APPENDIX-A

DETERMINATION OF PRECENTAGE OF FAT IN MILK BY GERBER METHOD IN LOW-FAT FROZEN YOGHURT

Procedure

1. Took 100ml of Gerber sulphuric acid from automatic measure into the butyrometer.

2. Pipette out 11ml of the well mixed sample of milk and transfer into the butyrometer carefully without allowing it to mix with the acid. This is done by allowing the jet of milk from the pipette in a slating manner and resulting the tip on the mouth of the butyrometer.

3. With the help of automatic pipette added 1ml of amyl alcohol to the above butyrometer.

4. Tightened the stopper and mixed the content by shaking the butyrometer at a 45 degree angle.

5. Kept the butyrometer in water bath at 65 ºC ± 2 ºC for 5 minutes.

6. Placed the butyrometer in the centrifuge and balanced the machine centrifuged for 3 minutes.

7. Adjusted the fat column within the scale butyrometer and took the reading.

Calculation:

The percentage of fat in the given sample of milk butyrometer reading.
DETERMINATION OF LACTOMETER READING IN MILK AND DAHI FOR THE CALCULATION OF SOLID NOT FAT USING RICHMOND’S FORMULA

Procedure

1. Warm the milk sample to 40ºC maintains the temperature for 5 minutes.

2. Mixed the content by rotating and taking care to avoid the formation of air bubbles and froth.

3. Cool the sample approximately to calibrated temperature of the lactometer. The temperature of milk at the time of taking lactometer should be within the range shown in the correction table.

4. Inverted the sample bottle two or three times, pour enough milk into the glass cylinder taking care to avoid the formation of air bubbles, so that same milk overflows when the lactometer is inserted.

5. Inserted the lactometer gently to wet the item not more than a short length about 3mm beyond the position of equilibrium. The lactometer floated freely and not touched the side of cylinder.

6. Allow the lactometer remain steady in the milk. Took the reading within about 30 seconds. Noted the reading of the lactometer corresponding to the top of the meniscus and the stem without the error of parallax.

7. Noted the temperature of milk.

Calculation

1. Obtained the correct lactometer reading by applying approximately correcting factor by referring to the approximate temperature.

2. Calculated the solid not fat using suitable Richmond’s formula.
Richmond’s formula

$$\text{SNF} = \text{CLR} + (0.2 \times F) + 0.14$$

$\frac{4}{4}$

Where = CLR = Correct lactometer reading.

F= Fat percentage.
APPENDIX – C

STANDARDIZATION OF MILK FOR THR PREPARATION OF LOW-FAT FROZEN YOGHURT

Procedure;

Standardization is a process of adjusting the composition of milk to milk to a desired level of fat SNF (Solid Not Fat) or both if the given sample of milk contain more fat than desired or required then excess fat is either removed in the form of cream by separating milk. In case the fat content is less than the desired output, the calculated quantity of cream is added to have the desired fat level in the milk.

For increasing the SNF calculated quantity of skimmed milk powder is added to have the desired level of SNF in milk.

In the experiment, since milk used had less SNF than desired, therefore calculated quantity of skimmer milk powder was added into the milk to have desired SNF percentage.

Calculation;

If the desired SNF content is 12 percent in milk and percent SNF of milk are 8.5 then 1 liter of milk content 85gm of SNF. The desired SNF is 12 percentages, and then 35gm skimmed milk powder is added.
APPENDIX – D

DETERMINATION OF TITRABLE ACIDITY IN LOW-FAT FROZEN YOGHURT

**Principle:** Percentage acid in milk is determined by titrating against standard base and stated in terms of predominant acid.

**Requirement:** Conical flask, measuring cylinder, burette, phenolphthalein indicator and N/10 standard NaOH solution.

**Procedure:** Take 20 ml of milk. Add 2-3 drops of phenolphthalein as indicator titrates against 0.1N NaOH solution till milk turn rose red. Process is repeated at least 3 times.

**Calculation:**

Percentage lactic acid = Eq. wt. × Normality × 100

\[
\frac{20}{\text{Percentage acidity} = A \times V}
\]

\[
\frac{10 \times W}{20}
\]

Where, V= Volume of NaOH used

W= Volume of milk taken

A=Equivalent weight of acid
APPENDIX – E

DETERMINATION OF TOTAL SOLID IN LOW-FAT FROZEN YOGHURT

Procedure:

1. Take a clean shallow bottom dish of aluminum, stainless steel, nickel, silica or porcelain about 8cm in diameter and 2.5 cm in height. Heat in oven at 102°C for about 2 hours. Cool in desiccators and weigh. This gives its tare weight.

