A COMPARATIVE STUDY OF SELECTED ICE CONTAINERS

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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

The demands made by the modern times on the homemaker is so great that she never finds the twenty four hours a day sufficient to discharge her responsibilities that of a homemaker, mother, teacher, nurse and social worker. Nickell and Dorsey (1967) stress the fact that as human needs and desires change with progress through time, new tools, new substances and new sources of power are discovered and created and new methods are devised. Accordingly, Agan (1970) recommends orgaganisation of efficient work areas and method of performing work, effective use of body and muscles and use of good labour saving devices to achieve efficiency. Of these, labour saving devices have earned paramount importance these days and have become a necessity rather than a luxury (Adams, 1963). Joslin and Taylor (1955) define labour saving device as a device used in simplifying work. According to the Encyclopaedia, it is a scheme or contravance which is used for some purpose or other. There are many types of labour saving devices, both large and small, electric and non electric, now on the market. According

to Gross and Crandall (1967) the labour saving devices used for food preparation enable one to produce, prepare and conserve food and save time and human energy. One such device is the ice container which is meant for keeping ice in its form for a good deal of time.

India being a hot country, chilled items such as ice-cream, jelly and sherbet are welcomed by both young and old alike. Some of the chilled items such as ice-cream contains certain essential nutrients as it is made up of cream, milk, sugar and nuts (Leon, 1959). But the Indian economic system does not permit even many of the middle class families to possess a refrigerator to enjoy chilled dishes whenever they like.

Ice container might help the family to keep the commercial chilled products purchased cool for at least a few hours in their own homes when need arises. Even if other devices are used for preparation, if the ice container serves the purpose of keeping the quality, for the time desired by the homemaker, it will surely be a boon to her.

The display within the shops reveals the numerous shapes, types and brands available in ice containers and the

homemaker who wishes to purchase it, is greatly confused not knowing the best quality. Hence, this study has been undertaken to evaluate the efficiency of selected ice containers by studying the duration for which ice can be retained in them. The investigator hopes that the results of this study will help the homemakers in making wise decisions regarding their purchase of ice containers and also the manufactures in evaluating and modifying their standards.

II. REVIEW OF LITERATURE

The literature pertaining to the "Study on Selected Ice Containers" are reviewed and discussed under the following headings:

A. Importance of equipment in the home

B. Factors to be considered in selecting equipments

C. Storage equipments for chilled items

D. Factors affecting chillness

and E. History of preservation of ice.

A. Importance of Equipment in the Home:

Among the various activities which keep the world going, homemaking is of prime importance (Gilbreth et al, 1960). The homemaker who rules the home requires adequate assistance to maintain the home happy, healthy and enjoyable since only such environment is conducive for the proper physical, mental and emotional growth and development of individual members (Devadas, 1959). Menon (1969) opines that making of a happy and healthy home and running it efficiently is important to the national life.

Due to the heterogeneous tasks in the home, the homemaker may have to move to and fro in the different work areas in the house to perform the tasks of immediate need. Hence Devadas (1959) and Rusk et al (1961), point out that one of the responsibilities of the homemaker is to plan household work in such a manner as to save time, energy and money. If essential facilities are not available, fatigue which is a health hazard will result (Menon, 1969; Perkins et al, 1945). The varieties of household equipment available to the family facilitate easy performance of household tasks. Sundari and Kamalanathan (1968) and Puri and Rajagopal (1968) stress the need to use time and labour saving equipment to help in saving part of the time and energy spent in the kitchen. To Justin and Rust (1956), equipment make the house convenient and comfortable, facilitate the work to be done there and many times add to its charm and beauty. They provide the homemaker with sufficient leisure hours to devote to children and outside social and wage earning activities which the modern times demand. Adams (1963) declares that use of time and energy saving appliances would well be a part of a 'great plan' to make possible the energy of women into business in overwhelming numbers. Moreover, honest paid helpers are rare these days (Das, 1973) and this trend requires equipping the home

to the extent possible to do the housework with ease. In this context the saying "Equipment does the work and hands get the credit" is quite genuine. To sum up, good working equipment is essential to secure leisure time, comfort and efficiency.

B. Factors to be Considered in Selecting Equipment:

Justin and Rust (1956) opine that the selection of equipment depends mostly on personal choice. However, there are several factors which influence the choice of an equipment. According to Peet et al (1970) the most important aspect to be considered is its cost. Other important factors are health and consequently the energy of the homemaker and attitudes of the family members. The size and need of the family and age of the children also play an important part in reaching a decision (Johnston, 1965). After evaluating the above conditions, if decision is reached to buy, other factors must be examined if the purchase is to give lasting satisfaction. These factors according to Peet and Thye (1965) are:

1. Reliability of manufacturer and dealer
2. Availability of servicing
3. Construction of appliance - its appearance, designs, colour, trim and size, materials used, convenience features and special features

4. Guarantee, operation direction and specification sheets

5. Cost - initial, installation, operating and servicing.

The initial cost of the equipment is affected by

a. Type of raw materials used

b. mode of transportation and the distance from source to company location

c. manufacturing process applied and the number of models

d. labour benefits provided

e. type of design followed

f. research work undertaken

g. guarantee and replacements provided

and h. competitions.

C. Storage Equipments for Chilled Items:

Good storage equipments are essential to avoid spoilage which renders foods unattractive, unstable and unwholesome. The spoiled foods are unfit for human consumption and are injurious to health (Salle, 1961). The type of spoilage for a particular food item depends on the composition, structure and type of food and condition of storage. If properly stored, they can last for several days, weeks or months. Careful storage will help to retain their appearance, flavour and general quality (Parker, 1954).

According to the American Home Economics Association (1959), the storage equipments for the chilled items include refrigerator and freezer among the electrical equipments. The Encyclopaedia Britanica (1968) and The Dictionary of International Food and Cookery Items (1967) consider ice pail, ice safe, ice-less refrigerator, ice chest, ice box and ice container useful for preserving chilled items.

1. Ice pail:

The Concise Household Encyclopaedia states that ice pail is a simple form of wine cooler. In the shape of a pail, it was made in silver and sheffield plate as well as in the cheaper metals. After a time, pieces were decorated, ornament taking the form of reeding, usually around the body about a third of the way from the top. The best specimens were made in the 18th and the early part of the 19th century.

