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Introduction:

The purpose of this guide is to disseminate technical information on food preservation skills, good practices and for food security among poor people from both rural and urban communities. The acquired skills would help the people at times of scarcity and skyrocketing prices and in remote areas or landless people. It would encourage agricultural production, for quality produce, curb fluctuating prices and empower local communities against vulnerability and malnutrition. This guide targets all community groups including, extension workers, nutritionists and women. The aim is not to make trainers or trainees experts in food preservation but to avail them with simple information to make maximum benefit of locally produced materials and use of best foods. The training guide includes vegetable and fruit drying, milk production and processing, sweets, jams and juices manufacture. It includes methods of food storage, preservation, preparation and processing for healthy foods that are year-round available to the communities. It is worth mentioning here that this guide has been prepared with the cooperative efforts of Practical Action Sudan and the Irish organization, GOAL. It is then edited by Professor Abdel Haleem Rahama from the Ahfad University for Girls/Department of Food Safety and Quality Control. The finance has been offered from GOAL through its Common Humanitarian Fund, CHF.
Vegetables and fruits drying
Definition of vegetables:
Vegetables is an important food, rich in minerals and vitamins and especially for supplying cellulose and fibres which increase food bulk that gives a feeling of satiety and satisfaction. It also helps in intestines’ movement and prevents constipation. Daily food intake should always contain vitamin C (as in vegetable salad) because this vitamin is affected by cooking. All vegetables are rich in vitamin A, vitamin C and minerals: calcium, potassium, iron and iodine.

Definition of fruits:
Fruits are a necessary food because they contain plant organic acids, minerals and vitamins, especially vitamin C which is always contained in sour fruits.

Drying:
Natural drying of vegetables and fruits is a simple method of food preservation that can be practiced at home particularly by rural women. They usually have excess of their daily consumption requirements of fresh vegetables and fruits at harvest seasons. They must be careful to go on the sequence of the drying steps and especially step 1 which is a basic one (That is selection of good raw material for processing and preservation) and from which latter steps follow.
Natural drying:
It is an ancient method of food preservation. Natural drying is very common in most of Sudan as weather conditions are favourable the year-round, sunshine and dry air. In the northern part of Sudan dates and onion are dried naturally, in the western part tomatoes, peppers and hibiscus, also meat and salted fish are dried in most parts of Sudan.

Purpose of drying technique:
1- To reduce humidity to a level where micro-organisms are prevented from decaying food material during drying and storage periods.
2- Reduce weight and bulk of food materials. This will make easy handling, storage and transportation. It will improve traditional ways of drying by clearing impurities, considering safety measures, good drying and innovation of suitable packaging materials that help in the preservation and promotion of dried foods.

Criteria for successful drying:
• Drying tools and equipment are carefully located far away from polluting areas like cattle fences or residential areas.
• Before food treatment care must be taken as to hygiene aspects of hand washing, cleaning of drying tools etc.
• Use of appropriate methods to dump solid and liquid waste.
• Drying must be done above ground level to protect materials from dust.
• When drying process is finished and food material is finally sorted out the dried material should immediately be put in a suitable package and tightly closed.
• Dried and packaged foodstuffs must be stored in suitable storage conditions and at recommended temperature.
• Use of additives, some improvers and preservatives that are usually permitted in the industry of the product under consideration.

Factors affecting selection of drying methods:
A- Nature of the raw material and specification.
B- Product quality and specification.
C- Economic considerations (price).
D- Minimal biological and chemical changes during preparation, drying and processing.

Basic steps in drying process:
• Suitable variety for processing i.e. selection of good quality crops for aspects of maturity, colour, size and weight to avoid deterioration.
• Sorting and grading to get rid of damaged parts and immature crops.
• Washing with clean water with continuous stirring so as to get rid of pesticides residues, soiled and muddy materials from the field.
• Careful peeling to remove damaged parts without affecting the pulp and avoid increasing losses.
• Prepare food for the required form (slicing or halving, juices or pulp)
• Blanch (boil) in water or vapour, particularly for vegetables.
• Use of preservatives to retain natural colour of raw material.
• Avoid overloading or heaping on drying containers so as to enable easy flow of drying air through the different pieces of the food material.
• Follow recommend methods for the different food materials
• Use packaging and binding material that is suitable to the nature of the food material intended for drying, and tightly close.
• Store and preserve under recommended temperature.
Advantages of blanching (boiling) before drying:
   a) Reduces the time interval for drying.
   b) Inhibits enzymes that cause change in colour, taste and smell.
   c) Drives out air from tissues of vegetables intended for drying
   d) Prevents microbial activity and reduces pollution.
   e) Improves texture of some foods, colour and flavour of all foods.
Blanching is done either by use of vapour giving enough time, 3-10 minutes or by immersing material in water at boiling point for 3-5 minutes. Some vegetables we do not generally blanch (like onions, garlic and chilies).

Treatment with preservatives:
Food materials are usually treated with some preservatives to retain its semi-natural characteristics. Prepared foods are treated with one of the following:
1) Common salt solution, sodium chloride or sodium bicarbonate solution. Citric acid may be replaced by fresh lemon or sugared solution.
2) Spray of powdered sugar on homogenously prepared fruit slices on aluminum containers, but shallow plastic ones are preferred and then left for some time.

Packaging and binding of dried foods:
Specification of the package material:
The package material must isolate food from external weather conditions and protects it against:
- Microbial pollution and insects’ infestation.
- Humidity absorption from the atmosphere.
- Light and oxygen that lead to fats oxidation
- Absorption of bad odours and tastes.
Care must be taken as to prevent chemical reaction of package with the food material.

Package specification:
1- Properly sealed, air tight and humidity proof.
2- Attractive to consumers.
3- Easy opening and closing.
4- It has enough capacity to contain a suitable amount of the food material.
5- Solid to withstand conditions of handling, storing and loading.
6- Accessible for reasonable price in local market.
In case of commercial products the following information must be clear on the labelling:
• Name of product.
• Food ingredients.
• Weight or volume in case of liquids.
• Date of production.
• Validity period or expiry date.
• Brand of the product source.
• Country of origin.
• Nature of product.
• In case of powdered material, ideal preparation methods are mentioned.
• Refer to food intake claims, in case of using food expressions.

Note:
Exposure of food material to blanching by vapour or boiling in water helps in preservation while not in use.