2. Pipette out 5ml of sample into the dish and weigh (w₁ g). Place the dish on a boiling water bath for at least 30 minutes

3. Transfer into a hot air oven.

4. Heat at 100°C for about 3 hours. Cool in desiccators and weigh. Heat again for 1 hour. Cool and weigh. Continue the process of heating, cooling & weighing until the difference between two successive weighing is not more than 0.0005 g. Note the lowest weight (w₂ g).

5. Calculate the percentage of total solids multiplying the weight of the residue by 100, dividing by the weight of sample taken.

Calculation-

% Total Solid = Weight of residue × 100

Weight of milk

= \frac{w₂ - w \times 100}{w₁ - w}

Where,

Tare weight of dish = w g

Weight of dish + sample = w₁ g

Weight of dish + residue = w₂ g
DETERMINATION OF OVERRUN IN LOW-FAT FROZEN YOGHURT

**Principle**- The overrun in frozen yoghurt depends upon the amount of air whipped into the mix during the freezing process.

In this test, the volume of water an alcohol used corresponds with volume of air originally contained in the ice cream and the difference between the sum of these two and the capacity of the flask is equivalent to the volume occupied by the sample.

**Reagent**- Amyl alcohol-specific gravity 0.817

**Apparatus**-

a. **Analytical Balance**: For weighing accurately to 0.001g.

b. **Beaker**: 400ml

c. **Volumetric flask**: 250ml

d. **Glass funnel**

**Procedure**: Weighed a unit of ice cream and from it calculated the weight of the frozen yoghurt per liter. For example, 200ml of a full cartoon of ice cream can be obtained, the ice cream carefully removed and the empty dry cartoon weighed. The difference in weights between the cartoon when filled and whey empty is, therefore the weight of 200ml of frozen yoghurt. Five times this weight would then equal the weight of a liter. To determine the weight of the mix, proceed as given.

Weighed and recorded the extract weight of a clean, dry 400ml beaker. Into the beaker weighted exactly 130g of the frozen yoghurt. Placed the beaker in water bath warmed to 49°C and melted it. Weighed and recorded the exact weigh of a 250ml volumetric flask. Using a glass funnel, transferred 130g of melted ice cream into the 250ml flask. Added exactly 10g of n-amyl alcohol to the flask and mixed to break the surface tension of the melted ice cream and released the incorporate air. 10g of n-amyl alcohol occupied a volume of 12.24ml. Cooled the flask with contents to 15.5°C and using...
the final rinse water bring the volume to 250ml mark. The bottom of the meniscus should correspond with the mark when temperature in exactly 15.5°C dry the outside of the flask and reweigh.

Calculate the weight in grams of the contents. Calculate the weight in grams of water added to the flask. Calculate the volume in milliliters occupied by the sample of frozen yoghurt. Determine the specific gravity of the mix by dividing its weight (130g) by the volume in milliliters which is occupies. Determine the weight in gram/liters of mix by multiplying by the specific gravity.

Note- After weighing the unit of ice cream it is essential to remove the cartoon carefully without tearing and dry it thoroughly before reweighing. If the ice cream has been shocked, accurate result cannot be obtained.

**Formula:**

\[
\% \text{ overrun} = \frac{\text{(Weight of Frozen Yoghurt mix)} - \text{(Weight of Frozen Yoghurt)} \times 100}{\text{(Weight of Frozen Yoghurt)}}
\]
APPENDIX – G

DETERMINED OF MOISTURE PERCENTAGE IN LOW-FAT FROZEN YOGHURT

Procedure:

1.) 5 g of the sample was weighted and taken in a tared porcelain dish (W).
2.) The sample was crushed at the bottom of the dish with the glass rod.
3.) Dish was placed in hot air oven maintained at 105°C and dried for at least 3 hours.
4.) Dish was cooled in a dessicator and weighted in g (W2).