2. Ice safe:

Ice safe is a device in which uncooked foods may be stored safely for several days in an ice box with about ½ CWT. of ice. It consists of an outer case enclosing a zinc box, the space between them being packed with slag wool, saw dust or some other material, which is a good non-conductor of heat (The Concise Household Encyclopaedia).

3. Ice-less refrigerator:

An ice-less refrigerator which is based on the principle of cooling by evaporation is a useful convenience for home (1958). This will keep meat, fruits and vegetables cool and extend the period for keeping milk and butter. It also keeps insects away from food. Foods cooked once for the whole day cannot remain fresh and wholesome in a warm climate. An ice-less refrigerator helps to keep such food fresher for a long period.

4. Ice chest:

Waldo (1967) explains an ice chest as a device using blocks of ice.

5. Ice box:

Craig (1936) and Waldo (1957) consider an ice box as an insulated cabinet for the safe storage of perishable foods. A well-made ice box properly supplied with ice will maintain temperature of 50°F or lower, sufficient to keep most foods from spoiling. An ice box also prevents dehydration by maintaining adequate humidity as well as coldness inside the cabinet.

The standard ice box is devided into two or more compartments, one holding the ice and the others the food. The ice is placed either above or in the upper portion of the food compartments. If a standard temperature is to be maintained, air must circulate freely between all compartments, therefore racks rather than solid shelves are used. A draining device also keeps the melting ice water, out of the rest of the cabinet. The ice box does not manufacture ice; household needs are filled by chipping from the large block in the ice compartment.

The coolest section which is nearest to the ice compartment, should be used for easily perishable foods such as milk. Hot foods should be cooled before being stored. The ice box has been largely supplemented recently by the electric refrigerator.

6. Refrigerator:

Ellacott (1957) states that the refrigerator of the 19th century was simply a lidless box containing a lump of ice, but Ash's patent of the 1890's had a closed top with the ice contained in a hopper. As the ice melted, the water passed under the bottom of the food container and was filtered through charcoal into a pan. It was claimed that the ice water was then fit to drink.

Walley (1958) and Ehrenkranz and Inman (1958) regard that mechanical refrigerators are designed primarily for the storage of food and the freezing of small quantities of ice cubes. However, most refrigerators in private homes and many that operate on the common current of the gas supply of an apartment house are equipped with a switch that will reduce the temperature temporarily to a degree that will permit the freezing of desserts in the trays from which the ice cubes have been removed.

The Concise Household Encyclopaedia states that the mechanical and other devices for reducing the temperature of the air in an enclosed space are known as refrigerators. Refrigeration depends upon the difference at a given pressure between the boiling point of certain volatile fluids. The process is also dependent upon the law that when the pressure applied to a liquid is raised, the boiling point is also raised. In order to freeze water, it must be exposed to a temperature lower than 32°F. and in order to obtain this lower temperature, the water must be brought in contact with a medium which has a lower boiling point than water. To make the process continuous and automatic, the refrigerator must be caused to yield up the heat extracted and then be made available for

further use. Today, we have refrigerators of many brands in different sizes.

7. Freezer:

Freezer is convenient for the small family which does not own a refrigerator (1956). The ice-cream prepared in a freezer resembles the product of a mechanical refrigerator and the same recipe may be used for both types of freezing. Sherbet may be frozen and stored in the freezer if the texture is not objectionable. A freezer may be a separate appliance or it may be combined with refrigerator (Van Zante, 1965). In standard freezers, two different cabinet designs in a variety of sizes are available - chest type with top lid or lids and the upright model with the front opening door (Peet and Thye, 1965).

8. Ice container:

Ice containers are simple insulated containers with tight fitting lids to keep chilled items. They are made of different materials such as plastic and thermocol.

D. Factors Affecting Chillness:

In scientific language, the condition of a body with regard to its hotness or coldness is called its temperature (Joshi, 1954). It is a condition or state of the body which determines the direction of the flow of heat. Temperature refers to the degree of hotness of a body (Krishnamoorthy, 1967). Chillness is referred to as the ice point, that is 0° in the thermometer which is also called as the end point. There are certain factors which effect chillness. They are heat, humidity, vacuum pressure and composition of the storage atmosphere.

1. Heat:

Heat is a form of energy which causes the rise in temperature of a body. The effect of the rise of temperature of a body is marked by different changes such as change of state and change of size (Joshi, 1954; and Sears, 1957). Heat always passes from a warmer to a cooler body. This process happens through one of the three ways - radiation, conduction, and convection (Daniel, 1956). Since the room air in which the refrigerator is located may be at least 30-40°F warmer than the air inside a container, heat is conducted through the walls to the cooler area. The larger the heat gradient between outside and inside, the greater the tendency

for heat to pass from one section to the other (Pace, 1960). The temperature of an ordinary ice box varies from 4.4° to 12.8°C (40-55°F) depending upon the amount of ice, the rate of melting, and the kind of ice box (Frazier, 1958).

2. Humidity:

Humidity is nothing more nor less than the moisture content of the air. To a certain extent, it is tied in with the temperature of the air (1961). The atmospheric water content is expressed in any of the several measures especially, relative humidity, absolute humidity, humidity mixing ratio and specific humidity. Relative humidity is the ratio in percentage of the moisture actually in the air to the moisture if would hold, if it were saturated at the same temperature and pressure. It is a useful index of dryness or dampness for determining evaporation or absorption of moisture. Absolute humidity is the weight of water (Krishnamoorthy, 1967).

The optimum relative humidity of the atmosphere in chilling storage varies with the food stores and with environmental factors such as temperature, compositions of atmosphere and ray tratments. Too low a relative humidity results in loss of moisture and hence of weight. Changes in humidity as well as in temperature, may cause sweating or precipitation of mositure (Frazier, 1958).

3. Composition of storage atmosphere:

It is a very essential factor but no attempt is made to control the composition of the atmopphere (Frazier, 1958).