Note:
An enzyme is any one of the large number of proteins produced by all cells: an enzyme acts as a catalyst on the chemical reactions which take place in all organisms. An enzyme is easily destroyed by heat and other conditions, so when non-existent in plant tissue, this enhances chemical reactions and hence food is contaminated.
**Tools and equipment:**
1) Sun-drying container with wooden frame, and bottom made of wire mesh. It is put on a wooden structure (fig 1).
2) Plastic buckets.
3) Aluminum containers of medium size.
4) Medium-sized aluminum bowls.
5) Aluminum basins.
6) Knives.
7) Soup spoons, coffee spoons and wooden spoons.
8) Charcoal Stoves.
9) Crushers or mortars.
10) Aluminum sieves or fine wire mesh of different sizes.
11) Small hose.
12) Linens of cotton (damourriah).
13) Light cloth or gauze.

**Material:**
1/ Common salt (sodium chloride).
2/ Sodium bi-carbonate.
3/ Lemon salt.
4/ Sugar.
5/ Drinking water.
6/ Packaging material (Nylon, polyethylene, bags), glass jars, tin cans or foils.
7/ Paraffin oil.

**A substitute to citric acid:**
Generally lemon juice can substitute citric acid, after treating the juice by heating to concentrate. One spoonful is equivalent to 5 g. of citric acid after concentration.

**Note:**
If containers in the required specifications are unavailable, they can be substituted by aluminum containers and covered with bags.
Tomatoes drying
In form of rolls (salsadeen)
The quality to be used is mature, disease- and- insect free, red and good textured for juiciness.

Steps of drying:
1- Tomato is sorted out, put on plastic basin and thoroughly washed with water.
2- Cut in quarters, put on aluminum bowl; on fire with stirring from time to time until tissues are completely destroyed and for 5- 7 minutes.
3- Then the bowl is taken back from fire and left to warm so that it can be easily destroyed and filtered by tomato hand filter.
4- An electric blender may be used for tomatoes, filtered with fine plastic filter or gauze, put in a plastic bucket and then left for the dense part to separate from water at the bottom.
5- Water is then drawn from tomatoes by a small hose to an aluminum bowl.
6- Tomato water is then put to a fire to increase concentration as two thirds of the amount would evaporate.
7- Tomatoes concentrated water is added to the dense red and thoroughly mixed with a wooden spoon for a homogeneous juice (Tomato mixture).
8- Salt is added to the mixture at the rate of one coffee-spoonful to three large cups.
9- Aluminum containers are kept dry clean, a piece of nylon spread on it and on which surface a thin layer of paraffin is applied (any other plant oil could do and
which would not affect tomatoes with bad taste or smell.

10- Juice is then poured on the containers (one small plastic bucket of mixture to each medium sized container i.e. 3-4 kg and the layer is maximum 5 ml thick.

11- The containers are placed under fan in a normal room or in a shed ‘Rakouba’ (Sudanese local building made of 4 wood posts and thatched roofing) where air current passes and the containers should be on a stand at least 1 metre above ground.

12- When tomato drying is finished in form of rolls, it is striped of the containers, and then divided into suitable pieces to facilitate filling into small nylon packages and for marketing. It can also be stored well in cardboard boxes under room temperature and storage period will be lengthened if put in refrigerator, in a dry place to avoid humidity effect.

Method of preparation for use:
1- When the bag is opened the whole amount is used so that it might not be exposed to dirt or affected by water vapour from the surroundings.
2- Put the required amount of tomatoes to be used in a container, immersed in a suitable amount of boiling water and then left for 5 minutes.
3- The foodstuff is then mixed with a wooden spoon to be used directly as tomato sauce. The remainder is kept in a glass jar, top surface covered with oil layer and placed inside the refrigerator or elsewhere in a cool place.

Drying in form of slices or quarter starry shapes (Traditional method):
Tomato should be mature, red and insect and disease free. It must be firm for chopping.

Steps of drying process:
A- Tomato is sorted out for good quality and firmness.
B- Tomato is put in a plastic basin and well-washed from mud and pesticides’ residues from the field.
C- Cuttings are made as needed (into halves or quarters)
D- Cut tomatoes are treated with common salt. This could be attained by the following methods:
  * By immersing in solution (one small spoonful of salt for two cups of water for 5 minutes).
  * Direct mixing: salt is sprayed homogenously at 2% concentration.
  * Spraying: concentrated solution (5%) sprayed on pieces of tomato arranged on the drying container.
E- Drying containers are prepared, dry and clean and thin layer of paraffin or any suitable plant oil is applied. Then pieces of tomatoes are spread on surface as in one layer.

Note: To enhance drying, a plastic comb is used to make openings on the upper layer of the foodstuff to make easy flow of air.

Note: Juiciness is not an important criterion in traditional tomatoes drying methods.

Note: Sometimes some sugar is sprayed with common salt on the surface of slices to give a special flavour.

Note: To accelerate drying process a table fork can be used to make openings on the slices for air currents flow.
F- Containers are placed on wooden posts; one metre above ground in a fan ventilated room or under local shed ‘Rakouba’ where natural hot air passes.

G- When drying is finished small nylon bags are used for packaging and properly sealed with a binding machine.

H- Put packages inside tin or aluminum cans, in large cardboard boxes or in glassware under room temperature in a cool dry place. Aeration and conditions of dry weather must be considered i.e. avoid humidity.

**Preparation method for use:**
1) Quantity of dried tomato intended for used is submersed in boiling water for 3 minutes, taken back from fire and left for 5 minutes.
2) Tomatoes are minced or blended for tomato mixture and used for cooking.
3) It can be crushed into fine powdered sauce and is preferred immediately before use.

**Note:**
For a consumer who does not prefer tomato peels, sieving is used for removal or minimization.
Drying of Okra
All fingers dehydration

Use clean, green okra, small or medium sized fresh and free of insects pores or damage.

Process steps:
1- Wash okra after sorting out and grading
2- Trimming of pods ends (removing cupules)
3- Boil water in aluminum pot
4- Fingers are tied to pieces of cloth in form of bundle and immersed in boiling water for 3 minutes. Or may be blanched by exposure to rising water vapour for 10 minutes depending on quality.
5- Empty okra (Bamya) blanched fingers in a plastic basin to cool down.
6- Prepare sodium bicarbonate solution (conc. 1% - one teaspoonful for two and a half cups of water) in plastic basin where fingers are immersed for 3-5 minutes.
7- Treated okra (Bamya) with bicarbonate is spread on drying containers and left to dry in a shaded place where naturally hot air current passes.
8- Put in nylon bags or cellulose, seal tightly and keep away from humidity until opened for use.