Observation:

Tare weight of dish—(W) g

Weight of dish with samples—(W1) g

Weight of dish + sample after keeping in oven (W2) g

Calculation:

Percent moisture content = loss in weight × 100

Initial weight of sample

= \( \frac{(W1-W2) \times 100}{(W1-W)} \)
DETERMINATION OF ASH PERCENTAGE IN LOW-FAT FROZEN YOGHURT

Procedure:

1.) 5 g of the sample was weighted and taken in a tared crucible dish.
2.) The sample was crushed in the dish with glass rod.
3.) The sample was ignited on a blue flame of a burner till the smoke was given off.
4.) Then the crucible was cooled in a dessicator and weigh of the dish was noted in g.

Observation:

Weight of dish + sample after drying = W2 (g)

Weight of dish + sample after ignition = W3 (g)

Calculation:

Weight of ash = weight of dish after ignition – tare weight of dish

= (W3 – W)

Ash% = \frac{\text{weight of ash} \times 100}{\text{Weight of sample}}

= \frac{w_3-w \times 100}{w_1-w}
APPENDIX – I

DETERMINATION OF PROTEIN PERCENTAGE IN LOW-FAT FROZEN YOGHURT

Procedure:

1.) 1 ml of the product was weighted and taken in a kjeldahl flask.
2.) 3 g m of digestion mixture (CuSO₄ + K₂SO₄, 4:96) and 25 ml of concentrated H₂SO₄ were added.
3.) Kjeldahl flask with contents was heated slowly carefully to minimize frothing. After sometimes, heat was increased and boiling continued further for an hour until the solution became clear.
4.) Then solution was transferred to a 250 ml volumetric flask and volume made up by using distilled water.
5.) 10 ml of aliquot was added in the receiver flask of distillation apparatus, after which 10 ml of 40% NaOH was added.
6.) Ammonia released was collected in 25 ml of 4% boric acid solution containing few drops of mixed indicator. (Mixed indicator gives pink colour in acid, which turns to blue by ammonia on distillation).
7.) Distilled for half an hour and then condenser outlet was disconnected.
8.) Then, boric acid was titrated with 0.01N sulphuric acid.
9.) Blank determination was carried out by using water in place of the sample and deducing this titer from acid titer.

Observation:

Volume of 0.01N H₂SO₄ for the sample—A

Volume of 0.01N H₂SO₄ for the blank—B

Weight of sample—W (g)

Volume made (V)—250 ml

Aliquot distilled—10 ml (v)
**Calculation:**

1 ml of 0.01N H₂SO₄ for — 0.0014 g (N)

Titer value — (A-B)

% Nitrogen (N) — \( \frac{(A-B) \times 0.0014 \times V \times 100}{W \times V} \)

Percentage protein — N \times \text{Conversion factor}

Conversion factor — 6.25
ESTIMATION OF CARBOHYDRATES

SIGNIFICANCE:

Carbohydrates serve as the chief source of energy in the food of humans and many other animals. They are the compounds of carbon, hydrogen and oxygen but the higher carbohydrates have been found to possess nitrogen and sulphur in the structures. Carbohydrates are stored as glycogen in animals and as starch in plants.

PROCEDURE:

Add up the values of moisture, crude protein, crude fat, crude fiber and ash and substract from 100. The difference will give values of available carbohydrate.
DETERMINATION OF CAROTENE CONTENT IN LOW-FAT FROZEN YOGHURT

**Principle:**

Carotene is estimated by extraction of the total pigments with alcohol and partitioning it with petroleum ether after saponification. The other pigments were removed by treatment with sodium sulphate. Carotenoids are then determined by finding out absorbance of sample as indicated by O.D. by spectrometer.

**Apparatus:**

Mortar pestle
Separating funnel
Whatman no.1 filter paper
Spatula
Fractionating funnel
Conical flask

**Reagents:**

Methanol
Diethyl ether
10% KOH
3%NaCl (cold)

Sodium sulphate

**Procedure:**

- 1g of sample was weighed and macerated in mortar pestle as fine as possible with methanol.
- Solution was filtered and solvent dried on boiling water bath.
- 10 ml of 10% KOH and 10 ml of diethyl ether was added after drying and then kept in dark for one hour.
- Then it transferred into the fractionating funnel by adding diethyl ether and 3% cold Nacl to it, and then shaken for two minutes horizontally by closing its cork. Pressure was released by opening the knob.
- Two layers were obtained in the funnel. Upper layer was discarded and carotenoid layer was collected in the conical flask covered with black paper.
- Upper layer was again taken into the fractionating funnel and whole process was repeated 2 times.
- Carotenoid layer was collected and kept for 1 hour by covering its mouth with aluminum foil.
- After 1 hour volume of original sample was taken by transferring the sample in a measuring cylinder.
- Blank was set by putting diethyl ether in the cuvette of the spectrophotometer and then readings are taken by putting the sample at 450 nm.