4. Vacuum pressure:

A vacuum is a condition where the pressure in a system is reduced from atmospheric pressure. If atmospheric pressure is normally 14.7 lbs. per square in the surface of the earth, a decrease in this pressure by one pound would create a partial vacuum. Two inches of vacuum equals approximately one pound of pressure. From a physical stand point, a vacuum is of value in holding the closures of glass jars, reducing the pressure in containers (Mendelson, 1958).

5. Moisture:

Frazier (1958) states that the control of moisture is often a serious problem. Warm air carries much more water vapour than cold air. If the amount of moisture is greater in the air, the pressure will be great. The increase in pressure will affect the room temperature (Varadhachari and Thangarajan, 1969).

E. History of Preservation of Ice:

In earlier years, ice was the only chilled item which people knew and they understood that ice could be preserved

fer sometime by keeping in saw dust. A mention is made in A to Z of Refrigeration (1961) that from Boston, ice was carried to West India by covering it with saw dust in ships for its medical value in curing yellow fever.

Thousand years later, Chinese learned that ice could keep drinks cold and more tasty in hot weather. During winter, they cut ice and packed in straw and chaff to sell during summer months.

In early Greek and Roman days, slaves were engaged in bringing snow down from mountain tops. They stored ice in huge cone shaped pits which were lined by straw and leafy branches pruned from trees. A thatched roof was built to protect if from sun's rays. An opening was left in the side of the pit to remove it as and when need arose.

The Emperor Nero built huge cellars in the Alps to store winter snows for summer use (Waldo, 1967). A Scottish surgeon William Cullen made the first known researches into the manufacture of ice in 1755. An American, John Gorrie patented the first American practical method for making ice in 1851 and in 1860, a French man Ferdinard Care obtained a United States patent for an ice making machine using ammonia as its freezing agent. Ice plants were then built in the smallest towns and home delivery of ice was common until the advent of electric and gas refrigerators.

III. EXPERIMENTAL PROCEDURE

The experimental procedure for the study of selected ice containers comprised of the following steps:

A. Household survey

B. Shopping survey

and C. Judging the efficiency of the selected ice containers.

A. Household Survey:

The household survey consisted of the steps given below:

1. Selection of the houses

2. Selection of the method of study

3. Framing the schedule

4. Conducting the study

and 5. Presentation of data.

1) Selection of the houses:

Houses which possessed ice containers alone were considered for the study from Coimbatore city. Thus twenty five houses were selected.

2) Selection of the method of study:

Interview method according to Devadas (1969) is a systematic method by which a person enters more or less imaginatively into the inner life of a comparative stranger. Moreover, information collected by this method will not be vague and clarification of doubts are possible since data are collected in person. Hence, interview method was selected for the present study.

3) Framing the schedule:

Since the purpose of the household survey was to understand from the homemakers the details regarding the containers such as brand, size, capacity, cost and advantages and problems realised in using them, an interview schedule which would draw these informations was carefully prepared. To avoid incorrect expressions and ambiguity, the schedule was pretested as suggested by Gee (1950). The pretesting done helped to modify the schedule and the schedule thus finalised is given in Appendix I.

4) Conducting the study:

The homemakers were contacted during their leisure. Rapport was first established to achieve homemakers' confidence (Festinger et al, 1953). The purpose of the study

was then explained after which informations as per the schedule were gathered one by one and recorded.

5) Presentation of data:

The data obtained through the household survey were consolidated and the findings are presented as given below:

a) Family background:

Of the 25 families selected, only ten belonged to joint families, which indicates the modern trend of moving away from the joint family system.

All the families received a monthly income of above Rs.600/-. Eleven families received a monthly income between Rs.601/- and Rs.1000/- while the others received an income between Rs.1001/- and Rs.1300/-. Seven of the head of the families were lecturers, six were engineers, four were doctors and the others were either bankers or other business people.

b) Preparation and use of chilled items by the families:

Among the 25 families surveyed, ten included chilled items in their menu occasionally, nine daily and six weekly once. The nine families which included the chilled dishes daily possessed refrigerators. The other families which

occasionally included such dishes always bought these from outside but preserved in ice containers.

Twenty two families reported that the ice containers they possessed helped to maintain the consistency, form and coolness of ice for more than six hours. Three families were disappointed with their ice containers since these could retain the qualities only for two to five hours. The homemakers remarked that they could not preserve either ice-cream or jelly for even two hours.

e) Cost brand and capacity of the ice containers:

It is noted that the homemakers possessed seven different types of ice containers. Five families possessed Brite. The other brands found were Leo, Eagle, Acme, Igloo, and Star. Only one family possessed Sun brand.

Table I presents the brand, cost and capacity of the ice containers possessed by the selected families.

TABLE I

BRAND, COST AND CAPACITY OF THE ICE CONTAINERS POSSESSED BY THE HOMEMAKERS

Brand	Size available	Cost (Rs.)	Capacity (ml.)
Brite	Three (Small, Medium, Big)	20 - 52	700 - 2000
Lee	Two (Medium, Small)	28 - 48	700 - 1300
Iglee	One (Medium)	7	2500
Acme	Two (Medium, Big)	28 - 47	2000 - 3015
Sun	Two (Medium, Big)	25 - 65	800 - 1800
Eagle	Two (Medium, Big)	22 - 47	1800 - 2200
Star	Two (Small, Medium)	18 - 38	500 - 1306

'Brite' was available in all the three sizes - small, medium and big. The other ice containers were available with the homemakers in two different sizes excepting Iglee available in one size only.

The minimum cost of the ice containers ranged from Rs.18 to 28 whereas it ranged from Rs.38 to 65 for the largest

size available in the particular brand. Igloo alone costed rupees seven for the available size.

The capacity varied depending upon the size.

d) Materials used in construction:

The materials used for the exterior and interior of twenty ice containers were plastic. Three were of thermocol while two were of chromium with glass in the interior. All the ice containers had smooth finish. They were non corrosive, leak proof and rust proof.

e) Advantages and problems in using:

As for the advantages, all the 25 homemakers reported that since they were light weight and portable, could be used for picnics and also for bringing chilled items such as ice-cream from outside. Majority of the homemakers felt that ice could be stored without much loss for more than six hours and hence could be used in emergency.

