MATERIALS AND METHODS

The study entitled “Value addition of pineapple based food products.” was carried out at Nutritional Research Laboratory Department of Foods & Nutrition, Ethelind school of Home Science and Department of Horticulture. Sam Higginbottom Institute of Agriculture, Technology & Sciences Allahabad-211007, U.P., India.

The details of materials and methods used in experiment during the course of this investigation are as follows.

3.1 Procurement of raw materials
Some useful materials viz Pineapple, Sugar, Citric acid, Mint, Basil, Ginger, Clove, Cardamom, Butter, Pectin powder, Butter paper were purchased from local market of Allahabad.

3.2 Tools and Equipments used
- Knife
- Plate
- Weighing machine
- Pan
- Muslin cloth
- Wooden spoon
- Tea spoon
- Mixer grinder
- Measuring slender
- Thermometer
- Glass bottle
- Glass jar
- Butter paper
- Plastic jar
- pH meter
- Refractometer
- Burette
• Pipette
• Beaker
• Conical flask
• Petridish
• Autoclave

3.3 Experimental site

The present investigation was carried out in the Laboratory of Foods & Nutrition, Ethelind School of Home science and Department of Horticulture, SHIATS, Allahabad.

3.4 Treatment

• T₀ is the control
• T₁, T₂, T₃, T₄, T₅, is the treatment of pineapple jam, pineapple jelly, pineapple cheese and value addition with mint, basil, ginger, clove and cardamom powder.
• There were 4 replications for each treatment.
### 3.4 Experimental Details

Table 3.4.1  Treatment detail of Pineapple Jam

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product and product Amount</th>
<th>Powder and Powder Amount</th>
<th>Citric acid</th>
<th>sugar</th>
<th>Pectin powder</th>
<th>Replication</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀</td>
<td>Pineapple pulp 1 kg</td>
<td>-</td>
<td>5 g</td>
<td>500 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₁</td>
<td>Pineapple pulp 1 kg</td>
<td>Mint 1 %</td>
<td>5 g</td>
<td>500 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₂</td>
<td>Pineapple pulp 1 kg</td>
<td>Basil 1%</td>
<td>5 g</td>
<td>500 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₃</td>
<td>Pineapple pulp 1 kg</td>
<td>Ginger 1%</td>
<td>5 g</td>
<td>500 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₄</td>
<td>Pineapple pulp 1 kg</td>
<td>Clove 1%</td>
<td>5 g</td>
<td>500 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₅</td>
<td>Pineapple pulp 1 kg</td>
<td>Cardamom 1%</td>
<td>5 g</td>
<td>500 g</td>
<td>5 g</td>
<td>4</td>
</tr>
</tbody>
</table>
### Table 3.4.2  Treatment detail of Pineapple Jelly

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product and product Amount</th>
<th>Powder and Powder Amount</th>
<th>Citric acid</th>
<th>sugar</th>
<th>Pectin powder</th>
<th>Replication</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀</td>
<td>Pineapple juice 1 kg</td>
<td>-</td>
<td>5 g</td>
<td>600 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₁</td>
<td>Pineapple juice 1 kg</td>
<td>Mint 1 %</td>
<td>5 g</td>
<td>600 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₂</td>
<td>Pineapple juice 1 kg</td>
<td>Basil 1%</td>
<td>5 g</td>
<td>600 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₃</td>
<td>Pineapple juice 1 kg</td>
<td>Ginger 1%</td>
<td>5 g</td>
<td>600 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₄</td>
<td>Pineapple juice 1 kg</td>
<td>Clove 1%</td>
<td>5 g</td>
<td>600 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T₅</td>
<td>Pineapple juice 1 kg</td>
<td>Cardamom 1%</td>
<td>5 g</td>
<td>600 g</td>
<td>5 g</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 3.4.3  Treatment detail of Pineapple Cheese