**Observation:**

Absorbance of the sample—D

Original volume of sample—V

Dilution factor—F

Average extinction co-efficient of pigment—2500

Weight of sample in g max 450nm—g
Calculation:

Total carotenoid I — (F×D×V×10) in mg/gm

(2500×g)
DETERMINATION OF CALCIUM IN ASH OF LOW-FAT FROZEN YOGHURT

Procedure:

1.) Take 10 ml of ash extract in clean beaker add 100 ml distilled water. Add two drops of Methyl orange indicator and stir with glass rod.

2.) Add drop-wise Ammonium Hydroxide solution till solution turns yellow.

3.) Now add drop-wise dilute hydrochloric acid solution till solution turns pink colour.

4.) Heat the content to boil and add 10 ml of Ammonium Oxalate solution, boil again.

5.) Add, drop-wise, very diluted (10 times diluted) Ammonium Hydroxide with constant stirring till colour of the content changes to yellow.

6.) Cover the beaker with watch glass and keep over a very low flame (do not allow it to boil) for about 30 minutes, undisturbed.

7.) Filter the supernatant through whatman No-1 filter paper. Wash the precipitate left several times with hot distilled water till fresh filtrate is free from oxalate ions. (To test oxalate ions collect about 5-ml of fresh filtrate in a clean test tube, add 2-3 drops of dilute H$_2$SO$_4$, warm, add 1 drop of dilute KMnO$_4$ solution. Pink colour, indicate free from oxalate ions).

8.) Take the filter paper containing precipitate out from funnel and open in same beaker. Allow it adhere on side of beaker. Add distilled water to run down the precipitate in solution.

9.) Collect about 100-150 ml water in the beaker. Add 10-12 ml dilute H$_2$SO$_4$ solution. Heat the content to about 60-80°C (do not allow it to boil).
10.) Titrate while hot with standard potassium permanganate solution very carefully till pink colour persists beyond 1 minute.

11.) Now push down the adhering filter paper on side of beaker with glass rod. Stir gently and complete the titration to faint pink colour end point. Record the burette reading.

**Observation:**

Volume of 0.1 N KMnO₄ (V-ml) = ---------------ml

**Calculation:**

Amount of Ca = Volume of KMnO₄ × 0.02 = ---------------gm Ca

1 Equivalent of KMnO₄ = 1 Equivalent of Calcium

1000ml of N KMnO₄ = 20 gm Ca

Amount of Ca in food = Amount of Ca × 10 × 100 / 50 × (w₁-w) = gm Ca

**Results:**

Amount of calcium in low-fat frozen yoghurt = --------------%
APPENDIX –M

DETERMINATION OF ENERGY

Energy value of food is often calculated from the analysis of foods for protein, fat and carbohydrate and multiplication of the content of these components with appropriate factors, one gram of carbohydrate and protein yield 4 kcal and one gram of fat yield 9 kcal of energy.

Calculation:

Physiological Energy value-

\[ \text{Kcal / 100g} = (4 \times \text{Protein \%}) + (9 \times \text{Fat \%}) + (4 \times \text{carbohydrate \%}) \ldots \ldots (3.10) \]
MICROBIOLOGICAL ANALYSIS OF LOW FAT FROZEN YOGHURT.

1 Yeast and Mold count

Apparatus required:

i) Test tube

ii) Petridishes

iii) Autoclave

iv) Laminar flow

v) Colony count

vi) 10ml pipette

vii) Glass rod

Medias:

1 Ringer solution

2 Potato dextrose agar

Procedure:

1 1gm of food sample was taken and crushed.