With regard to problems, 12 homemakers complained of unsuitability to keep ice-cream, jelly and such items since these do not keep their form and consistency, while five homemakers regarded irritating odour as a problem.

Two homemakers who had ice containers made of glass were bothered about the breakage problem.

f) Special features:

In ten families, the ice containers were provided with handle. They were Leo, Brite, Star and Sun. In four families, they obtained wooden spoons and also aluminium cups along with the containers. The brands which provided these were Lee and Star.

B. Shopping survey:

The same steps as in the case of household survey were followed for shopping survey.

Nine shops where ice containers were sold in Coimbatore city were selected.

Interview method was followed owing to its several advantages. The informations from the shops were gathered under the following headings: size, shape, capacity, cost, materials used in construction, special features and brand. Appendix II presents the schedule used for shopping survey.

The informations gathered were consolidated and are presented as given below:

The nine shops surveyed by the investigator in Coimbatore city revealed the availability of ice containers in Lee, Eagle, Brite, Iglee, Acme, Sun, Star, Taj, Jay, Hindustan, KSM and Hammerhaster Brands. These were available in three sizes - small, medium and big. Their cost ranged between Rs.7 and Rs.198.

Different shapes such as round, oval and square were available.

The materials used for constration were aluminium, plastic, chromium, thermocol and iron. The shopkeepers assured that Brite and Lee were the mostly demanded brands.

C. Judging the Efficiency of the Selected Ice Containers:

The procedure for judging the efficiency of the selected ice containers consisted of the following steps:

1) Selection of ice containers
2) Conducting experiments with ice containers
and 3) Evaluating the physical features of the selected ice containers.

1) Selection of ice containers:

For the experiment, five types of ice containers were selected based on the availability in the market. The five types selected were, 'Brite', 'Leo', 'Iglee', 'Eagle' and 'Acme', which had almost the same capacity. Their capacity ranged between 1200 and 2000 ml. Figure (1) presents the ice containers selected for the study.

Brite(A) which is made of plastic has a capacity of 2000 ml. The vacuum between the outer and inner surfaces serves as insulation. This costs Rs.52/-. Leo (B) is also made of plastic and similar in construction to that of Brite. Its capacity is 1200 ml. and the cost is Rs.48/-. Iglee (C) which is very economical, costs only Rs.7/- and is made of thermocock. Unlike Brite and Leo, the material itself serves the purpose of insulation. The capacity is 2000 ml. Eagle (D) and Acme (E) which cost Rs.28/- and Rs.25/- respectively are similar to Brite and Leo. The capacity of Eagle is 1870 ml. and Acme is 2000 ml.

2) Conducting experiments with ice containers:

Experiments were conducted to determine the time for which ice could be retained in the selected ice containers. This included the following steps.

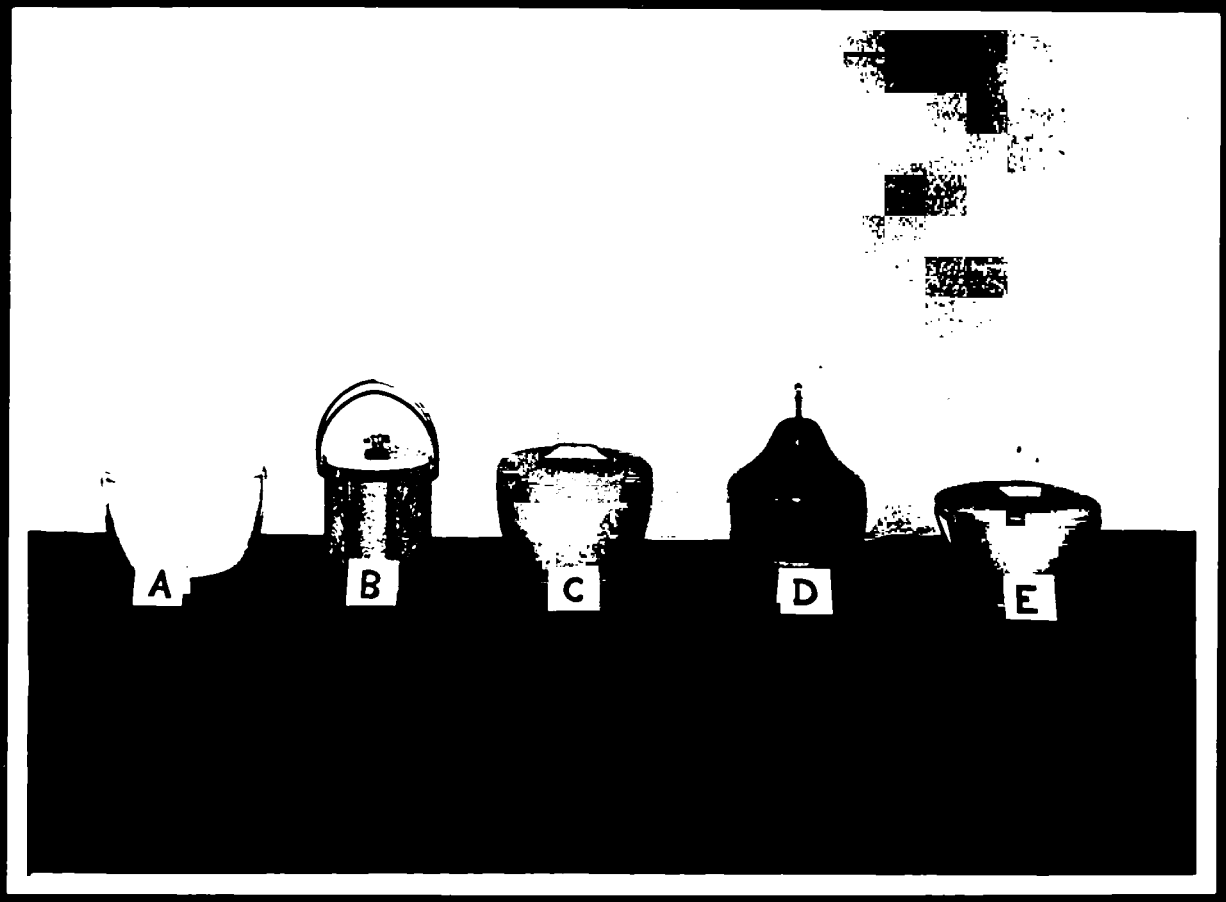

FIGURE 1

SELECTED ICE CONTAINERS

a) Selection of containers to prepare ice

b) Method of preparing ice blocks

c) Conducting preliminary experiments

d) Determining the time for which ice can be retained in the selected ice containers

and e) Assessing the suitability of ice containers in keeping ice-cream and jelly.

