer belt and have the advantage of quick hardening of smaller packages.

E. Quantity Cost and Contamination

Anon, (1961) presented a procedure of how milk fat and total milk solids reduction can be calculated in bulky flavoured ice cream.

Arbuckle,(1972) has compared the quality of ice cream made with concentrated liquid milk and with milk powders given low medium and low heat treatment. He found that the whipping properties had better texture body and storage properties but low flavour score.

Baumer and Jacobson,(1969) concluded from their study that ice cream consumption responds to price changes and that price changes come closer to decreasing consumption by a propertional amount.

Cladwell and Hilker,(1961) presented a formula and example for calculating weight/gallon of fluid dairy products using a specific gravity tables for density of fat at various temperatures.

Beckwith and Kiser,(1942) shows how acidity of strawberries and the presence of dissolved sugar destroys Salmonella typhosa in a few hours at room temperature when held above the freezing temperature for a few days with effect upon survival of bacteria at 0°F was perceived.

Brunsteller,(1937) found that only three genera of bacteria failed to survive freezing for 3-15 months when all the food was held at 15°F.

Ganada et al. (1964) determined the response of Clsperifringens spores and vegetative cells to low temperature using four strains and found that exposure to freezing at 17.7°C a large percentage of vegetative cells and the spores are resistant to freezing and freeze storage.

Castell and Garrad,(1939) claimed that cream was very satisfactory after being stored for 8 days at 77°F with salt added and showed less bacterial contamination.

Folts et al.(1960) studied the incidence of potentially pathogenic staphylococcoci in fluid milk and other diary products and found potentially irrelevent coagulance of the organism and isolated it from 3.4 per cent of the samples and concluded the plant workers are the contaminants.

Insalata et al.(1969) analysed 5719 industrially processed food samples for faecal streptococci and recovered that organisms from 10 percent of the samples and found that frozen foods had a higher incidence than other foods.

According to Kaufman,(1947) spoilage of all edible foods would eventually take place if man did not do something to stop or partially show up biological processess that normally take place in food.

Kennedy and Weiser, (1950) studied the effect of psychrophils in market milk supplies in which these organisms not only increased in numbers but caused a pronounced off flavour.

Among the contaminents which come from the intestinal origin of the cow, salmonella, fecal streptococci, staphyloccoci through handler and also salmonella contumination are the highest says Longree, (1972).

Macy and Thompson, (1940), stated that 7.5 to 10 per cent salt added to cream retarded bacterial growth and acid development and no appreciable off flavour, were observed. According to McCutcheon (1963) many of the outbreaks require the knowledge of the entire team, the physician, epidemilogist, engineer, veterinarian, and laboratory personnel to set right the situation.

Oglesby, (1936) innoculated a standard ice cream mix with salmonella typhosa and then froze it is the hardening room at - 4°F and found that it was difficult to destroy micro-organisms by cold.

Post et al. (1961) studied the growth of staphylococcus aureus in cream and cream products and found that there were antagonistic contaminents interfering with the growth of these organisms.

Sharpe et al. (1962) state that among the contaminents from equipment staphylococcus micrococci and other heat resistant organisms formsthe majority.

Swift, (1937) found that when streptococci was completely dried when frozen and that they survive for many years.

Weiser, (1962) states that in frozen foods there are many favourable and unfavourable areas for microbial growth; and that staphylococcus aureus remains viable after the culture is exposed to -252°C for two hours.

III EXPERIMENTAL PROCEDURE

Ice cream is a partly frozen foam with air content of 40-80 per cent by volume. It is one ofthe most popular frozen desserts enjoyed by both young and old. Whether ice cream is commercially made or home made the flavour, body and texture are the important factors in evaluating its quality.

The study on the "Assessment of the Quality of the Popular Ice Creams in Coimbatore City" was conducted through the following steps.

A. Selection of study
B. Conducting the survey
C. Selection of place and samples
D. Selection of method
E. Microbial analysis
F. Standardization of recipes
G. Acceptability test
H. Cost analysis

A. <u>Selection of the study:</u>

The study was taken up since ice cream is one of the most popular frozen desserts consumed both in and out of

home. It is widely consumed and relished by both young and old alike. However there are also certain misconceptions regarding it. The one foremost being that consumption of it is the sole season for septic sore throat, scarlet fever and typhoid in addition to many others. One reason for this is that ice cream gets contaminated from the adding of ingredients to the mix and to the reach of the consumer. Thus it becomes a public health problem concerned with manufacture and Public Health Authorities.

B. Conduction of the survey:

The information regarding the quality of ice cream was elicited from thirty five home makers and thirty five students. This was carried out in order to find out the popularity of ice creams among these two sections of the population. From the survey the popularity of the ice cream parlour visited, the reasons attributed to it were all elicited. In addition, the extent ofpopularity of the ready made ice cream mix, the brand and flavour appreciated were drawn out. Interview was also carried out in order to elicit more information.

C. Selection of place and samples:

The above data may throw light on the ice cream consumed by the majority ofthe mass surveyed, and hence its popularity. The investigator was also able to elicit information regarding why the particular area was chosen by the consumers. Hence the place and samples were therefore chosen depending on this popularity, and the quality analysed.

D. Selection ofthe method:

The methods for the quality assessment were chosen depending on the fact that being a frozen dessert which is a product of many ingredients, it is liable to become easily contaminated. Hence the microbiological assay was chosen.

E. Microbial analysis:

There is a growing concern for accelerated changes towards widespread environmental degradation, which are threatening the health and the very existence of human life and also the alarmed realisation that much more will have to be done to counter these. It is in this connection that the microbial examination of food carries its imminent worth. The quality of food, the conditions under which it is produced, distributed and consumed, is tested.

Microbiological procedures of food examination take advantage of the fact that it makes use of techniques and cultural procedures. The methods employed however depend on the food and the specific purpose of examination.

The microbiological assay was carried out for six popular Commercial ice creams and for five ice creams made by the investigater under different conditions like.

a. under good conditions
b. without sterilisation of utensils used
c. without pre-washing of utensils used
d. without pre-washing of freezer
e. when the mix was left exposed for half an hour.

The microbial assay was carried out by the following steps:

a. Preparation of the media
b. Collection ofthe samples
c. Organising the analysis
    1. Preparation of test laboratory
    2. Conducting the analysis

A. Preparation of the media

The microbiological study involving the examination of micro-organisms of specific kinds, in milk or dairy products, requires a special procedure and is carried out by means of special media for its cultivation. The media generally used is the "milk agar medium" and was prepared according to ISI 1962.

Ingredients

Lab lemco - 6 gms

Peptone -10 gms

Bacto agar -40 gms

Fresh cow's milk- 20 ml.

Distilled water- 2000 ml.

Method:

Dissolved lemco and peptone in water and adjusted the pH to 7.4 and then added agar and milk. It was autoclaved at 10 pounds pressure for 20 minutes. Filtered while hot through Buchnner funnel and tubed 15 ml quantities and autoclaved again at 10 pounds for 20 minutes. This was stored in sealed flask and kept refrigerated.

B. Collection of the samples

The reliability of the analysis and interpretation of the results depend largely on the correct manner in which the sample is taken. It should be truly a representative of the

sample and collected without extraneous contamination during collection. In order to ensure this the investigator took extreme care to see that the bottles in which the samples were to be collected, were autoclaved. As soon as the purchase was done it was introduced into these sterilized bottles.

e. Organising the analysis

Whatever be the test adopted for the examination of the microorganisms it should be capable of indicating the degree of bacterial contamination and thereby showing whether the conditions under which the product produced and handled are hygienically satisfied.

This part of the experimental procedure was carried out in two steps.

(1) Preparation of test laboratory and

(2) Conducting the analysis

i. Preparation of test laboratory

The test room was first sterilized for half an hour by means of the ultra violet light. This was done to destroy the microorganisms responsible for the aerial contamination.

The test room furniture was then cleaned with dettol to minimize contamination through them.

The material used for the experiments namely the petridishes the pipettes and the test tubes were thoroughly autoclaved.

2. Conducting the analysis

The method adopted was the Standard Plate Count method. According to Cruick Shank,(1970) Pour plate method is the best as it ensures even distribution of sample. The advantage of this method is that it gives the direct assessment of the number of the viable bacteria in the product. The results are also readily understood and it is the most suitable, method that can be adopted.