2 Three test tubes were labeled as $10^1$, $10^2$ and $10^3$ respectively.

3 Nine ml of ringer solution was taken in each test-tube.

4 One ml of crushed food sample was added to the test that was labeled as $10^1$.

5 One ml of the sample was taken for $10^1$ dilution and the sample was poured to $10^2$ dilution and was continued up $10^3$. 
Three Petri dishes each for $10^1$, $10^2$ and $10^3$ were labeled.

From $10^1$ dilutions, 1 ml of dilution sample was poured into 3 petri dishes each. The same was repeated for $10^2$ and $10^3$.

Sterilized melted PDA was poured in petridishes.

Incubation was done at $25^\circ\text{C}$ for 3 to 4 days.

Then colonies were counted and average was calculated.

**Preparation of Potato Dextrose Agar**

**Apparatus Required:**

1. Muslin cloth
2. Heater
3. Beaker
4. Erlemeyer flask
5. Conical flask
6. Knife

<table>
<thead>
<tr>
<th>INGREDIENTS</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Potato cubes</td>
<td>200gm</td>
</tr>
<tr>
<td>2. Dextrose</td>
<td>20gm</td>
</tr>
<tr>
<td>3. Agar</td>
<td>20gm</td>
</tr>
<tr>
<td>4. Distilled water</td>
<td>1 liter</td>
</tr>
<tr>
<td>5. HCL</td>
<td>0.1N</td>
</tr>
<tr>
<td>6. NaOH</td>
<td>0.1N</td>
</tr>
<tr>
<td>7. pH paper</td>
<td>-</td>
</tr>
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</table>
Procedure:

1. Potato were peeled off and weighed as 200gms.
2. It was chopped into small pieces with the help of a knife.
3. The chopped potatoes were transferred into a beaker containing about 1000ml distilled water.
4. The content was boiled with the help of a heater or gas about 20mins.
5. Supernatant was decanted and filtered with four fold of the muslin cloth and the filter was collected was into the beaker. This filter is called as potato extract.
6. Dextrose (200gm), agar (15gm) and peptone (2gm) were transferred into the potato extract and the gently heated and shacked to dissolved.
7. Finally this medium was transferred into a measuring cylinder of 1-liter capacity and the volume to 1 liter was made by adding more distilled water.
8. The pH of the medium was measured and adjusted to 5.6 by using 0.1N HCl drop wise.
9. The medium was poured into two or more Erlenmeyer flasks. It was covered by cotton plug or with aluminum foil/ paper and was kept in auto clave at 121°C for 20 mins.
10. When temperature was cooled down, the flasks were taken out and were used if required and stored in refrigerator.

Preparation of ringer solution

1) Conical flask - One liter (capacity)
2) Glass rod
3) Autoclave
4) Measuring cylinder

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Amount</th>
</tr>
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<tbody>
<tr>
<td>NaCl</td>
<td>9gm</td>
</tr>
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</table>
KCl 0.42

CaCl$_2$ 0.24gm, if hydrated then 0.48gm

NaHCO$_3$ 0.2gm

**Procedure:**

1. All components were weighted properly.

2. 250 ml distilled water was taken 1 liter conical flask and all the reagents were mixed conical flask.

3. After mixing all reagents, the volume to make to 1 liter by adding distilled water.

4. After making final volume 9ml of this solution was taken in 10 test tubes.

5. The solution of tubes was autoclaved at 15 lbs for 10-15 mins.
APPENDIX-O

2) COLIFORM TEST

Apparatus Required:

1) Sample
2) Lactose broth medium
3) Durham tubes
4) Bromocresol purple, 10 % (w/v in ethanol, 2 ml/1 liter).
5) 10ml double –strength lactose broth tube (LB2x5).
6) 5ml double –strength lactose broth tube (LB2x5).
7) 5ml double –strength lactose broth tube (LB2x10).
8) Sterile pipettes, one each of 10ml, 1ml and 0.1ml cativity.
9) Bunsen burner/ sprit lamp
10) Mechanical pipetting device
11) Glass marker pencil.

Medias: 1) Macconkey's broth

Procedure:

1.1ml of sample solution was taken from $10^{-1}$ test tube with the help of 1ml pipette. It was transferred into 2 macconkey's test tubes in which already 9ml of macconkey's broth medium was present.

2.5 double strength lactose broths were labeled in tubes “1”.10 and 5 single strength broth were labeled in other tubes “0.1”.