Note:
Candle flame may be used to seal dried okra packages
Preparation method for use:
Use okra (Bamya) for cooking by immersing the intended quantity in hot water for 3-5 minutes. It is taken back from fire and left to regain its naturally fresh condition by imbibition, refreshed and then cooked as usual.

Drying okra to small pieces (dry weikah/ okra) – The traditional method:
1\ Cut fingers into suitable parts (3-5 cm, length).
2\ Spread okra (bamya) on drying containers and leave to dry in a shaded place where there is flow of air current far away from pollutants.
3\ The dried parts are collected and crushed into fine powder form.
4\ The powdered okra can be sieved to remove solid parts.
5\ Fill in clean glass or plastic packages with powder, tightly seal from humidity and make ready for home use or otherwise marketed.
Potatoes and carrots drying

Potato or carrot tubers of large or medium size are used that are free from damage or infestation.

**Drying steps:**
1. Sort out potatoes or carrots.
2. Wash with water from pesticides residues or mud from the field.
3. Potatoes and carrots are peeled using a huller or knife under water in a plastic basin.
4. Potatoes or carrots are cut in circular forms, quarters or cubes, as needed and a piece thickness must be (5-7mm.)
5. Blanching is accomplished by exposure to water vapour for 5-10 minutes or tied to a cloth and immersed in boiling water as illustrated in figure below. The same applies to potatoes and carrots as for okra.
6. Slices are immersed in salt solution 5% conc. (two soup-spoonful of common salt for one large plastic bucket of water) for 5 minutes. Otherwise salt is added by mixing with potatoes or carrots; then mixed and stirred (the rate is one small spoonful of salt to 1 kg of potatoes or carrots.

**Note:**
In some carrots varieties we need to remove the xylem cylinder to avoid solid fibres before blanching is complete.
7- Drying containers are washed and well dried.
8- Carrots or potatoes slices are spread over containers evenly, not heaped or piled.
9- Drying is by placing containers under shading where naturally hot air passes.
10- Use nylon bags’ packages or cellulose and keep in cool place. The small packages can be stored inside large boxes, tins or cardboard after filling.

**Method of food preparation for use:**

1/ Boil water in a container.
2/ Put slices of potatoes or carrots in the container on boiling water for 3 minutes. Take it back from fire, leave until it regains its normally fresh conditions by imbibition and be ready for use as needed: soup, fried or cooked with meat.
Jews mallow and fennel drying

This method applies as well to green coriander, parsley and other fibrous vegetables. Use Jews mallow (cochortus olitorius) fresh, bright green and free of insect damage; do the same for fennel.

Sequence in drying process:
1. Clean Jews mallow ‘Moloquia’ or fennel from impurities and parasites.
2. Completely remove the roots.
3. Wash Moloquia or fennel in stems, with water thoroughly.
4. Prepare sodium bicarbonate solution 1% conc. (one teaspoonful of bicarbonate for one full plastic bucket of water).
5. Submerge the branches of the Jews mallow or green fennel in sodium bicarbonate solution for 3 minutes with leaves completely submerged in the preservative and continue stirring.
6. The branches of the Jews mallow or green fennel are then taken out; spread on the drying containers, put on a stand, one metre above ground in a shaded place where hot air passes it to dry out.

Note:
This method is also useful for drying of spinach and carrots leaves. For carrots, the veins can be removed to give dry fine powder.

Note:
It is preferred to dry Moloquia with leaves on stems, unremoved.

Note:
It worth mentioning that treatment with bicarbonate helps in the dried matter retaining its green colour.
7. After the leaves of the fennel or Jews mallow have dried, carefully collected and milled through a filter for homogeneity.
8. The product is then packed in nylon bags and put in cans or tins in a cool dry place far away from humidity effect.

**Preparation method for use:**
Jews mallow or green fennel quantity intended for use is submerged in boiled water for ten minutes and left for slowly imbibing water and then used, mixed with normal cooking ingredients.

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**Note:**
Fresh or dried pieces of carrots may be cooked with dried Jews mallow leaves.
Onion and garlic drying

Onion or garlic intended for drying must be fully mature, free of infestation and in large or medium sizes.

Sequence of drying process:
1- Sort out onion or garlic.
2- Thoroughly wash to get rid of mud and pesticides residues.
3- Use knife for peeling onions and hand peel garlic.
4- Onion is cut into thin circles and so is garlic cloves cut into wide circles not more than 5 cm in thickness.
5- Spread onion or garlic on drying containers, dry, clean and be careful not to be accumulated or heaped together.
6- After onion circles or garlic pieces drying is complete they are crushed into powder form.
7- Packages of nylon bags are used away from humid places, dry and cool.

Note:
Onion is peeled submerged in cool water.

Note:
Dried onions can also be preserved in form of slices, not only in powder and for certain purposes other than just for flavour.
Drying of red pepper and tomato in form of mixed powder

Tomatoes and red pepper used which are free from diseases, damaged parts, mature and red in colour.

**Drying steps:**
- Sort out pepper and tomatoes.
- Put in a plastic basin and wash thoroughly from mud and pesticides residues.
- Cut the branch attached to the pepper.
- Cut red pepper into slices either longitudinally or cross-sectional.
- Immerse red pepper in salt solution (0.5-1% conc.) for 3 minutes.
- Slices are filtered from solution, spread over drying containers and then placed under shaded place where left to dry under hot dry air current.
- Tomatoes are cut into slices and quarters in a plastic basin.
- Tomatoes are sprayed with common salt and stirred (one tea-spoonful of salt for 3 kg of tomatoes.
- Tomatoes are then spread on the drying containers, put on stands at least one metre above ground.
- Put containers under shade and expose to dry air to dry the same as for red pepper.
- Tomato and pepper, both dried are then mixed in equal ratios and pounded by mortar and pestle or by electric miller.
- Use nylon bags as packages for powdered tomato and pepper, put in tin boxes under room temperature.

**Red pepper and tomato preparation method:**
- A mixture of tomato and pepper powder may be used directly as spicing for cooking.
- It is preferred that the mixture be transformed to a sauce paste by adding boiled water to the quantity intended for use, then stir with a spoon until it is slowly imbibed forming a fine textured paste.