a) Selection of containers to prepare ice:

Since the capacity of the ice containers selected for study was between 1200 and 2000 ml. it was decided to select containers of almost the same capacity for preparing ice. Aluminium containers were selected because of its special qualities to conduct temperature. Five aluminium containers which were similar in shape, size and capacity were selected as shown in Figure (2). Each aluminium container had the capacity of 840 ml.

b) Method of Preparing ice blocks:

To prepare ice, 800 ml. of previously boiled and cooled water was poured into each one of the five aluminium containers and kept in the freezer chest of the refrigerator for setting.

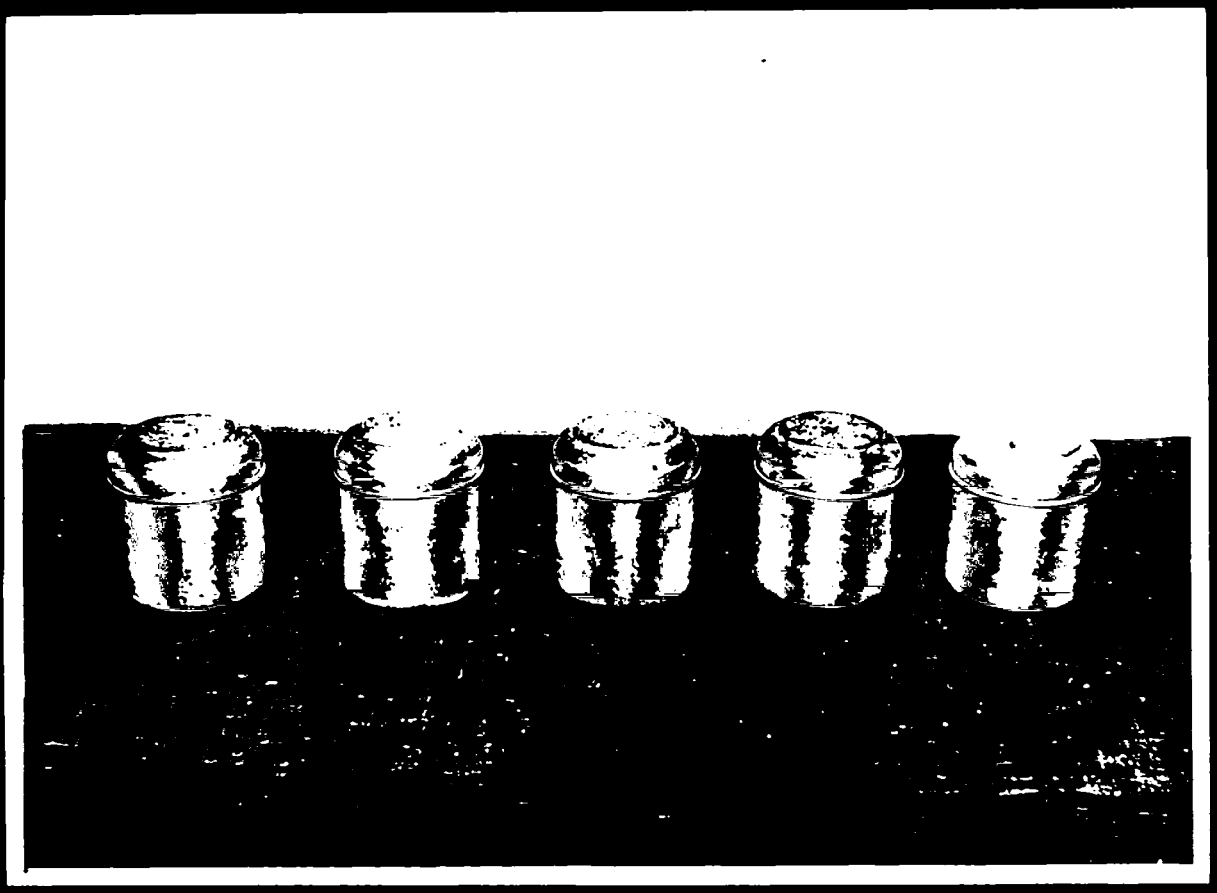

FIGURE 2

SELECTED ALUMINIUM CONTAINERS

FOR PREPARATION OF ICE.

Ice blocks thus made were preferred over ice cubes for this experiment since the area exposed to the atmosphere while transferring to the ice containers is lesser in the former than in the later case.

c) Conducting preliminary experiments:

Preliminary experiments were conducted to determine:

i. The time needed to transform 800 ml. of water into ice block. On an average, 15 hours were found to be necessary for water to transform into ice blocks in the aluminium containers kept in the freezer chest of the refrigerator.

ii. the time required to keep the aluminium containers with ice at room temperature to facilitate easy transfer of ice block prepared in the refrigerator to the ice container. It was noticed that four minutes were required to loosen the ice block from the aluminium container for easy transfer.

d) Determining the time for which ice can be retained in the Selected ice containers:

To determine the time for which ice can be retained, the selected ice containers were placed side by side in the Home Management Laboratory of Sri Avinashilingam Home Science College, where there was provision to check the atmospheric temperature also.

The five ice blocks of similar nature indicated earlier were prepared and transferred to the ice containers. They were kept in the particular containers for seven hours, eight hours and so on till 18 hours. New ice blocks were prepared and utilised at each time with the same quality of water. This required preparation of ice 12 times. These sets of experiments were repeated to get two readings for each hour thus 24 times ice blocks were prepared and used in the ice containers during December - January when the average temperature ranged between 27°C and 28°C which was comparatively cool weather.