3. Each “10” tubes were mixed thoroughly and inoculated with 10ml of sample using 10ml sterile pipette.
4. The 5 test tubes with 1ml of sample were inoculated using 1ml pipette.

5. The 5 test tubes 0.1 ml samples were inoculated using a 0.1ml pipette.

6. All 16 inoculated tubes were inoculated aerobically at 35°C for 48 hours.

7. Finally all the inoculated tubes were incubated at 37°C for 24 to 48 hours.

Results: All the lactose fermented tubes for the production of acid (yellow colour) and gas after 24-48 hours of incubation.

Preparation of Macconkey's broth

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<tr>
<td>Peptone</td>
<td>20gm</td>
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<tr>
<td>Lactose</td>
<td>10.0gm</td>
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<tr>
<td>NaCl</td>
<td>5.0gm</td>
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<tr>
<td>Bile salt</td>
<td>5.0gm</td>
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<tr>
<td>Neutral red solution</td>
<td>10ml</td>
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<tr>
<td>Distilled water</td>
<td>1000ml</td>
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</table>

Procedure:

1. Peptone, NaCl and bile salt were dissolved in 1 liter distilled water by heating.

2. The pH was adjusted 8.0 and boiled for 20 mins. Cooled, filtered and pH was adjusted to 7.4.

3. The lactose and indicator solution were added to 5ml portion in tubes containing Durham's tubes.

4. Sterilization was done by autoclaving it at 115°C for 15 mins.
 Score card for sensory evaluation of the products

Name: -------------------

Product: Low fat frozen yogurt with carrot pulp

Time of evaluation:

Test the sample and check how much you like or dislike each one. Use appropriate scale to show your attitude by checking at the point that best describe your feeling about the sample.

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<tr>
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<tr>
<td>T₄S₃F₂</td>
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<tr>
<td>T₄S₃F₃</td>
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</table>

<table>
<thead>
<tr>
<th>Comment</th>
<th>Name</th>
</tr>
</thead>
</table>

Signature:
APPENDIX-Q

Formula used for statistical analysis

4×3×3 Factorial Design:  
\[ G = T_1 + T_2 + T_3 + ... + T_n \]
\[ = R_1 + R_2 + R_3 + ... + R_n \]

1. Correction factor (C.F.) = \( G^2 / 3 \times 4 \times 3 \times 3 \)

2. S.S. due to Treatment (T) = \( T_1^2 + T_2^2 + T_3^2 + T_4^2 \_ C.F. \)

   27

3. S.S. due to Fat (F) = \( F_1^2 + F_2^2 + F_3^2 \_ C.F. \)

   36

4. S.S. due to Stabilizer (S) = \( S_1^2 + S_2^2 + S_3^2 \_ C.F. \)

   \[ S_1 = S_1 + S_1 + S_1 + S_1 \]
   \[ S_2 = S_2 + S_2 + S_2 + S_2 \]
   \[ S_3 = S_3 + S_3 + S_3 + S_3 \]

S.S. due to Stabilizer (S) = \( S_1^2 + S_2^2 + S_3^2 \_ C.F. \)

   36

5. S.S. due to Replicate (R) = \( R_1 = R_1 + R_1 + R_1 + R_1 \)

   \[ R_2 = R_2 + R_2 + R_2 + R_2 \]
   \[ R_3 = R_3 + R_3 + R_3 + R_3 \]

S.S. due to Replicate (R) = \( R_1^2 + R_2^2 + R_3^2 \_ C.F. \)

   36

6. Total S.S. = \( \sum \sum X_{ij}^2 \_ C.F. \)
7. Error S.S. = Total S.S. - S.S. due to treatments – S.S. due to fat – S.S. due to stabilizer
- S.S. due to replications

G = Grand total

t = Treatment

r = Replication

S.S. = Sum of squares

Critical difference (CD):

\[ \text{S.E.} = \sqrt{2 \times \text{EMSS}/r} \]

\[ \text{C.D.} = \text{S.E.} \times t \ (5\%) \text{ on error degree of freedom} \]

Where,

S.E. = Standard error

E.M.S.S. = Error mean sum of squares
## SKELETON OF ANOVA TABLE FOR ORGANOLEPTIC CHARACTERISTICS OF PRODUCTS