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Product and product Amount</th>
<th>Powder and Powder Amount</th>
<th>Citric acid</th>
<th>sugar</th>
<th>Butter</th>
<th>Pectin powder</th>
<th>Replication</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>Pineapple pulp 1 kg</td>
<td>-</td>
<td>5 g</td>
<td>750 g</td>
<td>70 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T1</td>
<td>Pineapple pulp 1 kg</td>
<td>Mint 1%</td>
<td>5 g</td>
<td>750 g</td>
<td>70 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T2</td>
<td>Pineapple pulp 1 kg</td>
<td>Basil 1%</td>
<td>5 g</td>
<td>750 g</td>
<td>70 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T3</td>
<td>Pineapple pulp 1 kg</td>
<td>Ginger 1%</td>
<td>5 g</td>
<td>750 g</td>
<td>70 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T4</td>
<td>Pineapple pulp 1 kg</td>
<td>Clove 1%</td>
<td>5 g</td>
<td>750 g</td>
<td>70 g</td>
<td>5 g</td>
<td>4</td>
</tr>
<tr>
<td>T5</td>
<td>Pineapple pulp 1 kg</td>
<td>Cardamom 1%</td>
<td>5 g</td>
<td>750 g</td>
<td>70 g</td>
<td>5 g</td>
<td>4</td>
</tr>
</tbody>
</table>

3.5 Development of food product

One standard and five herbal powder added recipes were prepared from pineapple, Mint, Basil, Ginger, Clove, and Cardamom powder using same proportions and methods of cooking.

3.5.1 Preparation of pineapple pulp

Pineapple pulp prepared by pineapple fruits. Took a fixed amount of pineapple (1 kg) in a tray and washed them. Then took a knife and remove the skin of pineapple fruit and cut the fruit in small pieces. After that took a pressure cooker and added water and pineapple fruits pieces in 1:1 ratio and cooked it for 1 hour in pressure cooker at
100° C. when it was done then ground the pineapple pieces to get the pineapple pulp, which was finally refined by passing it through the muslin cloth and collected the pure pineapple pulp.

3.5.2. Preparation of Herbal powder

Took Mint leaf / Basil / Ginger / Clove / Cardamom in a tray and washed it. Then weighing 100 g Mint leaf / Basil / Ginger / Clove/ Cardamom 100 g whole and ground it, which refined by passing through the muslin cloth and got the Mint, Basil, Ginger, Clove and Cardamom powder.

3.5.3 Flow chart for the preparation of herbs powder:

Collection of raw herbs
(Initial moisture content, 87-88 percent)

Washing of herbs
(To remove micro-organism and dirt)

Sorting, Cutting, Grading
Tray drying (50° – 60° C for 3-4 hrs)
(Final moisture content 9-11 %)

Grinding

Packaging and Storage

3.5.4 Preparation of Value added pineapple products

Methods and flow diagram of various value added pineapple products.

3.5.4 (a) Product 1 - Pineapple Jam

Preparation of Standard Pineapple Jam -

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineapple pulp</td>
<td>1 Kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>500 g</td>
</tr>
<tr>
<td>Citric acid</td>
<td>5 g</td>
</tr>
<tr>
<td>Pectin powder</td>
<td>5 g</td>
</tr>
</tbody>
</table>

Method of Preparation

Removed the skin of the pineapple and cut it into small pieces. Used only the soft flesh. Boiled the pineapple pieces with 2 cup of water until they became soft when it was done, removed the seed and core. Then ground the pineapple pieces. Boiled it again with continuous stirring. After that 5 g of pectin was added with 200 g of sugar and 5 g of citric acid. And then mixture was slowly added with the boiled solution while stirred constantly. Finally rest of the sugar was added. Stirred it well when the content becomes thick. After that judging the end point 68-70 % TSS by sheet test. Then removed from fire, poured into clean bottle and stored at ambient temperature.