**Method of preparation for use:**
Dry powder is used to add flavour while slices are used for different food purposes.
Fruits drying

There are two methods for drying fruits:
• Slices’ shape.
• Rolls.

Drying in form of slices (sugared mango slices):
Use mango fruits free from diseases and insects’ damage, firm and mature. The preferred varieties are: (Abu Samaka, Alphono, Kitchner, Gulp El tour). Traditional and high fibres content varieties are discard- ed from drying process.

Sequence in drying process:
• Mangoes are thoroughly washed with water
• Cut slices into desired shapes
• Prepare concentrated sugar solution (syrup) in which citric acid is dissolved (one small spoonful of citric acid for 5 syrup cups)
• Mangoes are then immersed in syrup for 8 hours (partial drying by osmosis)
• The syrup then filtered from mango slices
• Spread mango slices on aluminum container, dry, clean and leave to dry under shade
• Use packages of glass jars or polythene bags and keep in cool, dry place.

Note:
It is preferred not to peel mangoes because in the process of peel- ing the fruit loses a large part of its juice and liquids.

Note:
These slices are not indicated for diabetics because of its high added saccharose con- tent.
Method of preparation for use:
A- It can be eaten dry with some nuts.
B- It can regain normal condition when moist with warm water and used in fruit salad, cakes or custard.
C- This method can be used for cantaloupe and guava.

Drying mangoes in form of rolls:
Use fruits free from diseases and insect damage, juicy varieties and with fine pulp for mango rolls (mangodin).

Steps of drying:
• Sort out mangoes for size
• Wash thoroughly with water
• A juice extractor is used to extract dissolved materials and fine pulp
• Cut into small pieces and put in aluminum bowl
• Put mangoes liquids and pulp on fire for 10 minutes with continuous stirring until tissues are broken and become soft
• Squeeze and filter into an intense juice, then add glucose honey (10%) and citric acid (1-2%) and mix homogenously
• Prepare aluminum containers, dry, clean with nylon sheet on surface
• Pour the required amount of mango concentrate on containers after being covered with nylon. It must be of equal thickness in order to dry.
• Put containers on stands at least one metre above ground level in a shaded place where hot air current passes to dry them. It is preferred to place containers under fans in clean rooms and left to dry gradually. Use a fork to break the hard surface and hence accelerate the drying process.
• Cut dried rolls into quarters, each piece in a separate package, twined (like gamardin) in nylon bags and kept under normal room temperature away from humid places.

Preparation method for use:
The required amount of dried rolls is put in warm water until it imbibes and then mixed homogeneously to be in form of juice ready to use. It may be used for preparation of desserts, custard and may be used for jams and sweets.

Note:
Apply a thin film of olive oil on the outer surface to give shining appearance.
Milk processing and milk products
Yoghurt processing

Contents:
• One pound of milk
• Two large spoonful of powdered milk (skimmed)
• One big spoonful of yoghurt (starter)

Note: quantity may be raised by the same ratios.

First method:
• Milk is heated to 90-98 Celsius (i.e. for 10 minutes, when it begins to vaporize)
• Cool down to 45-48 Celsius (milk heated to the degree that can be tolerated by finger for 2 minutes).
• Add skimmed powder milk to raise total solids and improve consistency (in case of fresh milk we may not need to add it).
• Add starter or previously used yoghurt.
• Well stir for 2 minutes and put in special yoghurt packages.
• Put in an incubator or warm place for 3-4 hours.
• Put in refrigerator when coagulation begins.

Note: Expiry is max. 7 days in the refrigerator at less than 10 degrees centigrade.
Second method:

Contents:
1) One pound of full cream powder milk.
2) Two pounds skimmed milk.
3) Small cup of yoghurt (150 g).

In case of using powder milk the steps are as follows:
1- Mix milk thoroughly (150-160 g powdered per litre).
2- Heat milk to 45 degrees Celsius and then cool down.
3- Add yoghurt (one small cup frozen).
4- Fill in special yoghurt packages.

5- Packages with good coverings are placed in kitchen at 37-40 degrees Celsius for 3-4 hours (normal temp. as in Sudanese kitchen).

6- Put in refrigerator.
7- Keep for 15 days only.
Pickled cottage cheese (Mish)

Composition:
A hundred pounds of milk
Three cups of yoghurt
Three pounds of common salt
Two ounces of cumin, clean and washed
One ounce of fenugreek (trigonella), clean and washed.

Steps:
Pasteurization of milk: heated up to 65 centigrade for half an hour and cooled down to 32 degrees centigrade (milk heated to intolerable temperature degree, when small amount of vapour begins to rise, then the container is put in cold water where milk becomes less hot)
Add starter (fermented milk) at 2-3%, stir well and then put under normal room temperature for 6-12 hours.
Add salt, black cumin and fenugreek immediately and hot pepper may be also added after being washed in warm water.
It is always preferred without filtering whey (ششش).
Keep in a refrigerator in covered plastic container.
Cheese making

Tender white cheese

Definition:
Tender white cheese is defined as milk coagulation/clotting which is prepared by different methods in solution (local milk whey) for many days.

Equipment to use:
1) Plates made from wood or metal which are not corrosive
2) Iron tables which would not be affected by corrosion
3) Fine cloth (gauze).
4) Bowls, knives, big spoons.
5) Buckets, plastic barrels.
6) Local stoves.

Ingredients:
To prepare 12-14kg of cheese, the following is required:
- A hundred pounds of milk (44-45 litres).
- One tablet of rennet (rennin enzyme).
- Common salt (2.2-3.6 kg).