<table>
<thead>
<tr>
<th>Sources of variation</th>
<th>d.f.</th>
<th>S.S.</th>
<th>M.S.S.</th>
<th>F cal.</th>
<th>F tab (5%)</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due to replicate (R)</td>
<td>r-1 = 2</td>
<td>S.S. (R)</td>
<td>S.S. (R)/2 =MSS (R)</td>
<td>M.S.S. (R)/ E.M.S.S.=F</td>
<td>$F_{2,98} = 3.092$</td>
<td>NS</td>
</tr>
<tr>
<td>Due to Treatments (T)</td>
<td>t-1 = 3</td>
<td>S.S. (T)</td>
<td>S.S. (T)/3 =MSS (T)</td>
<td>M.S.S. (T)/ E.M.S.S.=F</td>
<td>$F_{3,98} = 2.702$</td>
<td>S</td>
</tr>
<tr>
<td>Due to Fat (F)</td>
<td>f-1 = 2</td>
<td>S.S. (F)</td>
<td>S.S. (F)/2 =MSS (F)</td>
<td>M.S.S. (F)/ E.M.S.S.=F</td>
<td>$F_{2,98} = 3.092$</td>
<td>S</td>
</tr>
<tr>
<td>Due to Stabilizer (S)</td>
<td>s-1 = 2</td>
<td>S.S. (S)</td>
<td>S.S. (S)/2 =MSS (S)</td>
<td>M.S.S. (S)/ E.M.S.S.=F</td>
<td>$F_{2,98} = 3.092$</td>
<td>S</td>
</tr>
<tr>
<td>Due to error</td>
<td>107 – 9 = 98</td>
<td>E.S.S.</td>
<td>E.S.S./98 = EMSS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total S.S.</td>
<td>rt-1= 108-1 = 107</td>
<td>T.S.S.</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX – R

Standards for frozen dessert

Frozen Dessert/ Frozen Confection mean the product obtained by freezing a pasteurized mix prepared with milk fat and / or edible vegetable oils and fats having a melting point of not more than 37.0°C singly or in combination with the addition of natural sweetening agents i.e. sugar, dextrose, fructose, liquid glucose, dried liquid glucose, maltodextrin, high maltose corn syrup, honey, fruits and fruits products, eggs and egg products, coffee, cocoa, ginger and nuts. It may also contain chocolate, cake or cookies as a separate layer or coating. It may be frozen hard or frozen to a soft consistency. It shall be free from artificial sweetener. It shall have pleasant taste and flavor free from off flavor and rancidity. The product may contain permitted food additives. It shall conform to the following requirements:

<table>
<thead>
<tr>
<th>REQUIREMENTS</th>
<th>FROZEN CONFECTION</th>
<th>MEDIUM FAT FROZEN CONFECTION</th>
<th>LOW FAT FROZEN CONFECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total solids</td>
<td>Not less than 36.0 percent</td>
<td>Not less than 30.0 percent</td>
<td>Not less than 26.0 percent</td>
</tr>
<tr>
<td>Weight volume (gms/1)</td>
<td>Not less than 525</td>
<td>Not less than 475</td>
<td>Not less than 475</td>
</tr>
<tr>
<td>Total Fat</td>
<td>Not less than 10.0 percent</td>
<td>Not less than 5.0 percent</td>
<td>Not less than 2.0 percent</td>
</tr>
<tr>
<td>Total protein (N*6.25)</td>
<td>Not less than 3.5 percent</td>
<td>Not less than 3.5 percent</td>
<td>Not less than 2.5 percent</td>
</tr>
</tbody>
</table>
APPENDIX – S

Cost of the product

Conversion of Kilograms into liters:

1.) Formula of Specific Gravity of ice cream =

\[
\frac{\% \text{ Fat} + (\% \text{ Sugar} + \% \text{ Stabilizer} + \% \text{ MSNF}) + \% \text{ Water} + \% \text{ Product}}{100}
\]

\[
\begin{array}{cccc}
\% \text{ Fat} & (\% \text{ Sugar} + \% \text{ Stabilizer} + \% \text{ MSNF}) & \% \text{ Water} & \% \text{ Product} \\
0.93 & 1.58 & 1 & 0.599 \\
\end{array}
\]

2.) Density = Mass/Volume

3.) \% Overrun = \frac{\text{Volume of ice cream} - \text{Volume of mix} \times 100}{\text{Volume of Mix}}