Jam should contain 30 to 50 percent sugar. If the percentage is less than 30, sugar may crystallize out on storage and if it is more than 50 the jam will become a honey-like mass due to the formation of small crystals of glucose. Corn syrup or glucose may be added along with cane sugar to avoid crystallization. (Srivastava and kumar, 2006).
3.5.4 (a)– Flow chart for preparation of Standard Pineapple Jam

PINEAPPLE FRUIT

↓

WASHING

↓

PEELING

↓

CUTTING IN SLICES

↓

PULPING (remove core)

↓

BOILING

↓

GRINDING

↓

BOILING (with continuous stirring)

↓

ADDITION OF SUGAR (add water if necessary)

↓

ADDITION OF PECTIN AND CITRIC ACID

↓

JUDGING OF END POINT BY FURTHER COOKING UP TO 105°C, 68-70% TSS OR BY SHEET TEST

↓

FILLING HOT IN TO STERILIZED BOTTLES

↓

COOLING AT ROOM TEMPERATURE

↓

WAXING

↓

CAPPING

↓

LIDDING LABELING

↓

STORAGE UNDER AMBIENT TEMPERATURE

3.5.4 (b) Preparation of Value added Pineapple Jam -

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineapple pulp</td>
<td>1 Kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>500 g</td>
</tr>
<tr>
<td>Citric acid</td>
<td>5 g</td>
</tr>
<tr>
<td>Pectin powder</td>
<td>5 g</td>
</tr>
<tr>
<td>Mint/Basil/Ginger/Clove/Cardamom powder</td>
<td>10 g (1%)(each)</td>
</tr>
</tbody>
</table>

**Method of Preparation**

Removed the skin of the pineapple and cut it into small pieces. Used only the soft flesh. Boiled the pineapple pieces with 2 cup of water until they became soft. when it was done, removed the seed and core. Then ground the pineapple pieces. Boiled it again with continuous stirring. 5 g of pectin was added with 200 g of sugar and 5 g of citric acid. And the mixture was slowly added with the boiled solution while stirred constantly. Finally rest of the sugar was added. Then added 10 g Mint / Basil / Ginger / Clove / Cardamom powder. Stirred it well when the content becomes thick. After that judging the end point 68-70 % TSS by sheet test. Then removed from fire, poured into clean bottle. And then stored at ambient temperature.
3.5.4 (b) Flow chart for preparation of Value added Pineapple Jam

PINEAPPLE FRUIT
  ↓
WASHING
  ↓
PEELING
  ↓
CUTTING IN SLICES
  ↓
PULPING (remove seed and core)
  ↓
BOILING
  ↓
GRINDING
  ↓
BOILING (with continuous stirring)
  ↓
ADDITION OF SUGAR (add water if necessary)
  ↓
ADDITION OF MINT / BASIL / GINGER / CLOVE / CARDAMOM
  ↓
ADDITION OF PECTIN 5 g AND CITRIC ACID 5 g
  ↓
JUDGING OF END POINT BY FURTHER COOKING UP TO 105°C, 68-70% TSS OR BY SHEET TEST
  ↓
FILLING HOT IN TO STERILIZED BOTTLES
  ↓
COOLING AT ROOM TEMPERATURE
  ↓
WAXING
  ↓
CAPPING
  ↓
LIDDING LABELING
  ↓
STORAGE WITH AMBIENT TEMPERATURE
3.5.5 (a) Product 2- Pineapple jelly

Preparation of Standard Pineapple Jelly -

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineapple juice</td>
<td>1 Kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>600 g.</td>
</tr>
<tr>
<td>Pectin powder</td>
<td>5 g</td>
</tr>
<tr>
<td>Citric acid</td>
<td>5 g per kg of fruit</td>
</tr>
</tbody>
</table>

Method of Preparation

Removed the skin of the pineapple and cut it into small pieces used only the soft flesh. Then boiled with water. During boiling added the citric acid 2 g per kg of fruit. Then sieved the mixture and separate the Juice and pulp. 5 g of pectin was added with 200 g of sugar and 5 g of citric acid. And then mixture was slowly added with the boiling solution while stirred constantly. Usually about 0.5-0.1 percent of pectin of good quality was sufficient to produce good jelly. Finally rest of the sugar was added. Stirred it well, when content become thick. After that judging the end point 65% TSS by sheet test method. Then filled into clean sterilized bottles and stored at ambient temperature.