It consists of essentially of the following operations according to (King & Miller 1970).

1. addition of the melted sample (0.1 ml) into a sterilised petridish
2. addition of the liquified milk agar media (15ml) into the petri dish
3. Thorough mixing ofthe sample with media by rotating the petri dish in a clock wise and anti-clock wise directions
4. Incubation at 32 - 35°C after the solidification of the media
5. Counting ofthe colonies after 48 hours by using an apparatus - colonoy counter and recording the count obtained.

F. Standardisation of recipes

Standardisation of recipes means determining accurately the quantities of foods to be cooked in relation to the servings required and working out the cooking procedures so that the

same combination of foods are produced and also expected when standardized cooking procedures are used. In standardization either the basic ingredient or any other ingredient is replaced by another product and the acceptability listed by means of various acceptability tests available. In this study scoring was the method employed.

The standard used was the recipe where milk, sugar, custard power, vanilla, essence, and cashew nut were the ingredients (Lowe 1955). This was refrigerated for 2-3 hours.

The variations were in relation to cashew nut and as follows:

(1) Plain without addition of nuts

(2) Crushed and roasted bengal gram

(3) Crushed and roasted peanuts

(4) Boiled and ground peanuts

(5) Crushed and roasted soyabean

(6) Boiled and ground soyabean

G. Acceptability test

Sensory methods in which palatability is evaluated are essential in most food experiments because they answer all the important questions of food tastes, smell, texture and appearance. This is generally done by a selected panel of judges.

According to Griswold,(1962) it is better to select judges on the basis of taste tests made on food being investigated. Hence a screening test was done by the investigator and five taste panels belonging to the sage age group of 22 years were chosen out of ten tested.

These taste panels were also trained by means of the Duo trio test as suggested (Peryam ,1950) and paired comparison test (Roessler, 1956) triangle test by Harries(1956).

The experiment was carried out three times and the taste panels were asked to score the points on the score card given. The acceptability of the product was finally assessed by the 'F' test.

H. Cost analysis

Good cost control is based on the system of records that serves as a tool to operate a business or department within the predetermined, financial limits (West & Wood 1977).

Food is the most readily controlled item of expenditure and the one that is subjected to greatest fluctuation. The purpose of food control or food cost accounting is to assert the management in obtaining the highest possible gross profit on food sale,consistent with the quality and size of portions (Jeyachandran, 1978).

Standardized portions are therefore an important factor in creating customer satisfaction and good will. The cost analysis was done on the standardization variations. It was done by totalling the market cost of the ingredients and dividing by the total number of portions obtained to determine the selling cost of one portion.

IV RESULTS AND DISCUSSION

The results of the study "The Quality Assessment of the popular Ice cream in Coimbatore City" are discussed and presented below under the following aspects.

A. Survey

B. Microbial analysis

C. Standardization of icecream

D. Cost analysis

A. Survey:

The data obtained from the survey carried out among thirty-five homemakers and thirty-five post graduate students, were consolidated and analysed. The results obtained from these two sections of the populations are comparitively discussed below and the questionnaire used is given in Appendix I

Ice cream is a palatable, nutritious healthful, and relatively inexpensive food. In addition, the high palatability of ice cream stimulates the flow of digestive juices, a valuable aid to the digestive process. These factors together with its sweet flavour, its smooth velvety texture, and its glistening coolness make it an ideal food for all.

Flavours Preferred:

The table below shows the percentage of people preferring each of the flavours.

TABLE I

FLAVOURS PREFERRED IN ICE CREAM

S.No.	Flavours	No.of students	Percentage	No.of housemakers	Percentage
1.	Vanilla	16	45	10	29
2.	Pista	3	9	7	19
3.	Strawberry	2	6	2	6
4.	Raspberry	1	3	-	-
5.	Orange	2	6	2	6
6.	Chocolate	4	11	10	29
7.	Pineapple	3	9	-	-
8.	Others	4	11	4	11
	Total	35	100	35	100

The flavour of ice cream is the result of blending of the flavours of all the ingredients some of which may not be sufficiently pronounced to be recognizable, although each

actually contributes to the final effect. Furthermore the desirability of a particular flavour depends upon the consumer or individual doing the testings and seldom explains why.

From the above table it can be concluded that among both the sections Vanilla flavour ranks the highest in preference namely 43 percent and 29 percent of student and homemakers respectively; and raspberry the least only to the extent of 3 per cent by the students while homemakers do not prefer it. Chocolate flavour ranks second namely 29 percent among the homemakers while 11 per cent of the students preferred it. The preferences are depicted in Figure (I).

The homemakers go very seldom to the ice cream parlours and are very choosy about the flavours whereas the students were found not to be so. This is due to the fact that students have a tendency to try out new flavours.

Parlour Preferred

Table II reveals the popularity of the parlours among the students and the homemakers.

FLAVOURS PREFERED IN ICE CREAM

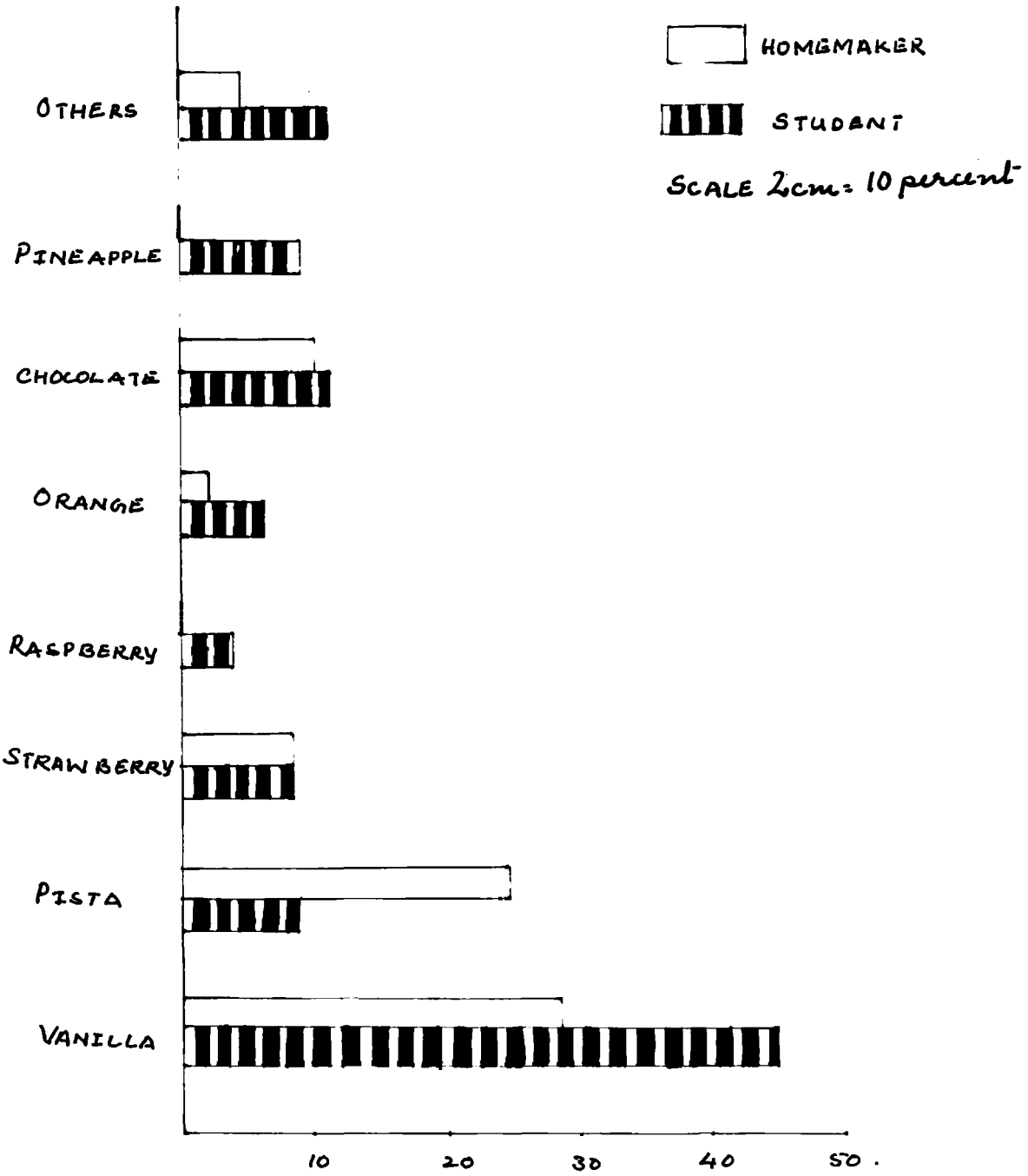

FIGURE I

TABLE II

POPULAR ICE CREAM PARLOURS IN THE CITY

S. No.	Name of Parlour	5% and below		6 - 10%		11 - 20%		21 - 30%		31 - 40%	
		Student	Home-maker	Student	Home-maker	Student	Home-maker	Student	Home-maker	Student	Home-maker
1.	Richie Rich	✓					✓				
2.	Ice-cone	✓	✓								
3.	Joy Enterprise		✓	✓							
4.	Chintamani				✓	✓					
5.	Kamadhenu	✓	✓								
6.	Bombay Ice-cream stall		✓								
7.	Restaurants	✓	✓								

The consumer has learned to depend upon ice cream as a safe, enjoyable energy-giving nourishing, refreshing food. In order to obtain maximum enjoyment and relaxation they visit the parlours which they feel, would induce the maximum amount of satisfaction.