To compare the use of ice containers in cold and hot seasons, these experiments were repeated in the month of March to get data for the 9th, 12th, 15th and 18th hours. The temperature during the days of experiment in March was 32°C on an average.

e) <u>Assessing the suitability of ice containers in keeping Ice-cream and jelly:</u>

To study the usefulness of selected ice containers in keeping ice-cream and jelly, these items were kept in these containers for two hours after which they were evaluated by a panel of experienced judges selected among the faculty members.

The following precautions were taken throughout the experiment to maintain accuracy.

1. Room temperature at the beginning and end of the experimental period on each day was noted.
2. Time for which the aluminium containers with ice, was kept outside, to loosen the ice from the sides was same for all the five sets.
3. Minimum time was used to transfer ice into the ice containers.
4. At the end of the experimental period, while taking temperature of the contents inside the ice container, the lids were only partially opened for a minimum time of one minute to minimise the effect of atmospheric temperature.
5. The melted ice in each container with the lid partially closed was carefully transferred to another container without spilling and the volume of water thus obtained was measured accurately using a measuring jar.

The results thus obtained are presented and discussed under Chapter IV.

3. Evaluating the physical features of the ice containers:

The following features were evaluated based on the physical characteristics of the ice containers selected for the study:

1. Pleasing appearance
2. Suitability of size for an average family

3. Light in weight
4. Ease in carrying
5. Suitability of knob on the lid
6. Ease in maintenance
7. Air tight
8. Unbreakable
9. Suitable finish
10. Leak proof

Score cards were prepared and distributed to the 15 selected judges (Appendix III). On the basis of the scores obtained, the ice containers were evaluated and the results are presented under Chapter IV.

IV. RESULTS AND DISCUSSION

The results of the study of selected ice containers are discussed under the following headings:

A. Volume of melted ice in the selected containers during cool season

B. Volume of melted ice in selected containers during hot season

C. Suitability of ice containers in keeping ice-cream and jelly

and D. Scores obtained for the physical features of the selected ice containers.

A. Volume of Melted Ice in the Selected Containers During Cool Season:

This step comprised of:

1) Volume of melted ice at the end of 7th, 8th and 9th hours.

2) Volume of melted ice at the end of 10th, 11th and 12th hours.

3) Volume of melted ice at the end of 13th, 14th and 15th hours.

1. Volume of melted ice at the end of 7th, 8th and 9th hours:

Table II presents the volume of melted ice at the end of 7th, 8th and 9th hours.

TABLE II

VOLUME OF MELTED ICE IN THE SELECTED CONTAINERS AT THE END OF SEVENTH, EIGHTH AND NINTH HOURS

Time	Replicate	Volume of melted ice in millilitre in				
		Brite	Lee	Iglee	Eagle	Acme
7th hour	1st	205	210	210	295	320
	2nd	185	210	210	270	245
	Mean	195	210	210	282.5	282.5
8th hour	1st	210	219	220	300	340
	2nd	225	221	224	310	338
	Mean	217.5	220	222	305	339
9th hour	1st	240	240	242	320	350
	2nd	252	251	258	325	356
	Mean	245.5	245.5	250	322.5	353

The mean values indicate that the volume of melted ice is less at the end of the 7th hour and maximum at the end of the 9th Hour in all the ice containers. The data further show that Brite and minimum and Acme had maximum of melted ice at the end of each hour; the other ice containers falling in between. Leo and Igloo were closer to Brite expressing almost the same capacity for retaining ice, while Eagle stood close to Acme.

2. Volume of melted ice at the end of 10th, 11th and 12th hours:

Table XXI presents the data regarding melted ice at the end of 10th, 11th and 12th hours in the selected ice containers.

TABLE XXX

VOLUME OF MELTED ICE IN THE SELECTED CONTAINERS AT THE END OF TENTH, ELEVENTH AND TWELTH HOURS

Time	Replicate	Volume of melted ice in millilitre in				
		Brite	Lee	Iglee	Eagle	Acme
10th hour	1st	300	350	365	468	505
	2nd	310	341	365	460	544
	Mean	305	345.5	365	464	509.5
11th hour	1st	310	386	367	469	555
	2nd	325	352	367	469	561
	Mean	317.5	369	367	469	558
12th hour	1st	324	394	381	470	563
	2nd	324	361	388	470	559
	Mean	324	377.5	384.5	470	561

Much difference was not noticed in the volume of melted ice in the selected ice containers between the 10th, 11th and 12th hours. In the case of Brite, Igloo and Eagle, these differences were negligible. The differences between Brite with Eagle and Acme were higher when compared to Leo and Igloo at every hour. The volume of melted ice was least in Brite followed by Leo, Iglee, Eagle and Acme at the end of each of the three hours as observed at the end of 7th, 8th and 9th hours.

3. Volume of melted ice at the end of 13th, 14th and 15th hours:

Table IV presents the volume of melted ice at the end of 13th, 14th and 15th hours.

TABLE IV

VOLUME OF MELTED ICE IN THE SELECTED CONTAINERS AT THE END OF THIRTEENTH, FOURTEENTH AND FIFTEENTH HOURS

Time	Replicate	Volume of melted ice in milli litre in				
		Brite	Lee	Iglee	Eagle	Acme
13th hour	1st	314	381	372	500	541
	2nd	315	374	375	504	538
	Mean	314.5	377.5	373.5	502	539.5
14th hour	1st	400	475	475	500	645
	2nd	400	394	481	578	639
	Mean	400	434.5	478	579	642
15th hour	1st	401	560	470	595	665
	2nd	401	460	491	592	671
	Mean	401	510	480.5	593.5	668

The data reveal that the difference in the volume of melted ice between the 13th and 14th hours was obvious in all the selected containers. When considering the 14th and 15th hours, much differences was not observed in the volume of melted rice except in Leo.

B. Volume of Melted Ice in the Selected Containers During Hot Season:

Table V and Figure (3) present the volume of melted ice noticed in the month of March when the temperature was 32°C on an average. Data were collected only for the 9th, 12th, 15th and 18th hours since they gave definite idea regarding the containers capacity toretain ice.