More or less quantity of cheese may be prepared using same ratios.
Cheese preparation methods:

First method:
Steps:
1) For quantity of milk use a standard measure (if unavailable use weights)
2) Use clean gauze.
3) Pasteurize milk by water bath (put water in a large container, put milk in a smaller one and place on fire until its temperature reaches 65 degrees Celsius). This is indicated by rising vapour before boiling and for some minutes only.
4) Take milk out of fire.
5) Cool to 23 degrees Celsius (when it can still be tolerated by dipping finger for some time). Cold water in a container may also be used to cool milk.
6) Put milk in a plastic bucket which had been washed with hot water and add salt at the ratio of 2.2-3.6 kg per 100 pounds of milk (44-45 litres).
7) Add starter (one cup or 150 g) to the above contents and stir for two minutes and then leave for 15 minutes (in case starter is unavailable a small cup of yoghurt may be added).
8) Add rennet (rennin) to the milk, after being dissolved in a small amount of water and stir for 2 minutes (one tablet for 100 pounds of milk).
9) Leave contents until milk curdling is complete after 1 or 2 hours. This is indicated by driving a clean knife and taking it out. If the clotting separates then coagulation is complete. The clotting is then broken by a common or special knife to separate cheese water.
10) Coagulation is softened by hand using hygienic gloves.
11) Cheese plates covered with gauze are then placed on a special table.
12) Softened coagulants covered with gauze, are put in plates to take shape and then a weight is placed on top of it to get rid of excessive liquids for 2 hours.
13) Cheese water is collected in a bucket placed under the table.
14) A bucket or plastic barrel that had been washed in hot water is prepared where cheese water is poured, heated for sterilization and then cooled.
15) Cheese is cut after removal of gauze from plates, put in sterilized cheese water for a week so as to complete ripening, acquire flavour and for more ripening.
16) The soft white cheese is kept in cheese water for a period up to 3 months; it is not packaged in polythene bags except intended for immediate consumption and in this case it is preserved in refrigerator for a period not more than 7 days.

The second method:
Steps:
1) Milk is heated to 74 Celsius degrees (vapour rising degree) with continuous stirring.
2) Suddenly cooled down to 42 degrees centigrade (can be tolerated by hand)
3) Rennin is dissolved in half teacup of water
4) The mixture of rennin and water is added to the milk, well mixed and then covered and left for enough time to start curdling.
5) After coagulation (tested by knife as in the first method), cut into quarters to separate water
6) Clotting is softened as before.
7) Prepare open plate from top, bottom and perforated and lined with a piece of cloth
8) Softened cheese is poured on the plate and covered with gauze (whey begins to infiltrate through the perforation; a container is placed to collect the filtrate).
9) A suitable weight is put on top cheese surface to make firm and soft textured.
10) After 24 hours take cheese out of plate, cut and put in preservation containers with salted whey added (whey is sterilized and then salt is added as needed).
11) Remainder is similar to the first method.

Note: salt may be added to the milk when processing cheese by the second method while in the first method salt is added before softening the clotting.
**Intertwined strands-like cheese (jibbna moduffra)**

**Procedure:**
Weigh and filter milk using gauze:
1- Pasteurize milk by heating to 65 degrees Celsius and quickly cool down to 32 degrees Celsius.
2- Add starter at the rate of 2 cups of yoghurt and stir for 2 minutes.
3- Add rennet (as indicated on the label), stir for 2 minutes and leave to settle for one hour.
4- Soften when coagulation is complete
5- Stir the curd thoroughly for 15 minutes until whey is separated and then precipitated in the container.
6- Remove the curd from the whey and put in another container.
7- Test an elastic curd by putting a small piece in water in a container on fire. If the curd become like dough, it can be stretched this indicates maturity. If not the curd is left for some time to ferment and the test is again repeated (Fifteen minutes are required for a soft curd to ferment before it is cured and stretched).

8- After the curd becomes mature (fermented) it is chopped and each piece is put on hot water and moved by a wooden tool before it becomes elastic and can be stretched.

9- Cumin (Cuminum) is put on a table and cheese placed on it where another quantity of cumin is sprayed. A hole is made in the middle and the paste is stretched by pulling the hands apart and folding and so on.

10- The cheese is transferred to a container with cold water for half an hour, and then moved to another container where 15 pounds of common salt is dissolved in 100 pounds of whey. Then put mahaleb (Cerasus mahaleb) tied to a piece of gauze at room temperature for 72 hours (3-7 days) and the container must be well covered (common salt must be 5-6% in cheese and 10-15% whey solution). Intertwined strands cheese may be left for many months in whey to acquire its characteristic flavour and taste and also inelastic consistency when used.

11- Put in refrigerator (at 5 degrees centigrade) after being weighed and distributed to polythene bags.

12- It can be stored in refrigerator for 6 weeks or more.
Mozzarella

Contents:
1- A hundred pounds of milk.
2- One tablet of rennet (rennin enzyme).
3- One to one and a half of common salt.
4- One cup of yoghurt.

Procedure:
Milk is weighed and filtered with gauze:

1- Pasteurize milk (heat up to 65 degrees centigrade and then cool to 32 degrees centigrade).
2- Add starter and leave to settle for 10 minutes.
3- Add rennet (as indicated on the package) and stir for 45-60 minutes for clotting. Coagulation is tested by knife.
4- Cut the curd into cubes i.e. across and longitudinally.
5- Cubes are stirred well for 15 minutes until the whey separates from the curd.
6- Soften and move to another container for 15 minutes to ferment (mature). Then add salt: 1-1.5%, with stirring.
7- Coagulation is tested by taking a small piece and then heat in water (82 degrees Celsius), when vapour begins to rise.
8- Cut into suitable pieces, immerse in heated water 77-82 degrees centigrade and stir for 3-5 minutes. Then take out of water and stretch as for pancake, unlike strands and the process continues until it becomes delicate and bright. Then put in a plate while hot and put in iced water.
9- After 2 hours take out of iced water, put in cold salt solution (1-1.5%) and press and place in refrigerator in the next day for 3-6 hours. Take out of salt, dry on air for 2 hours and then bind in polythene bags and preserve in refrigerator (5 degrees Celsius).

Danish cheese

Contents:
1- A hundred pounds of milk.
2- One rennet tablet.
3- Twenty-five pounds of common salt.
4- Three to four cups of yoghurt.

Procedure:
Weigh milk and filter with gauze:

1) Pasteurize milk (Heat to 65 degrees centigrade and then cool down to 32 degrees centigrade).
2) Add starter (0.75%), leave for 5 minutes and then add rennet, as indicated on the package.
3) Leave for half an hour and then cut into cubes and stir for 20
minutes until curd is separated from whey (cheese water).
4) Remove part of whey.
5) Add hot water at 70 degrees Celsius (when vapour is rising gradually and heating the clotting up to 37 degrees Celsius (that can be tolerated by finger and for longer time).
6) The clotting is collected on one side of the container and pressed for 25 minutes by placing a bucket full of water on it.
7) Move to the plate lined with gauze, cover with gauze and press with cheese-press for half an hour.
8) Move cheese to the other side and press for 25 minutes.
9) Put in a salt solution (25% i.e. 25 pounds of salt in 100 pounds of water for 3 days).
10) Place on table and leave to dry under room temperature for 3 days and then move to the refrigerator.