From the above table it can be perceived that a large section of the student population surveyed namely between 11-20 per cent go to Chinthamani, while among the homemakers 11-20 per cent of the families go to Richie Rich. The reasons given by the students was that this particular area was the nearest to the college and also that they preferred and liked the taste and flavours catered to. In addition they correlated this popularity also to the cost of the product. Richie Rich, is the popular parlour among the homemakers due to the fact that it has a very pleasant atmosphere and moreover this is the a parlour where they could relax with the family for a span of time; and where they catered to customer's varied flavour fancies.

The parlours least favoured by both the groups surveyed were Kamadhenu and Bombay Ice cream stall namely 5 per cent and below in number among both the groups. This they accorded to the reason that there was no resting convenience, comfort.

Ice-cone though it produces the best quality ice cream is not much preferred by the homemakers and students as they feel that being located near the hospital it is liable to be heavily contaminated. Students state the reason that it is too far for their convenience.

Table III depicts the frequency of visits to the ice cream parlour. Frequency of visits to the ice cream parlours by the sample.

TABLE III

FREQUENCY OF VISITS TO THE ICE CREAM PARLOUR

Frequency of visit to the parlour	Number of students	Percentage	Number of homemakers	Percentage
1. Monthly	4	11	7	20
2. Weekly	8	23	7	20
3. Occasionally	23	66	16	45
4. Never	-	-	5	15
Total	35	100	35	100

The above table reveals that majority, 66 per cent and 45 per cent of the students and homemakers go occasionally.

The homemakers stated the reason that whenever they went out shooping they visited the parlour, while the students stated that they do so whenever they feel like in addition to their visits during shopping. 15 per cent of the homemakers do not visit the parlour at all as they do not go out shoping nor do they get the time nor do they enjoy going into a crowded area. figuratively described in figure II

FREQUENCY OF VISIT TO ICECREAM PARLOURS BY SAMPLES.

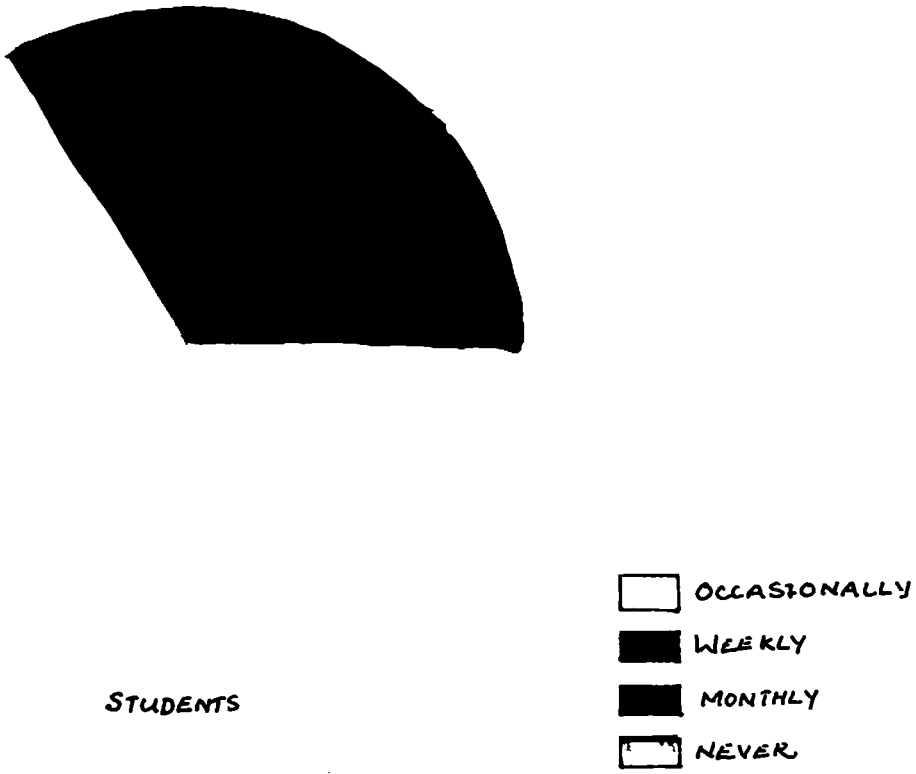

FIGURE II

Frequency of visit according to season

Season plays a very vital part in the frequency of visit to the ice cream parlour and hence the consumption, as shown in Figure II. Majority namely 60 per cent of the homemakers and 54 per cent of the students sponsor the parlour more during summer. This increased consumption during summer was justified by the reason that during summer the need for frozen desserts to refresh them and cool their system, was increased. 46 per cent and 40 per cent of students and homemakers respectively visited equally during summer and winter. They belonged to the category who went out just for enjoyment and did not care particularly for factors like humidity, season, and weather.

Salient features considered during purchase

Table IV reveals the salient features that the customers consider during purchase of the ice cream.