This essential constituent of jelly imparts to it sweetness as well as body. If the concentration of sugar is high, the jelly retains less water resulting in a stiff jelly, probably because of crystallization. (Srivastava and kumar 2006)
3.5.5 (a)– Flow chart for preparation of Standard Pineapple Jelly

PINEAPPLE FRUIT (firm not over ripe) → WASHING → CUTTING INTO THIN SLICES → BOILING WITH WATER

(1 ½ times the weight of fruit for about 20-30 minutes)

ADDIOTION OF CITRIC ACID 3 g DURING BOILING

(2 g per kg of fruit)

→ STRAINING OF EXTRACT → PECTIN TEST (for addition of sugar) → ADDITION OF SUGAR AND PECTIN 5 g

JUDGING OF END POINT 65 % TSS (sheet/Drop/Temperature test) → REMOVAL OF SCUM OR FOAM

(one teaspoonful edible oil added for 45 kg sugar)

→ COLOUR AND REMAINING CITRIC ACID ADDED → FILLING HOT INTO CLEAN STERILIZED BOTTLES → WAXING (paraffin wax) → CAPPING

STORAGE AT AMBIENT TEMPERATURE

3.5.5 (b) Preparation of Value added Pineapple Jelly -

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineapple juice</td>
<td>1 Kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>600 g.</td>
</tr>
<tr>
<td>Citric acid</td>
<td>5 g</td>
</tr>
<tr>
<td>Pectin powder</td>
<td>5 g</td>
</tr>
<tr>
<td>Mint/Basil/Ginger/Clove/Cardamom powder</td>
<td>10 g (1%) (each)</td>
</tr>
</tbody>
</table>

**Method of Preparation**

Removed the skin of the pineapple and cut it into small pieces, used only the soft flesh. Then boiled with water. During boiling added the citric acid 2g per kg of fruit. Then sieved the mixture and separate the Juice and pulp. 5 g of pectin was added with 200 g of sugar and 5 g of citric acid. And then mixture was slowly added with the boiled solution while stirred constantly. Finally rest of the sugar was added. Usually about 0.5-0.1 percent of pectin of good quality was sufficient to produce good jelly. After that added the Mint / Basil / Ginger / Clove / Cardamom powder. Stirred it well, when content become thick. After that judging the end point 65% TSS by sheet test method. Then filled into clean sterilized bottles and stored at ambient temperature.
3.5.5 (b)– Flow chart for preparation of Value added Pineapple Jelly

PINEAPPLE FRUIT (firm not over ripe)

WASHING

CUTTING INTO THIN SLICES

BOILING WITH WATER

(1 ½ times the weight of fruit for about 20-30 minutes)

ADDITION OF CITRIC 3 g ACID DURING BOILING

(2 g per kg of fruit)

STRAINING OF EXTRACT

PECTIN TEST (for addition of sugar)

ADDITION OF SUGAR AND PECTIN 5 g

ADDITION OF MINT / BASIL / GINGER / CLOVE / CARDAMOM POWDER

JUDGING OF END POINT 65 % TSS (sheet/Drop/Temperature test)

REMOVAL OF SCUM OR FOAM

(one teaspoonful edible oil added for 45 kg sugar)

COLOUR AND REMAINING CITRIC ACID ADDED

FILLING HOT INTO CLEAN STERILIZED BOTTLES

WAXING (paraffin wax)

CAPPING

STORAGE AT AMBIENT TEMPERATURE
Material And Methods

Plate -3.1 Jam prepared by incorporating herbs

Plate -3.2 Jelly prepared by incorporating herbs
3.5.6 (a) Product 3 Pineapple Cheese