**Dry cheddar cheese**

**Contents:**
1) A hundred pounds of milk; one rennet tablet.
2) One cup of yoghurt.

**Procedure:**
1) Pasteurize milk and put on fermentation container.
2) Add starter (at 1%), one cup of yoghurt and leave for 15 minutes.
3) Add rennet and stir for 2 minutes and then leave to settle.
4) Cut the clotting into cubes and stir for 20 minutes, till it is separated from the whey.
5) The clotting is softened, collected and put in the plate lined with gauze while cold and then covered with gauze.
6) Put weight on surface and leave to dry at room temperature (20-25 degrees centigrade are preferred).
7) Discs are covered with waxy material and left to mature for three months.
Labaneh (laban mousafa)
It is cheese without rennet (rennin enzyme)

Contents:
1- A hundred pounds of milk
2- Two pounds of common salt
3- Two cups of yoghurt

Procedure:
Weigh milk and then filter with gauze:
• Pasteurize milk and put in fermentation container.
• Add starter at 2%, stir for 2 minutes and leave for 24 hours at room temperature.

• Filter whey with gauze, leave curdling in gauze hanging for 24 hours till all whey is filtered and then put in a plate covered with gauze and lightly pressed for further filtering whey.

• Add salt at 2%, cut into shapes as needed, use some oil and then store in refrigerator.
Ghee making

• Collect skimming and add cold water
• Agitate for cream separation
• Collect butter and put in a heat treated container so that ghee melts
• Filter ghee in bottles after it cools down.

Traditional ghee making:

• Add starter “Rawabb” to the milk and leave for the next day.
• Move to a container made locally from leather (sienn or girbba) or gourd (bukhssa) or plastic material (jerikanna) and agitate until cream is separated.
• Then collect the cream or ‘butter’.
• Heat on fire until the ghee melts.
• Filter in bottles or plastic containers after it gets cool.
Jams processing
Jam processing is considered as a branch of the canning industry. It is simply the preservation of food at the required concentration in properly closed packages, sterilized to kill microorganisms that cause food spoilage. Jams are composed of mixtures of fruits, vegetables and sugar, with different forms depending on the type of fruit and vegetables used. It may be crushed, parceled or cooked mixture of fruits and vegetables and sugar at the ratio of: 45:55 under relatively high temperature until there is consistency.

**Basic steps of jam processing:**

1. Select fruits for jam processing that are fully mature, with the characteristically natural colour of the fruit (it is not necessary to use excellent qualities; any type of fruit can be processed into jam.
2. Fruits are washed well with water.
3. Some fruits are hulled, cleaned, some are hulled and immersed in acid solution (one small spoonful of lemon for one liter of water) so as to retain natural colour like bananas.
4. Peeled fruits are boiled on fire for 10-20 minutes until tissues become tender. This can be tested by fruits crushing when lightly pressed between fingers.
5. After boiling fruits or vegetables are crushed, sugar added and cooked on quiet fire. Continuous stirring is facilitated by large wooden spoon so that sugar might not stick at the bottom, form isolated layer and brown the jam. Continue stirring until full maturity.
6. Add lemon salt.
7. Add pectin.
8. Add flavour.
9. Add preservative.
10- Package in glass bottles.

The following steps are observed when processing:
Be careful about critically high temperature degree so as to avoid burning the jam.
Remove materials floating on surface of the jam so as to avoid changing jam colour.
Be careful for continuous stirring and adding acid to the jam 15 minutes before maturity.

Note:
Sugar quantity added to contents depends on fruit sugar content:
• Fruits or vegetables (like carrots) with high sugar content: add sugar one times its weight.
• Fruits with low sugar and sugar-free vegetables (tomato and eggplant): add sugar time and a half its weight.

Substitute for citric acid (lemon salt):
Generally, lemon juice can substitute for citric acid after being treated and concentrated by heating. One concentrated spoonful is equivalent to 5 g of citric acid.

Pectin substitute:
Pectin is a water soluble, fibrous substance in plants and vegetables which helps cohesion of food stuff and gives consistency. In case the processed food material is pectin-deficient the following works as a substitute:
• Use the endocarp of the grapefruits thick skin, treat with boiling and refresh with water to avoid the bitter taste. Remove the epicarp (outermost layer) of the fruit. Add one cup of lemon juice to the mixture. The mixture is then squeezed, dried and milled. Add a large spoonful of the material to 1g of the processed foodstuff.
• Use baobab tree fruits (Tebaldi: Adansonia digitate), powdered if grapefruits are unavailable.
• A small amount of gelatin may be used (use of commercial gel).

Some problems with jams industry, during and post processing:
1\ Jam fluidity is cause by:
   • Excess of organic acid.
   • Increased period of time for cooking.
   • Pectin content low.
2\ Jam Browning is caused by:
   • Sugar burning.
   • Use of overripe fruits.
   • High cooking temperature.
   • Polluted metal utensils.

Problem solution:
- Do not use overripe fruits
- Use non-corrosive instrument, vessels etc.
1\ Rotten fruit jam:
   - Immature fruits
   - Utensils or instruments, not completely sterilized.
   - Not complying with preparatory hygiene conditions.

Treatment:
- Follow basic hygiene measures and methods for food cooking and preservation.
Planning for working place, equipment and packaging material:

1. Working place:
   Working place should be prepared according to criteria and conditions required to guarantee safety of the final product. A housewife can work in the kitchen while carefully making necessary arrangements, cleanliness of place and instruments. For larger production units, a room is arranged with tightly closed windows so as to get rid of flies and insects. The room must be aerated and with fixed floor to facilitate cleaning. The rooms should be supplied with washbasin, tap water and a large table. A shed (ra'oubbah) should be adjacent for sorting out raw materials.

2. Equipment required for processing jams and concentrated juices:
   • Plastic basins.
   • Plastic buckets of different sizes.
   • Large steel or plastic filters.
   • Different mincers (No. 5 and No. 10).
   • Tomato crusher.
   • Fruit squeezers.
   • Different spoons from wood and steel.
   • Scoops.
   • Funnels, steel or plastic.
   • Vessels: different sizes, from aluminum or plastic.
   • Steel knives, small and medium size.
   • Table coverings, plastic sheet.
   • Different sizes of charcoal stoves. A flat pan is preferred.
   • Boards: 20 cm*30cm for preparing raw material
   • A balance.
   • Brushes of different sizes for glass cleaning
   • Cloth linens.