Seasonal Variation In The Consumption Of Icecream

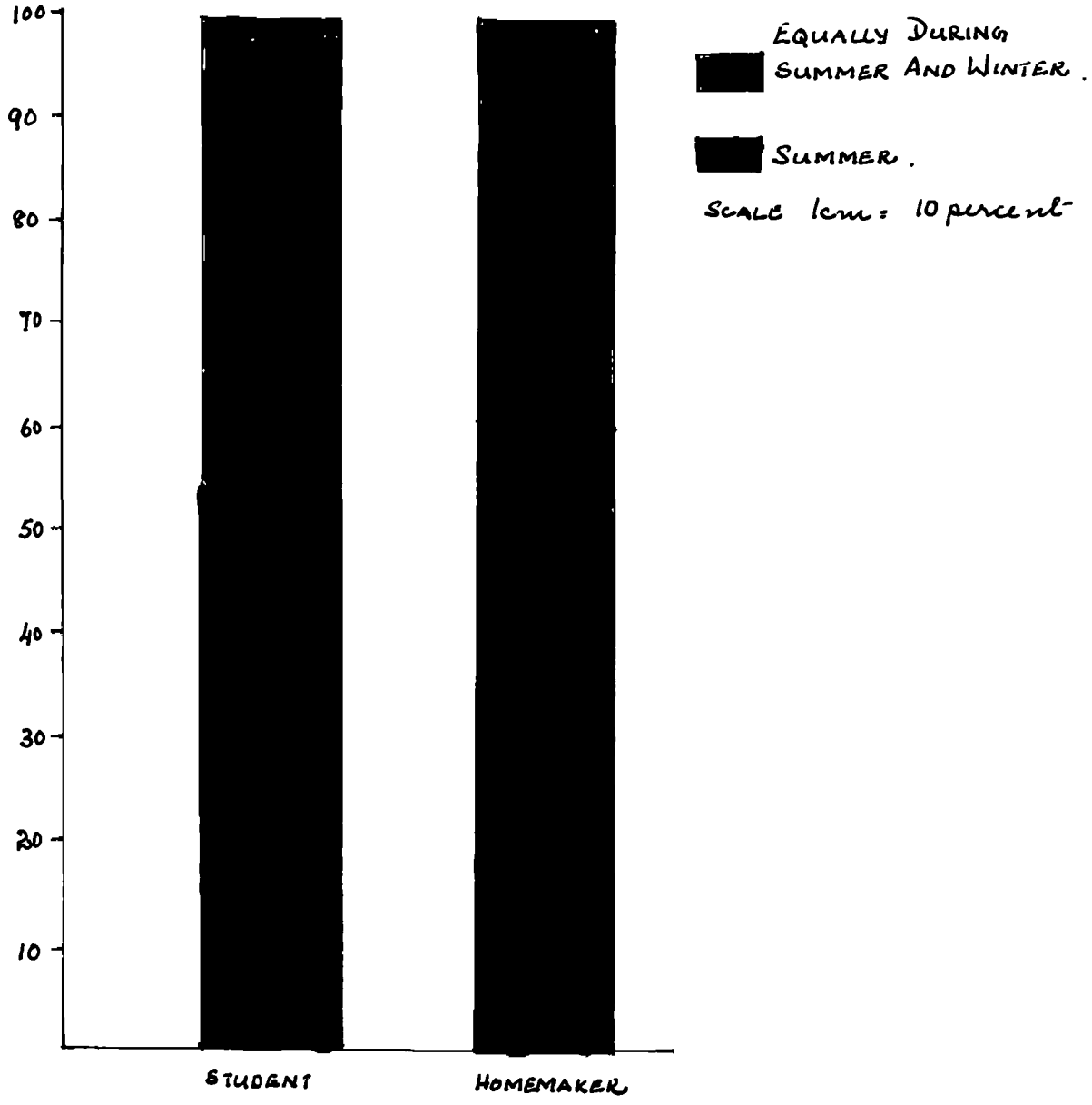

Figure III

TABLE IV

SALIENT FEATURES CONSIDERED DURING THE PURCHASE OF ICE CREAM

Features	10 and above		11 - 20%		21 - 30%		31 - 40%		41-50%		50 and above	
	Home maker	Student	Home maker	Student	Home maker	Student	Home maker	Student	Home maker	Student	Home maker	Student
Quality		✓			✓							
Brand			✓	✓								
Taste									✓	✓		
Flavour	✓	✓										
Cost	✓					✓						

Consumer acceptability dependson a number of factors.

~~From the above table it is clear that concerning the frozen dessert.~~

From the above table it is clear that 40-50 per cent of the students and th homemakers consider that the taste is the most important criteria. 21-30 per cent of the students surveyed feel that cost is the next important factor in selection while only 10 per cent and below of those families survey feel so. The statement given to justify this increased consciousness of cost

among students was that they are not earning members and hence do not have any financial holding. The homemakers feel that quality of the product, namely 21-30 per cent of them, feel is more important than cost as they always are aware of cleanliness, sanitation of environmental surroundings whereas only 5 to 10 per cent and below among the students are quality conscious. Regarding the brand of the ice cream consumed the two sections feel the same, that is 11-20 per cent of both. This is so because the number of ice cream brands available is very limited. Flavour preference ranges from 10 per cent and below among both the sections and this is due to main reason that, taste and flavour are often synonmous to the consumer, and are easily confused.

Preparation of ice cream at home

From the survey carried out it was concluded that 69 per cent of the homemakers and 45 per cent prepared ice cream at home. 31 per cent and 55 per cent of the homemakers and studentsrespectively belonged to the category who do not. Those who did not prepare at home gave the reason that they do not possess a refrigerator. Among those who prepared justified their reason with the fact that it was solely for their children who liked the dessert very much.

Frequency of preparation at home

In Table V the frequency of preparation of ice cream by the housewives are discussed.

TABLE V

FREQUENCY OF PREPARATION OF ICE CREAM AT HOME

Percentage of people	Weekly		Monthly		According to wish		Do not prepare	
	Home maker	Student	Home-maker	Student	Home-maker	Student	Home-maker	Student
10% and below	✓	✓						
11 - 20%			✓	✓				
21 - 30%								✓
31 - 40%							✓	
41 - 50%								
51% and above					✓	✓		

In order to make good ice cream, the mix products and other ingredients must be available along with all the facilities for freezing.

From the above table it can be perceived that 50 per cent and above of the students and homemakers prepare according to wish with out any set routine. 10 per cent and below of both these groups prepare ice cream weekly while 11 per cent to 20 per cent prepare it monthly. Those who prepared either weekly or monthly belonged to the category of those who were conscious ofthe home budget, and did not entertain much, while those who prepared according to wish prepared according to the availability of ingredients and also the time at their disposal and whenever their children requested. 20 per cent to 30 per cent of the students and 31 to 40 per cent of the homemakers did not prepare due to lack of facilities.

Special occasions for preparation

Regarding this aspect of the survey the analysis showed that 10 per cent of the homemakers and 14 per cent of the students had ice cream as a dessert whenever they entertained guests. 49 per cent and 52 per cent of the groups respectively prepared whenever they felt an urge to do so while 6 per cent and 10 per cent of them whenever there held a party. The reason for their preparation of ice cream is that it is the only dish that is liked by all ages and also that they found the preparation easy. Those who prepared whenever they wished did so depending on the availability of the ingredients and

time. 28 per cent of the students and 31 per cent of the homemakers did not prepare ice cream due to lack of facilities.

Popularity of commercial ice cream mix

Table VI elicites the information regarding the popularity of commercial ice cream mix available in the market.

TABLE VI

POPULARITY OF COMMERCIAL ICE CREAM MIX

Whether used	Number of students	Percentage	Number of homemaker	Percentage
Yes	16	47	20	58
No	9	25	4	11
Do not prepare	10	28	11	31
Total	35	100	35	100

The popularity of the ice cream mix among the surveyed groups showed that 47 per cent among the students and 58 per cent among the homemakers used the commercial ice cream mix available while 25 per cent and 31 per cent did not use it. The data is depicted in Figure (IV). Majority used the mix as they felt that the mix was both economical and convenient.

Popularity Of Commercial Icecream Mix

Scale 3cm. 10 units

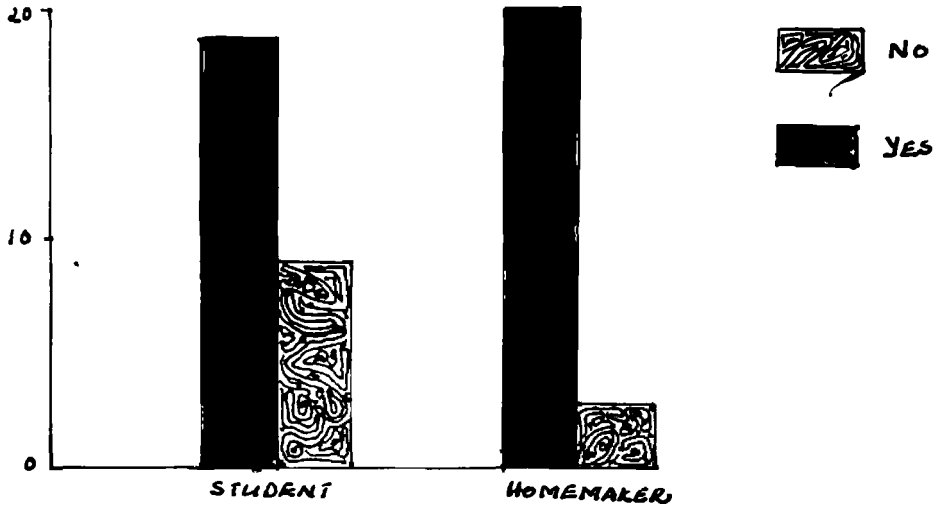

Figure IV

From the survey carried out it was found that 40 per cent of the homemakers and 34 per cent of the students preferred the commercial mix product, whereas 36 per cent of the homemakers and 42 per cent of the students preferred the freslity prepared product. 24 per cent of the homemakers and 9 per cent of the students preferred both.

Those who preferred the mix stated that it was convenient and economical, the taste was better and moreover it required less preparation in addition to its good storage quality of 45 per cent of the homemakers and 33 per cent considered the mix to be convenient and economical respectively. While among the students 40 per cent and 42 per cent belonged to this category.

Those who preferred the ice cream made from the raw ingredients justified their liking with reasons that the product prepared from fresh milk gave a better taste and flavour than that prepared by commercial ice cream mix. This according to them had an unpleasant taste and flavour and often did not set properly.