Preparation of Standard Pineapple Cheese –

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineapple pulp</td>
<td>1 kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>750 g</td>
</tr>
<tr>
<td>Butter</td>
<td>70 g</td>
</tr>
<tr>
<td>Citric acid</td>
<td>5 g</td>
</tr>
<tr>
<td>Pectin powder</td>
<td>5 g</td>
</tr>
<tr>
<td>Salt</td>
<td>2 g</td>
</tr>
</tbody>
</table>

Method of Preparation

Removed the skin of pineapple. Then cut into thin slices. After that Boiled with equal quantity of water to soften the pulp. For making fine pulp removed the seeds and skin. Then added sugar, citric acid, pectin and butter to pulp. Mixed thoroughly. After that cooked until they became thick. Then added salt. After that removed from fire, when the mass started to leaven the side of pan. Then spread hot cheese in 0.6 cm thick layer on tray smeared with butter. After that allowed to cool and set. When it became cool, cut into small pieces of suitable sized. After that wrapped the butter paper and packed in dry jar for storage.
3.5.6 (a) – Flow chart for preparation of Standard Pineapple cheese

PINEAPPLE FRUIT (firm and ripe)

WASHING

CUTTING INTO THIN SLICES

BOILING WITH EQUAL QUANTITY OF WATER (to soften pulp)

SIEVING (to remove seeds and skin) AND MAKING INTO FINE PULP

ADDITION OF SUGAR, CITRIC ACID 5 g, PECTIN 5 g AND BUTTER TO PULP

MIXING THROUGHLY

COOKING TILL SUFFICIENTLY THICK

ADDING SALT

REMOVE FROM FIRE (when the mass starts leaving side of pan)

SPREADING HOT CHEESE IN 0.6 Cm THICK LAYER ON TRAY SMEARED WITH BUTTER

ALLOWING TO COOL AND SET

CUTTING INTO SMALL PIECES OF SUITABLE SIZE

WRAPPING IN BUTTER PAPER OR POLYTHENE SHEET

PACKING IN DRY JAR

SEALING AND STORAGE

3.5.6 (b) Preparation of Value added Pineapple Cheese –

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineapple pulp</td>
<td>1 kg</td>
</tr>
<tr>
<td>Sugar</td>
<td>750 g</td>
</tr>
<tr>
<td>Butter</td>
<td>70 g</td>
</tr>
<tr>
<td>Citric acid</td>
<td>5 g</td>
</tr>
<tr>
<td>Pectin powder</td>
<td>5 g</td>
</tr>
<tr>
<td>Salt</td>
<td>2 g</td>
</tr>
<tr>
<td>Mint/Basil/Ginger/Clove/Cardamom powder</td>
<td>10 g (1%)</td>
</tr>
</tbody>
</table>

Method of Preparation

Removed the skin of pineapple. Then cut into thin slices. After that Boiled with equal quantity of water to soften the pulp. For making fine pulp removed the seeds and skin. Then added sugar, citric acid, pectin and butter to pulp. Mixed thoroughly. Then addition of Mint / Basil / Ginger /Clove / Cardamom powder. After that cooked until they became thick. Then added salt. After that removed from fire, when the mass started to leaven the side of pan. Then spread hot cheese in 0.6 cm thick layer on tray smeared with butter. After that allowed to cool and set. When it became cool cut into small pieces of suitable size. After that wrapped the butter paper and packed in dry jar for storage.
3.5.6 (b)– Flow chart for preparation of Value added Pineapple cheese