TABLE V

VOLUME OF MELTED ICE IN THE SELECTED CONTAINERS AT THE END OF NINTH, TWELVETH, FIFTEENTH AND EIGHTEENTH HOURS IN HOT SEASON

Time	Volume of melted ice in milli litre in				
	Brite	Leo	Igloo	Eagle	Acme
9th hour	270	330	340	480	460
12th hour	390	480	490	610	650
15th hour	430	530	520	680	680
18th hour	530	650	617	700	720

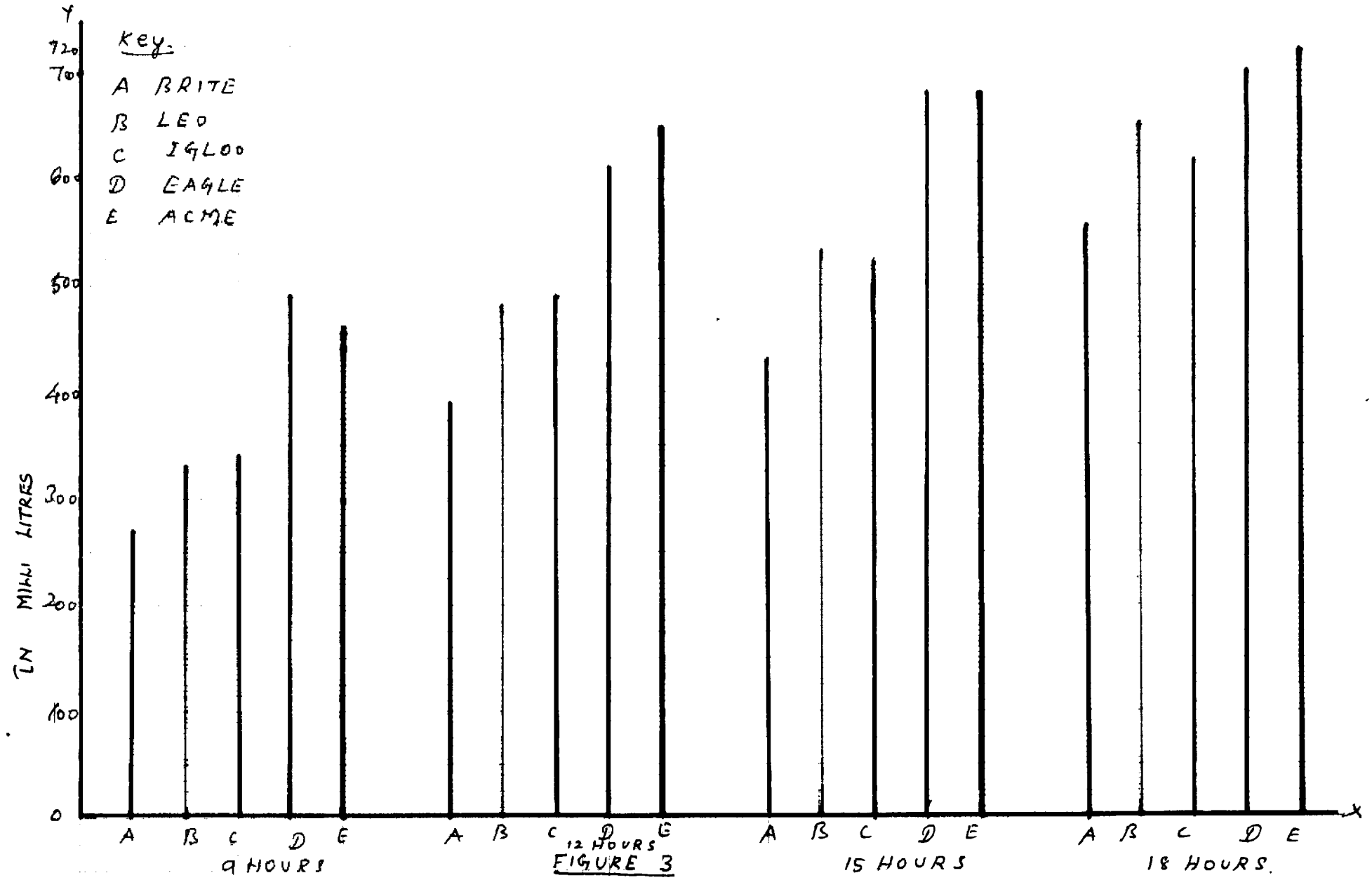

FIGURE 3

VOLUME OF MELTED ICE IN THE SELECTED ICE CONTAINERS AT THE END OF NINTH TWELVETH FIFTEENTH AND EIGHTEENTH HOURS IN HOT SEASON

The data reveal that the volume of melted ice was minimum at the end of the ninth hour but showed increase as the time of storing advanced in all containers. It is interesting to note that between the 9th and 12th hours, the differences in melted ice were maximum in all cases. The same was the case between the 15th and 18th hours excepting in Iglee, Eagle and Acme. The differences between the 12th and 15th hours were comparatively less. This might be due to the effect of outside temperature which might have been comparatively low during those hours.

This comparison showed that Brite retained ice to the maximum followed by Iglee, Leo, Eagle and Acme in the descending order.

Table VI displays the efficiency of the selected ice containers in retaining ice in the cool and hot seasons revealed through the volume of melted ice.

TABLE VI

COMPARISON OF THE VOLUME OF MELTED ICE IN THE SELECTED CONTAINERS

Time	Season	Volume of melted ice in milli litre in				
		Brite	Leo	Igloo	Eagle	Acme
9th hour	Cool	245.5	245.5	250.0	332.5	353.0
	Hot	270.0	330.0	340.0	480.0	460.0
12th hour	Cool	324.0	377.5	384.5	470.0	561.0
	Hot	390.0	480.0	490.0	610.0	650.0
15th hour	Cool	401.0	510.0	480.5	593.5	668.0
	Hot	430.0	530.0	520.0	680.0	680.0

The data show that Brite retained maximum ice in both cold and hot weather, while Acme retained the minimum. Eagle showed greater difference in the volume of melted ice in both the seasons when compared to all the other ice containers. This may be due to the effect of temperature on any of the features in construction.

C. Suitability of Ice Containers in Keeping Ice-cream and Jelly:

Commercially prepared ice-cream with the required consistency and jelly prepared in the refrigerator by the investigator following the instructions given on the packet, were stored in the selected ice containers for two hours.