3. Packaging material:
   When making jams at home one may use previously used glass jars. These should not be broken on edges, have air-tight lids and non-corrosive. They should be well-washed with hot water, soap and put in boiling water and dried before repackaging. In case of production for market used glass jars may be reused; they should be of the same volume to meet conditions of marketing and market supply. Also plastic cups may be used as these are locally available at suitable prices and with different volumes to meet different consumer needs and incomes. The plastic cups have the advantage of being disposable, withstand high temperature at packaging and easily close and welds from different available energy sources. They can be used wherever necessary conditions for jams industry are found.

   It is important to note that the empty space between the level of the jam in the package and lid should not be large so as to minimize air volume inside the package and hence inhibit the growth of microorganisms responsible for spoilage of food. It is noteworthy that after packaging has been completed packages should be placed in an up-side down position, hot and so lid area and empty capacity in the package gets sterilized.
Guava jam making

Sort out for mature guava fruits; discard the damaged and the insect infested. Then guava is well washed with water from soil and mud.

Procedure of work:
1- An electric blender may be used if available, no matter there will soft granules of guava left in the jam and also guava can be crushed.
2- Weigh guava, add sugar at 50 fruits: 50 sugar and then well mix the contents.
3- Place the mixture on fire and add pectin at 5 g for 1 kg of sugar (one small tea-spoonful). Dissolve pectin in a cup that contains sugar 5 times the amount of pectin well mix, dissolve in water and add to the contents while cooking.
4- Continue cooking and remove froth from top surface until signs of maturity appear i.e. by observing jam adherence to the edge of the spoon when falling. You can also know this by putting drops of jam in a cup full of cold water. The jam will precipitate at the bottom of the cup without being dispersed.
5- Add sodium benzoate, one gram per one kilogram of jam
6- Whole hibiscus flowers may be added as a coloring material, as needed or that permitted food colors may be added. The product may be without coloring and for red pulp guava the natural coloring may be satisfactory.
7- Citric acid is added (in case unavailable add filtered lemon juice) depending on taste.
8- Place jam on fire and continue stirring until foam disappears. Package while hot and then leave to cool down.

Mixed jam

Take pumpkin fully mature. Also take mature mango. Then pumpkin is chopped into slices, outer layer peeled and seeds discarded. Then cut into cubes and boil until it becomes delicate, then sieve and crush. Mango is cut into slices, juice extracted and added to the pumpkin at the ratio: 1:1.

Processing procedure:
1- Add sugar to a mixture of mango and pumpkin at 50:50 ratio, then well mix contents.
2- Place on fire for cooking and add pectin (small spoonful each for 1 kg of sugar.
3- Continue cooking, removing foam until signs of maturity appear.
4- Add preservative.
5- Add citric acid before cooking is complete.
6- Take jam out of fire, stir well, package and cool.
7- Store in refrigerator.
**Grapefruits jam**

**Contents:**
- One kilogram of grapefruit shell, boiled.
- Grapefruits juice: 3/4 of a cup.
- Sugar: 1 1/4 kg.
- Lemon juice: 1 1/2 soup spoonful.
- Water: 2 cups.

**Procedure:**
1. Decorticate grapefruits, immerse in water for 12 hours (water is renewed two times at least). Or boil in water and renew it.
2. Scratch the inner layer of the shell, remove seeds and fibres and cut into slices.
3. Submerge slices in water, boil, blend with a blender and filter.
4. Prepare a sugar solution with the given quantities of water and sugar, put on fire for 5 minutes and remove foam.
5. Add the boiled grapefruits shell, place on fire for 1/2 an hour, add the juice and leave the jam mature, take from fire and fill while hot.

**Mangoes jam**

**Contents:**
- Mangoes: 1 kg, peeled and seeds removed.
- Sugar: 3/4 kg
- Pectin.
- Preservative
- Lemon juice
- One cup of water

**Process:**
1. Wash fruits, smoothly peel and chop.
2. Put in a blender with some water, blend and filter.
3. Add the sugar dissolved in water to the mangoes, put in cooking container and add pectin.
4. Put on quiet fire and leave for some time, add lemon and test for maturity as indicated before.
5. Add preservative (1 g/1 kg of jam).
6. Package as before and store.
Water melon’s jam

Contents:
• Water melon shell: 2 kg.
• Sugar: 1/2 kg.
• Vanilla: 2 spoonful
• Lemon juice: 1/2 teacup

Procedure:
1) Remove outer shell with a knife, remove fibres, seeds residues from the inner layer and cut into cubes.
2) Put in a bowl, add sugar and leave for 3 hours.
3) Add lemon juice, vanilla, and place bowl on quiet fire until it reaches the boiling point and continuously stirring so that jam may not stick to the surface. Continue cooking for about an hour or until it matures.
4) Take back from fire and package in sterilized glass bottles.

Carrots jam

Contents:
• Carrots: 1 kg.
• Sugar: 1 kg.
• Citric acid: 10 g, or use lemon juice.
• One teacup of gum Arabic solution or pectin.
• One cup of water.
• Two spoonful of vanilla.
• Preservative.

Procedure:
1- Well wash carrots, peel and scratch outer peel and then chop into circular shapes.
2- Boil on enough water to submerge carrots, until tissues softens
3- Filter carrots, crush well and then add the boiled water and blend.
4- Add sugar to carrots at the ratio: 50:50, well mix and add pectin (at 5 g for each kilogram of sugar).
5- Place mixture on quiet fire with continuous stirring.
6- Add preservative (1 g/ kg of jam.
7- Add flavoring substance.
8- Add citric acid and continue cooking until maturity.
9- Take back from fire, well stir, package hot and then cool.
10- Store in refrigerator to be used at home or marketed in a short period.
Pumpkin jam

Contents:
- Pumpkin: 1 kg.
- Sugar: 1 kg.
- Two lemons’ juice.
- One lemon’ peel.
- Some ginger.
- One packet of jelly.

Procedure:
1- Wash pumpkin, peel, remove pulp, scratch and cut into cubes.
2- Put pumpkin in alternated layers with half of the sugar quantity; add lemon peel and ginger wrap in gauze and then leave for some time.
3- Submerge in one liter of water and then place on fire to soften.
4- Add the remainder of sugar, slowly dissolve. Add lemon juice, leave until boiling, remove foam as it appears and then add jelly.
5- Leave until it matures, test for maturity take back from fire and then package in sterilized glass jars.