Those who did not favour the ice cream mix product did not find it, convenient nor economical. Among this division falls 14 per cent and 36 per cent, 32 per cent and 30 per cent of the homemakers and students respectively. According

to them it does not set properly and hence it does not give the consumer any satisfaction.

Brand of ice cream mix preferred

The results of the survey reveal that 30 per cent of the homemakers prefer Brand A while only 9 per cent of the students prefer it. 20 per cent and 28 per cent of the homemakers and students prefer Brand B ice cream mix. 13 per cent and 9 per cent of the homemakers and students respectively prefer Brand C. The reason behind this disparity in popularity of the mix is attributed to the fact that they buy the product depending on the availability in their regular shopping area.

B. Microbial assay

In spite of the safe and wholesome food supply the bacteriological quality of many foods is quite variable and is dangerous. Quality tests which primarily include bacterial enumeration has a distinct value and usefulness from the stand point of the degree of contamination and infections. The results of the plate count carried out for six commercial types of ice cream depending on the popularity of ice cream as concluded from the survey is shown in the Table VII and Figure (IV).

TABLE VII

MICROBIAL ASSAY OF COMMERCIAL ICE CREAMS

Samples	Colony Count
Sample A	106×10^2
Sample B	125×10^2
Sample C	103×10^2
Sample D	125×10^2
Sample E	93×10^2
Sample F	73×10^2

The microbial assay showed that the bacterial count of the sample ranged from the maximum of 125×10^2 to 73×10^2. The reason for this wide range contamination can be attributed to factors like locality sanitary practices, method of serving, plant cleanliness, personnel cleanliness, cleanliness of utensils and also the hygeinic methods, followed. The plate counts are as shown in Figures (V) to (VI).

Reasons for the extent of contamination

It was observed during the investigation that the degree of minimal contamination of the product Sample F was due to the fact that the parlour was an area where