The contents at the end of the experimental period were not acceptable to the panel of experienced judges selected among the faculty, since these had lost their texture, form and consistency during the two hours of storage.

D. Scores Obtained for the Physical Features of the Selected Ice Containers:

The Table presents the scores received for the physical features of the five selected ice containers when evaluated by 15 judges.

TABLE VII

SCORES OBTAINED BY THE SELECTED ICE CONTAINERS

S. No.	Features	Scores obtained				
		Brite	Lee	Igloo	Eagle	Acme
1.	Pleasing appearance	32½	67	32½	44	53½
2.	Suitability of size for an average family	53½	49½	47½	49½	51
3.	Light in weight	41	49½	64	44	35½
4.	Ease in carrying	35	66	47	30	35
5.	Suitability of knob on the lid	41½	57½	42	45	43½
6.	Ease in maintenance	56	39	37½	41½	35½
7.	Air tight	58½	60	32½	30	38½
8.	Unbreakable	56	61½	59½	38	38
9.	Suitable finish	50½	54	44	40	48½
10.	Leak proof	61½	60	43	46	46½
		486	564	449½	408	425½

It is evident from the Table that Leo received the highest total scores among all the other ice containers followed by Brite, Iglee, Acme and Eagle in the descending order.

Leo received the maximum scores for six individual aspects - pleasing appearance, ease in carrying, suitability of the knob on the lid, air tightness, unbreakability, and suitability of finish. Brite received the maximum scores for suitability of size for an average family, ease in cleaning and leak proof qualities. While Igloo received the maximum scores for light in weight, Eagle and Acme never received maximum scores for any aspect.

Among the ten qualities adjudged, Eagle received the least marks for ease in carrying, air tightness, unbreakability and suitability of finish. While Iglee and Acme received minimum marks for three qualities, Brite received the minimum marks for two qualities. Least marks were not scored by Leo at all.

It is obvious from the scores that Leo was considered as the best by the members among the containers while Eagle was the last choice.

It is proved that the physical features were never the deciding factor of efficiency of the ice containers. Though Leo obtained the highest rank in the physical features' evaluation, Brite was found to be the best as far as use was considered.

V. SUMMARY AND CONCLUSION

The results of the study on the five selected ice containers - Brite, Lee, Igloo, Eagle and Acme revealed the following:

1. Brite was superior over the other ice containers in its efficiency to retain ice upto 15 hours.
2. Acme was adjudged as the last in its efficiency to retain ice upto 15 hours.
3. No difference was noticed in the volume of melted ice retained by 'Brite' during different seasons while Eagle alone exhibited variations.
4. The selected ice containers were not suitable to store ice-cream and jelly even for two hours.
5. 'Lee' ranked first on evaluation of the physical features, while 'Eagle' scored the least marks.

The study revealed the need for the following modifications:

1. The lid should be tight fitting with suitable insulation.

2. The ice containers should be portable with suitable handle.

3. The knob provided for opening the lid should be convenient to facilitate smooth handling.

4. More importance should be given to the utilitarian aspect than the decorative aspect.

Further investigation is needed in the material, design and construction of ice containers to meet the needs of the family.

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APPENDICES

APPENDIX I

SRI AVINASHILINGAM HOME SCIENCE COLLEGE, COIMBATORE-11

AN INTERVIEW SCHEDULE TO ELICIT INFORMATION ON DETAILS REGARDING THE ICE CONTAINERS IN SELECTED HOUSE-HOLDS

Date:

Name of the Investigator:

1. Name of homemaker:

2. Address :

3. Family background:

S. No.	Relationship to the head of the family	Age	Education	Occupation	Income in Rs.	Total family income in Rs.

4. Do you include chilled items in your menu?

Daily ☐ Weekly ☐ Occasionally ☐ Never ☐

5. If yes,

List the chilled items you include in the menu

Prepared at home	Bought

6. What method do you adopt to chill dishes at home?

a) By using refrigerator

b) By ice-cooling

c) Any other method

7. Where do you keep the chilled items prepared by ice cooling/bought from outside?

	Reasons
a) Ice flask	
b) Ice container	
c) Any other	

8. How long does it maintain its consistency, flavour, form and coolness?

Below two hours	2 to 4 hours	4 to 6 hours	6 to 8 hours	More than 8 hours

9. If you possess an ice container, give the details:

a) Place from where purchased

b) Year of purchase

c) Cost

d) Brand

e) Capacity

f) Shape

g) Size:

Weight

Width

Depth

h) Materials in construction:

Exterior:

Plastic

Polythene

Chromium

Any other

Interior:

Plastic
Polythene
Glass
Aluminium
Any other

i. Finishes

Smooth
Rough

j. Quality of materials

Used in construction

Non corrosive

Rust proof

Leak proof

Any other

k. Special Features:

10. How often do you use them?

Daily/Weekly/Occasionally/Never

11. What are the advantages of using the Ice container?

a) Portable

b) Maintains coolness

c) Maintains consistency

d) Serves in emergency

e) Any other

12. Rank in order the problems you face in using:

a) Irritating odour

b) Easily breakable

c) Does not keep the solidity

d) Any other

APPENDIX II

SRI AVINASHILINGAM HOME SCIENCE COLLEGE

AN INTERVIEW SCHEDULE TO ELICIT INFORMATION REGARDING THE ICE CONTAINERS FROM THE SELECTED SHOPS

1. Name of the Investigator: Date:

2. Name of the shop:

Give the following information asked

S. No.	Brand Name / Manufacturer's address	Model No.	Cost in Rs.	Capacity in ml.	Shape	Materials used				The brand in much demand	Special features	Gurantee period
						Base	Finish	Accessory	Insulation			

APPENDIX III

SCORE CARD TO EVALUATE THE PHYSICAL FEATURES OF THE SELECTED ICE CONTAINERS

Features	Maximum scores	Bri- te	Leo	Ig- loo	Ea- gle	Acme
1. Pleasing appearance	5					
2. Suitability of size for an average family	5					
3. Light in weight	5					
4. Ease in carrying	5					
5. Suitability of knob on the lid	5					
6. Ease in maintenance	5					
7. Air tight	5					
8. Unbreakable	5					
9. Suitable finish	5					
10. Leak proof	5					