Tomato jam

Contents:
- Tomatoes: 2 kg.
- Sugar: 3 kg.
- Vanilla: 2 spoonful.
- Water: half liter, or 2 cups.
- Preservative substance.

Procedure:
1- Tomatoes are washed, submerged in warm water for a period of time so that the thin peel is easily removed.
2- Peeled, cut into quarters and taken out of the container where sugar is added to the remaining water with traces of chopped tomato on it.
3- The indicated quantity of water is added, put on fire and then left to boil.
4- Add the preservative substance.
5- Add the tomatoes, vanilla, cinnamon and leave on fire, gently stirring from time to time till maturity.
6- Take back from fire; fill while hot in storing packages.
**Eggplant jam**

**Contents:**
- Eggplant: 1 kg.
- One kilogram sugar; one liter of water.
- Ten grams: lemon salt.
- One teacup of gum Arabic or pectin.
- Large spoonful, 10 g. of hibiscus (karkadie) powder.

**Procedure:**
Eggplant is peeled, cut into small cubes and washed. Put in a bowl, one liter of water added and left to mature on fire. Then mixed and measured: a cup of mixture to one cup of sugar. Place on fire, add lemon salt and stir until completely mature. Add gum solution or pectin, flavoring and hibiscus powder (10 g). Package while product is hot.

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**Hibiscus jam**

**Contents:**
- Hibiscus (karkadie): 1 kg.
- Sugar: 1 kg.
- Spoonful of lemon salt.
- Half packet of red jelly.

**Procedure:**
Wash and soak hibiscus in water for 8 hours, then filter. Boil the shells until mature, then mix, filter and add sugar. Put on fire and leave to mature. Add lemon salt, jelly and then package in glass jars while hot.
Juices
Hibiscus juice (syrup)

Contents:
- Hibiscus: 1 lb.
- Sugar: one and a half kilograms.
- Gum Arabic solution: one tea-cup.
- Citric acid: one small spoon, 5 g.
- Strawberry flavoring: one small spoon, 10 g.

Procedure:
Hibiscus is cleaned, washed and then soaked in 2 liter of water for 3 hours. Then juice is filtered, measured in a cup where sugar is added at the rate of 1 cup of juice to 1 cup of sugar and then placed on quiet fire until sugar dissolves and foam is continuously removed. Gum Arabic solution is added at the rate of 1 teacup to 1 liter of juice, lemon salt is added (or 5 g of citric acid) and then a large spoon (10 g) of strawberry flavoring is added. The juice is packaged while it is still hot.
Water melons juice

Contents:
- Water melons: 2 kg.
- Sugar: 1/4 kg.
- Strawberry flavoring: small spoonful, 5 g.
- Citric acid: large spoonful, 10 g.

Procedure:
Remove seeds and fibres using a knife. Chop into cubes, put in a mixer, add sugar, strawberry and citric acid. Well mix, package in a small bucket or beaker and put in the refrigerator; juice is served while it is cold.

Tomatoes juice

Contents:
- Tomatoes: 1 kg.
- Sugar: 1/2 pound.
- Citric acid: 5 g. or lemon juice.
- Strawberry flavoring: 5 g.
- Water: half liter.

Procedure:
Tomatoes are washed, chopped and put in the blender. Water, sugar, citric acid, flavoring is added, blended and filtered. Put in the refrigerator and serve the juice when it is cold.

Pumpkin Juice

Contents:
- Pumpkin: 1 kg.
- Sugar: 1 kg.
- Lemon salt: one spoonful.
- Baobab fruit powder: 10 g.
- Pineapple flavoring: 10 g.
- Drinking water: 1 liter.

Procedure:
Peel the pumpkin, cut into cubes and boil in a liter of water. Leave it to mature and then filter. When it cools down, blend in one liter of water. Add half kilogram of sugar, spoonful of lemon salt, baobab powdered and pineapple flavoring. Well mixed by blender, put in a beaker and move to the refrigerator and serve when it is cold.
Pickling
Pickling is the preservation of some vegetables and fruits in salt solution or vinegar in a certain concentration ratio. After pickling is complete the foodstuff should retain its characteristic colour, taste and firmness.

Requirements:
- Good growing media for bacteria processes.
- Optimum temperature.
- Preparation of salt solution or vinegar.

Pickling process is summarized as follows:
1- Dissolve salt at the ratio of one medium sized spoonful to one cup of water.
2- Food material intended for pickling are packaged in glassware.

Two methods of pickling:
1- Dry pickling as for olive and sardine.
2- In solution as for cucumber and other vegetables.

Important substances used in pickling:
• Salt: pure, white.
• Vinegar: good quality.
• Clean water.
• Spices: garlic, peppers and onions.
• Coloring substance.
Cucumber-carrots pickling:

Contents:
- Cucumber: 1 kg.
- Carrots: 1/2 kg.
- Spices: salt + peppers + garlic + parsley + chilies (capsicum) + a hot cup of water.
- Vinegar: 1/4 cup, of good quality.

Method:
1\ Cucumbers and carrots chopped.
2\ Prepare glass jars with pieces of onions, parsley, cardamom and garlic. Put cucumber and carrots; submerge in water, vinegar and salt added. Leave it for some time, to be used later.

Pepper Pickling

Contents:
- Cucumber.
- Carrots.
- Garlic, grinded.
- Red pepper.
- One cup of water, quarter of cup of vinegar and salt.

Procedure:
Cucumber and carrots are peeled, to which garlic, salt and red pepper and then stuffed into the green pepper. A glass jar is prepared where pieces of onions, parsley, garlic, chilies and cardamom are put. Then peppers are stacked on the contents, submerged in salt solution, vinegar and left to mature.

Lemon pickling

Contents:
- Lemon: 1 kg.
- Spices: green chili, salt and cardamom.
- Small sized onion.
- Cup of water.
- Quarter of a cup, vinegar.
- Cumin.
- Curcuma.

Method:
1) Blanch lemon; renew water until it is tasteless.
2) Holing lemon.
3) Prepare a glass jar where onion cut into circles is put. Then add parsley, garlic, green chilies, cardamom and cumin.
4) Lemon is piled submerged in vinegar and salt solution, curcuma and left to ripen.