PINEAPPLE FRUIT (firm and ripe)
↓
WASHING
↓
CUTTING INTO THIN SLICES
↓
BOILING WITH EQUAL QUANTITY OF WATER (to soften pulp)
↓
SIEVING (to remove seeds and skin) AND MAKING INTO FINE PULP
↓
ADDITION OF SUGAR, CITRIC ACID 5 g, PECTIN 5 g AND BUTTER TO PULP
↓
MIXING THOROUGHLY
↓
ADDITION OF MINT / BASIL / GINGER / CLOVE / CARDAMOM EXTRACT
↓
COOKING TILL SUFFICIENTLY THICK
↓
ADDITION OF SALT
↓
REMOVE FROM FIRE (when the mass starts leaving side of pan)
↓
SPREADING HOT CHEESE IN 0.6 Cm THICK LAYER ON TRAY SMEARED WITH BUTTER
↓
ALLOWING TO COOL AND SET
↓
CUTTING INTO SMALL PIECES OF SUITABLE SIZE
↓
WRAPPING IN BUTTER PAPER OR POLYTHENE SHEET
↓
PACKING IN DRY JAR
↓
SEALING AND STORAGE
Plate -3.3 Cheese prepared by incorporating herbs

Plate -3.4 Cheese prepared by incorporating herbs
3.6 Chemical Analysis

3.6.1 Determination of Ash percentage - Ash percentage was determined according to the method described in AOAC (1980).

3.6.2 Determination of Moisture - The moisture percentage of pineapple products determined as per procedure given in exercise 31 of manual in dairy chemistry, ICAR (1972).

3.6.3 Determination of T.S.S- T.S.S content was directly measured on the “Zeiss hand refractometer” (40-80) on brix basis at 20°C temperature.

3.6.4 Determination of Acidity- The citrus fruit contain citric acid in large amount which gives its acidity. The acid was extracted or diluted with distilled water and determined by titrated with standard solution of sodium hydroxide.

3.6.5 Determination of pH- The pH was measured by a microprocessor based pH meter (century) filled with angle filled electrode.

3.6.6 Determination of Vitamin C- The method was based upon the reduction of the dye 2 -6 dichlorophenol – indophenols by an acid solution of ascorbic acid. In the absence of interfering substance (Cu, Fe, Sn etc) reduction capacity of the extract of the sample was directly proportional to the ascorbic acid content.

3.6.7 Determination of Total sugar- The Total sugar was measured by a ("Volumetric” Lane and Eynon’s Method)).

3.6.7.1 Determination of Reducing Sugar

3.6.7.2 Determination of non-reducing sugar
Plate 3.5 Evaluation of products by Judges
3.7 **Organoleptic Analysis of each Product –**

The products developed were subjected to sensory evaluation by a panel of five judges. The evaluation of the product was carried out by using the “9 point Hedonic scale” (Srilakshmi, 2008). (Appendix B)

3.8 **Microbial count of each Product** :

The microbiological analysis i.e. yeast and mould count and SPC count. of products were estimated by using standardized procedure of laid down in I.S. 1947 part III and manual in dairy bacteriology, ICAR publication (1972)(Appendix A.8). The developed jam, jelly were stored in sanitized glass bottles and developed cheese was wrapped in butter paper and placed in glass bottles at 120°C.

3.9 **Calculation of nutritive value**

Nutrient composition of products were computed with the help of food composition table published by Gopalan et.al. (2004). This included values per 100 g each products, with respect to “jam” “jelly” and “cheese”.

**Formula used**

\[
\text{Nutrient/100g of product} = \frac{W_1X_1 + W_2X_2 + \ldots + W_nX_n}{W_1 + W_2 + W_3 + \ldots + W_n}
\]

W= weight of the ingredient used  
X= Nutritive value of the ingredient

3.10 **Statistical - Method for analysis of data**

Data ascertained from the experiment was subjected to statistical analysis using analysis of variance technique two way classification, Randomized Block Design (RBD) and critical difference test (Panse and Sukhatme 1967).
3.11 Economics of the product:

To find out the economics of untreated and best variety of prepared products

1. Cost of pineapple (A)
2. Cost of sugar (B)
3. Cost of butter (C)
4. Cost of citric acid (D)
5. Cost of pectin (E)
6. Total expenditure of packaging (F)
7. Total labour charge (G)
8. Total gas charge (H)
9. Total expenditure on labeling (I)

Total cost = A + B + C + D + E + F + G + H + I

Total income = price of 1kg packets x 100

Benefit cost ratio = Benefit / cost