Microbial Assay Of Commercial Icecreams

Scale 1cm = 1000 units

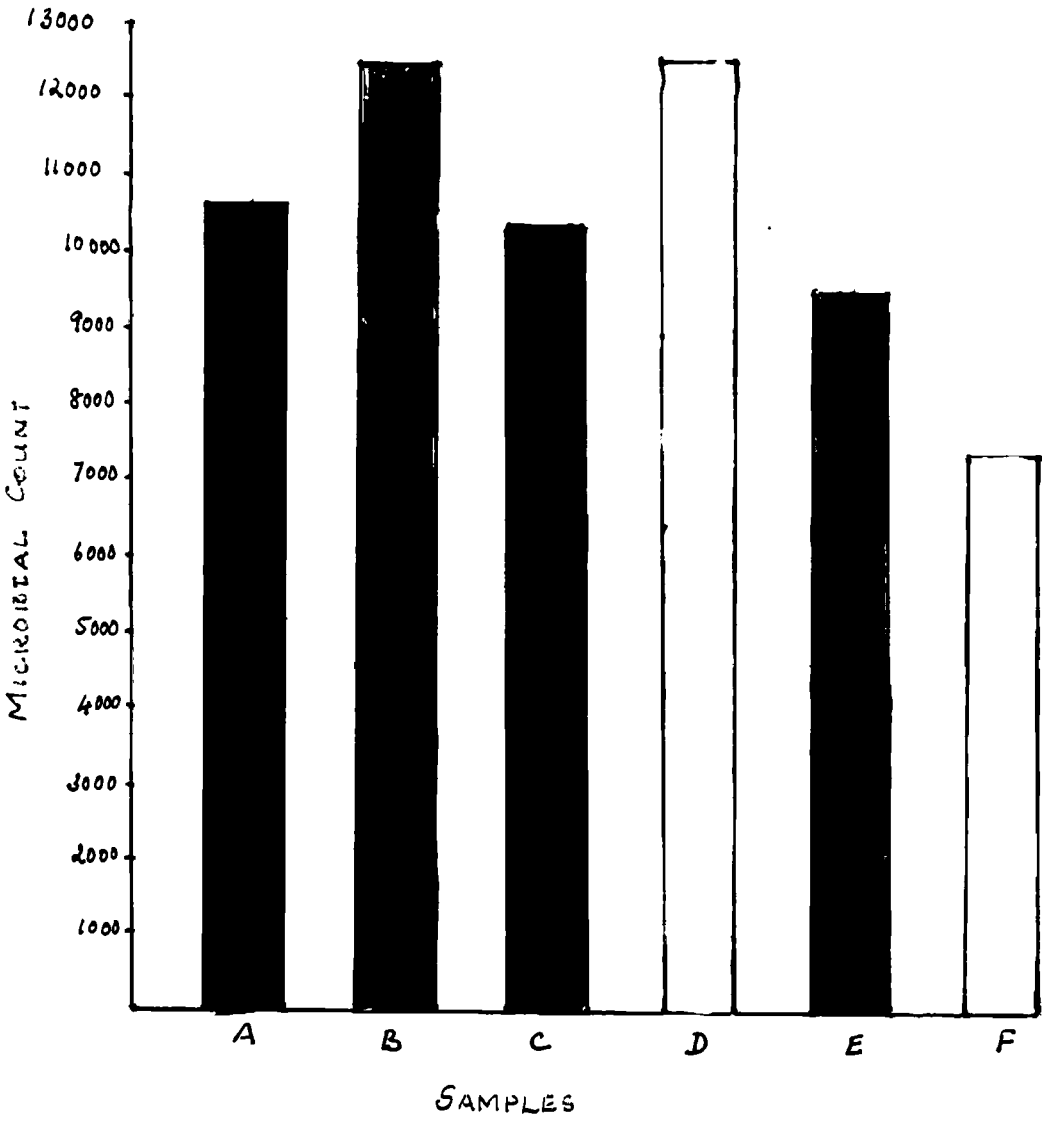

Figure V

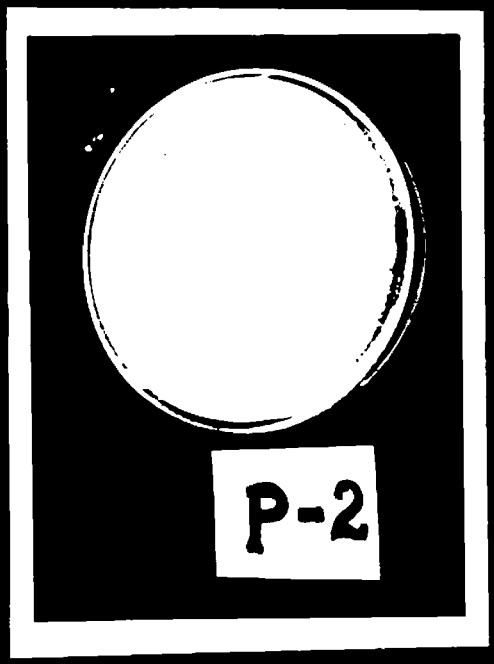

FIGURE VI PLATE COUNT OF SAMPLE A

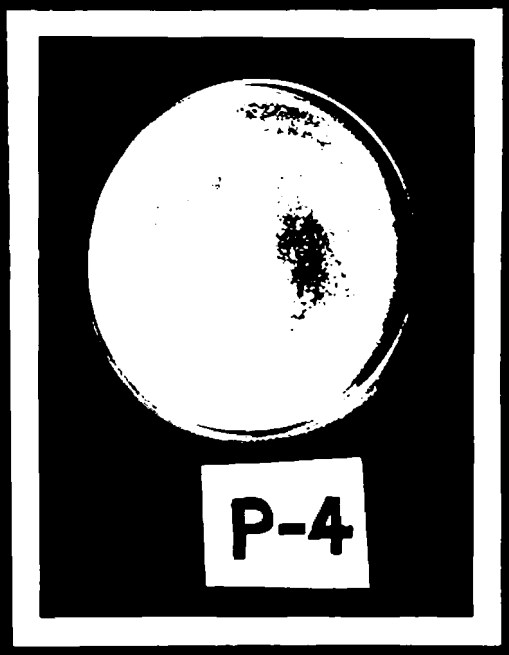

FIGURE VII PLATE COUNT OF SAMPLE B

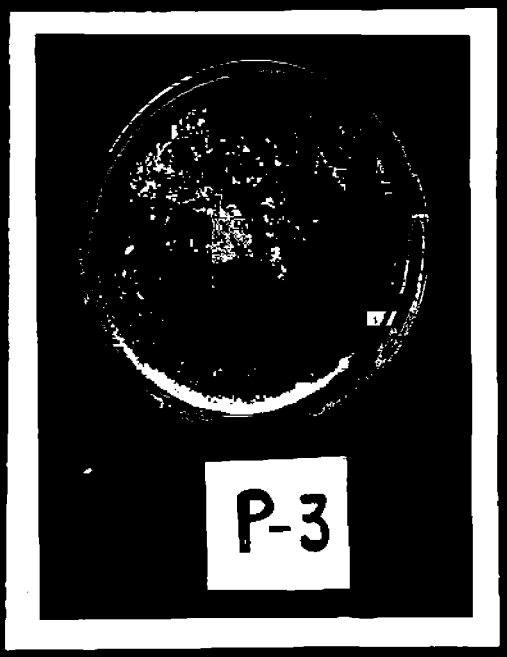

FIGURE VIII PLATE COUNT OF SAMPLE C

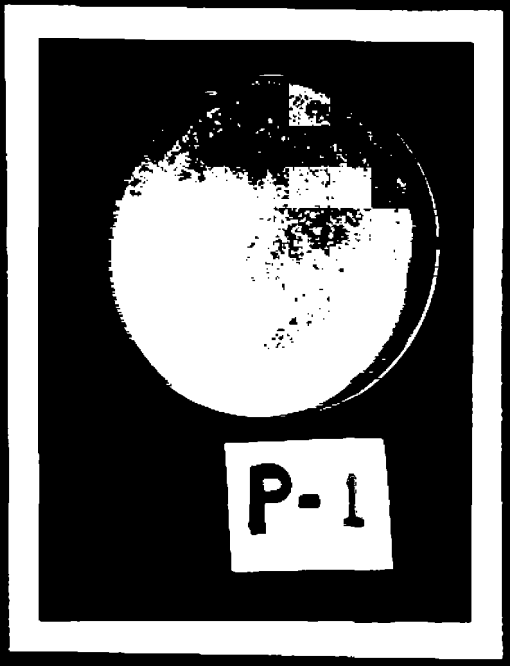

FIGURE IX PLATE COUNT OF SAMPLE F

there was less traffic and hence the dust raked up was minimal. In addition it was perceived that personnel hygiene, environmental cleanliness, method of food handling and also equipment cleanliness, were also good. The number of personnel was limited to two. The various possible sources of confamination of ice cream are as shown in Figure (.X).

Sample E was manufactured by the most popular parlour in Coimbatore City. This parlour is located in a very busy area where there is plenty of traffic and hence there is a possibility of greater extent of contamination. However the analysis proves otherwise mainly due to the extreme environmental sanitation, method of serving and personnel cleanliness. The parlour is completely safeguarded from the dust contamination by the glass doors.

Contamination in sample C may be attributed to the reason that it is a busy shopping spot and also because the parlour is an open one. The environmental cleanliness is passably good.

Sources Of Contamination Of Icecream

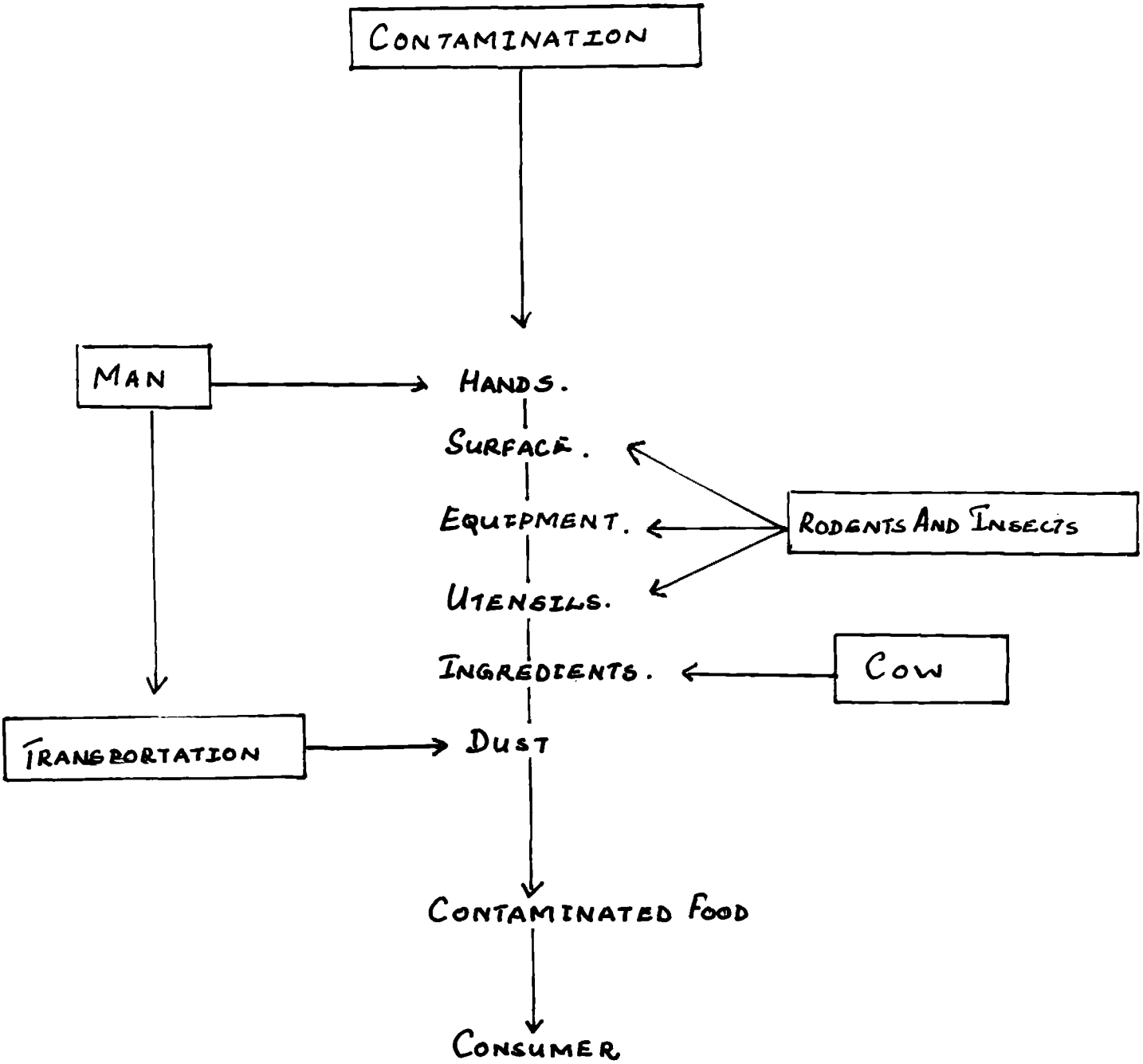

Figure X

Sample A showed less contamination even though it has been observed that the environmental, plant cleanliness and personnel cleanliness are very poor. This may be due to one reason that the source of milk purchased is of good quality. Only in this area did the investigator notice that the ice cream was produced by both manual and mechanically freezed. This may be the another reason for the less contamination even under the adverse factors perceived.

Sample B and D are produced by parlours whose exterior are good. But it was perceived that in both these areas the interior sanitation and method of serving were not satisfactory. The personnel cleanliness was also found to be poor.

The investigator studied the extent of microbial contamination of ice cream under various conditions and the results and discussed in Table VIII.

TABLE VIII

MICROBIAL ANALYSIS OF ICE CREAM PREPARED BY THE INVESTIGATOR UNDER DIFFERENT CONDITIONS

Samples	Microbical Count
Samples I	15×10^2
Samples II	19×10^2
Samples III	20×10^2
Samples IV	24×10^2
Samples V	35×10^2

The investigator took extreme precautions during the preparation of the sample I. The investigator took caution to wash her hands well and used a glove while preparation, hair was held back by a hair net and an apron was worn during the preparation of mix. The utensils used were sterilized, and the ice cream machine was rinsed thoroughly with hot water. The microbial examination of this product showed that the extent of contamination was only 15×10^2 while when the extent of contamination of mix prepared without sterilization utensils was 19×10^2 (Sample II) and that of product Sample III prepared without prewashing of utensils was 20×10^2.

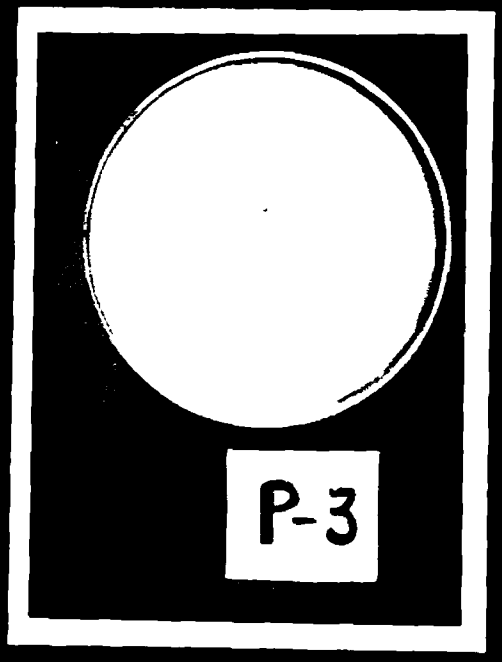

FIGURE XI PLATE COUNT OF SAMPLE I

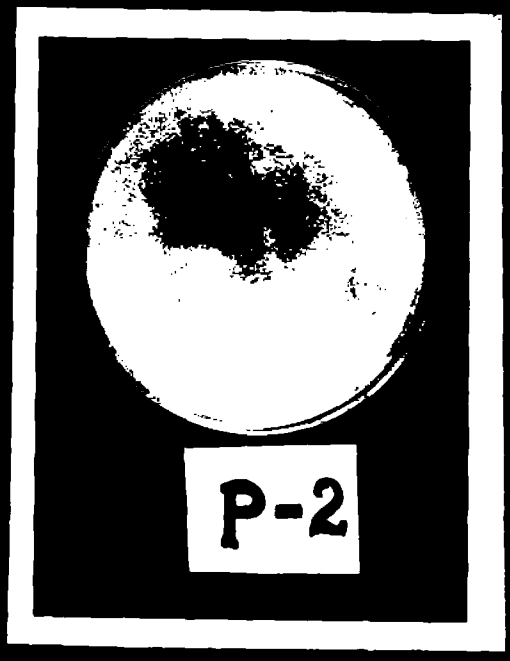

FIGURE XII PLATE COUNT OF SAMPLE V

The product produced, Sample IV and Sample V under conditions where in the former case the freezer was not cleaned before pouring the milk, and in the later the mix was left exposed for ½ an hour were 24 x 10^2 and 35 x 10^2 respectively. The plate counts are shown in Figures XI and XII.

C. Standardization:

A standard recipe may be defined as "as written formula for producing a food item of a specified quality and quantity for use in a particular establishment" - Kotas and Davies (1973).

It should show precise quantities of the ingredients together with the sequence of preparation and service of the food item.

The term standardization is synonymous with the phrase "What it should be" and is a measurement of product acceptablity.

Different variations of the ice creams were standardised under the same conditions, and scoring was done.

The results of this aspect of the study is presented and discussed under the following aspects:-

a. Total mean score of the variations

b. Acceptability test F test between the variants and between the criteria of the variations.

a. Total mean score for the variations:

Total mean score of the variations was found out by finding the average mean score given by the taste panels for each criteria. The score card used is as in Appendix (II).

Table IX depicts the total score

TABLE IX

TOTAL MEAN SCORE FOR THE VARIATIONS OF ICE CREAM

Criteria	Cashew	Plain	Roasted Bengal gram	Roasted pea nuts	Boiled pea nuts bean	Roasted soya bean	Boiled soya bean
	I	II	III	IV	V	VI	VII
Colour	5.7	4.3	3.9	4.4	3.8	3.6	3.9
Appearance	4.2	4.1	3.8	3.5	3.4	3.1	3.2
Texture	5.0	4.8	4.2	4.6	4.5	3.9	3.8
Flavour	4.8	4.3	3.3	3.2	5.2	2.6	2.6
Taste	4.5	4.2	3.0	3.1	2.9	2.2	2.1
Melting quality	4.2	4.2	4.0	4.2	4.2	3.6	3.8
Total	28.4	25.9	22.2	23.0	24.0	19.0	19.4

The above Table reveals the acceptability of the variations depending on the total scores acquired by each variation for each criteria. It can be concluded from the above totals that the ice cream considered as the standard has the highest score namely 28.4. Ice cream II where no nuts were added ranked the second with a total score of 25.9. The third place with the score of 23 was acquired by the variation in which boiled peanuts were added. Ice cream III held the next place with a score of 22.2. Among the ice cream variations VI and VII, Ice cream VI ranked least with a score of 19th and Ice cream VII had a score of 19.4.

The reasons attributed to the high acceptability of the standard was mainly due to the reason that the taste panels liked the stimulating flavour, taste and pleasing appearance, of the ice cream, containing cashew nut.

The ice cream in which roasted bengal gram was added was not appreciated for it had an off-flavour and an unacceptable taste.

The soya bean variations were least preferred due to off flavour it produced and also because the consistency of the ice cream was gummy. Among the peanut variations the taste and flavour ofthe boiled peanut product was better.

The textures of all the variations were the same as it was prepared in the "soft ice cream machine".

b. Acceptability test: 'F' test:

'F' test was done between the variants and between the criteria.

The statistical analysis was done between the variations and also between criteria to ensure whether there exists any significant difference or not.

The carried out statistical test leads to the rejection of the homogeneity of the various criteria and the variants at 5 per cent level as shown in Appendix III.

D. Cost Analysis:

Cost control has been defined as the guidance and regulation of the cost operating of an undertaking. To guide and regulate the cost means to ensure that they are in accordance with the predetermined objectives. The objective of food cost control is to ensure that costs are neither more or less, than they ought to be.

From the cost analysis done it was found that variation II was the least expensive namely 19 paise while Variation I was the most expensive namely 26 paise. The reason being that in variation II no nuts were added while in variation I cashew nut was added which is expensive.

Among the other five variations the cost was found to be equal, 20 paise each as the ingredients added were available in plenty and not as dear as cashewnuts. The nuts were, raw peanut roasted peanuts, roasted bengal gram, roasted soya-bean and boiled soyabean.

The portions obtained in each variations were 64 cups and each portion weighed 60g.

V SUMMARY AND CONCLUSION

The most popular desserts in and out of home are those that are designated as frozen desserts. Ice cream among these leads in popularity because of its pleasing colour flavour and texture. It is also valued for its capacity to stimulate the flow of digestive juices.

From the survey done it was found that people preferred the Vanilla and Chocolate flavour the most. 20 per cent of the homemakers and 46 per cent of the student favoured vanilla flavour.

40 per cent of the homemakers preferred the ice cream prepared out of the ice cream mix while only 34 per cent of the students preferred it. The homemakers preferred this due to the less time and labour involved in the preparation. Students stated that it did not give a satisfactory product.

Any food, fresh or frozen are susceptible to contamination and ice cream is exception. From the microbial analysis done it was found that sample F was the least contaminated namely 73 x 10^2, where hygienic conditions prevailed like

proper manner of serving and the use of good quality ingredients. The most contaminated, sample B and Sample E, 125 x 10^2 was due to poor sanitation and method of serving.

From the microbial analysis done for the samples prepared by the investigator under different conditions it was found that contamination of the sample exposed for half an hour was 35 x 10^2. When the utensils were sterilized and ice cream machine was washed with hot water, it was 15 x 10^2, and for unwashed utensils was 20 x 10^2.

From the standardization of recipes it was found that ice cream where chashewnut was added was accepted more due to the colour, flavour and pleasing taste. The ice cream in which peanuts were added were also found to be acceptable.

The carried out statistical analysis leads to the refection of the homogeneity of the various criteria and among the variants at 5 per cent level.

Among the five variations the cost was found to be equal, 20 paise each as the ingredients added were available in cheap rates and not dear as cashewnut in which variation alone the cost was 26 paise.

In order to reduce the contamination, personnel health habits, environmental cleanliness along with good fresh ingredients are important.

Training of personnels is another important factor. Emphasis should be made that trained, qualified personnels with a basic knowledge of catering and food sanitation should only be employed.

Random inspection of the parlour, equipment cleanliness, environmental sanitation, hygienic method of serving, personnel health and sound habits are necessary to minimise contamination of the foods.

It should be made sure that no adulterants or non-permitted colours are used. It is in this context that the Health Authorities have a vital role to play in the prevention of any health hazard.

However there is no doubt that ice cream is liked by all age groups as it is found to be the most looked forward dessert on most occasions and on special days. In addition, it also forms an useful outlet for surplus milk and dairy products available in the country.

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APPENDICES

APPENDIX I

SRI AVINASHILINGAM HOME SCIENCE COLLEGE FOR WOMEN
COIMBATORE 641011

QUESTIONNAIRE TO ELICIT INFORMATION REGARDING THE POPULARITY OF ICE CREAM

1. Name of the interviewer -
2. Name of interviewee -
3. Address -
4. Age 5. Sex
6. Occupation
7. Income (Annual)
8. Vegetarian/non-vegetarian
9. Family Background

Name	Relationto interviewee	Age	Sex	Education	Occupation	Income
1.						
2.						
3.						
4.						

10. Do you consume ice cream Yes No.

11. What is your favourite flavour (1) (2) (3)

Reason:

12. Name the parlour you go for your ice-cream -

Reason

13. How often do you go to the parlour

Weekly ☐ Monthly ☐ Daily ☐

Sometimes ☐ Rarely ☐ Never ☐

14. Do you visit the ice cream parlour (any one)

a) More during summer

b) More during winter

c) Equally during summer and winter

15. What are the points you would consider in an ice-cream. (Please grade 1, 2, 3, etc. in the order of your preference).

a) Cost

b) Brand

c) Taste

d) Flavour

e) Colour and appearance

f) Texture

g) Quality

h) The ice-cream parlour

i) Chooses depending on the attractiveness of names.

16. Do you prepare ice-cream at home? Yes / No.

17. How often do you prepare?

Weekly ☐ Monthly ☐ Daily ☐

and as and when you wish ☐

18. Do you prepare icecream (Grade 1, 2, 3, as you think)

a) Whenever there's a guest at home

b) When there is a party

c) When you feel like

19. Do you use the icecream mix? Yes / No

20. Which brand do you use

Rex ☐ Polson ☐ Weikfield ☐

If any other name

21. Do you prefer the ice-cream made from mix or the ordinarily made one

Reason

22. Do you find the ice-cream mix really a convenient food?

Yes No

Reasons

23. Is it economical? Yes / No

Reason

24. What are the problems you face when preparing ice-cream at home?

APPENDIX II

SCORE CARD FOR ICE CREAM

S.No.	Crtieria	Score	I	II	III	IV	V	VI	VII
1.	Colour								
	Most acceptable	5							
	Acceptable	4							
	Tolerable	3							
	Not acceptable	2							
	Leastacceptable	1							
2.	Appearance								
	Extremely pleasant	5							
	Moderately pleasant	4							
	Pleasant	3							
	Not pleqsant	2							
	Least pleasing	1							
3.	Texture								
	Soft and good	5							
	Coarse or icy	4							
	Fluffy or gummy	3							
	Sandy	2							
	Lumpy	1							

contd...

S.No.	Criteria	Score	I	II	III	IV	V	VI	VII
4.	Flavour								
	Good and pronounced	5							
	Good	4							
	Tolerable	3							
	Not good	2							
	Intolerable	1							
5.	Taste								
	Very good	5							
	Good	4							
	Tolerable	3							
	Not acceptable	2							
	Least acceptable	1							
6.	Melting Quality								
	Melts fast	5							
	Moderately fast	4							
	Hard	3							
	Remains fluffy	2							
	Watery	1							

APPENDIX III

SQUARED VALUES OF THE SCORES FROM TABLE X

Criteria	Cashew	Plain	Roasted bengal gram	Roasted peanuts	Boiled pea-nut	Roasted Soya-bean	Boiled Soya-bean	Total
	I	II	III	IV	V	VI	VI	
Colour	32.49	18.49	15.21	19.36	44.44	12.96	15.21	138.16
Appearance	17.64	16.81	14.44	12.25	11.56	9.61	10.24	92.55
Texture	25.0	23.04	17.64	21.16	20.25	15.21	14.44	136.74
Flavour	23.04	18.49	10.89	10.25	27.04	6.76	6.76	103.22
Taste	20.25	17.64	9.00	9.61	6.41	4.84	4.41	74.16
Melting Quality	17.64	17.64	16.00	17.64	17.64	12.96	14.44	113.96
Total	136.06	112.11	83.18	90.26	99.34	62.34	65.50	648.79

Correction factor $= \frac{(GT)^2}{7 \times 6} = \frac{161.9^2}{42} = 624.09$

Total sum of squares = 648.79 - 624.09 = 24.70

Column sum of squares = 635.43 - 624.09 = 11.34

Row sum of squares = 631.45 - 624.09 = 7.36

Error = 24.070 - 18.70 = 6.00

APPENDIX III

ANOVA TABLE

Source	Sum of squares	Difference	Mean sum of squares	Ratio	5 per cent
Total	24.70	41			
Column sum of squares (between variants)	11.34	6	1.89	9.45	2.41
Row sum of squares (between criteria)	7.36	5	1.47	7.35	2.53
Error sum of squares	6.00	30	.20		

APPENDIX IV

VARIATION I (STANDARD)

Ingredients	Quantity	Rate Rs. ps	PER	Cost Rs.ps	Cost/ portion
Milk	4 litres	.00	litre	8.00	
Sugar	800 g	4.00	kg	3.20	
Custard	50 g	7.50	450g	0.83	26 p
Cashewnut	100 g	43.00	kg	4.30	
Essence	15 g	2.50	50 ml	0.25	
				16.58	

VARIATION II (PLAIN)

Ingredients	Quantity	Rate Rs. ps.	PER	Cost Rs.p.	Cost/ portion
Milk	4 litres	2.00	litre	8.00	
Sugar	800 g	4.00	kg	3.20	
Custard	50 g	7.50	450 g	0.83	19 p
Essence	15 g	2.50	50 ml	0.25	
				12.28	

VARIATION III (ROASTED BENGAL GRAM)

Ingredients	Quantity	Rate Rs.ps	PER	Cost Rs.p.	Cost/ portion
Milk	4 litres	2.00	litre	8.00	
Sugar	800 g	4.00	kg	3.20	
Custard	50 g	7.50	450 g	0.83	20 p
Roasted Bengal gram	100 g	3.25	kg	0.32	
Essence	5 g	2.50	50 ml	0.25	
				12.61	

VARIATION IV (ROASTED PEANUTS)

Ingredients	Quantity	Rate Rs.ps.	PER	Cost Rs.ps	Cost/ Portion
Milk	4 litres	2.00	litre	8.00	
Sugar	800 g	4.00	kg	3.20	
Custard	50 g	7.50	450 g	0.83	20 p
Roasted peanuts	100 g	6.00	kg	0.60	
Essence	5 g	2.50	50 ml	0.25	
				12.88	

VARIATION V (BOILED PEANUTS)

Ingredients	Quantity	Rate Rs. ps.	PER	Cost Rs.ps.	Cost/ Portion
Milk	4 litres	2.00	litre	8.00	
Sugar	800 g	4.00	kg	3.20	
Custard	50 g	7.50	450 g	0.83	20 p
Boiled peanuts	100g	5.00	kg	0.50	
Essence	15g	2.50	50 ml	0.25	
				12.78	

VARIATION VI (ROASTED SOYABEAN)

Ingredients	Quantity	Rate Rs. ps.	PER	Cost Rs.ps	Cost/ portion
Milk	4 litres	2.00	litre	8.00	
Sugar	800 g	4.00	kg	3.20	
Custard	50 g	7.50	450 g	0.83	20 p
Roasted Soyabean	100 g	2.50	kg	0.25	
Essence	15g	2.50	50 ml	0.25	
				12.53	

VARIATION VII (BOILED SOYABEAN)

Ingredients	Quantity	Rate Rs.ps	PER	Cost Rs.ps	Cost/ Portion
Milk	4 litres	4.00	litre	8.00	
Sugar	800 g	4.00	kg	3.20	
Custard	50 g	7.50	450g	0.83	
Boiled soyabean	100g	2.50	kg	0.25	20 p
Essence	15g	2.50	50 mg	0.25	
				12.53	

Number of portion in each variations = 64

Weight of a portion = 60 g

To the cost of the variations worked out five paise is to be added as fuel and overhead charges per portion of the icecream.