TOMATO PROCESSING AND UTILIZATION

EXTENSION BULLETIN No. 241

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AKNOWLEDGEMENT

NAERLS wishes to acknowledge the financial support of Katsina state Government and FAO for the production of this bulletin. The bulletin has been updated with current information on Tomato Processing and Utilization. Utilization and value addition of these perishable crops are of great importance to the well-being of our farmers.

Authors:

Esther Okwori, Hadiza Dikko and Hilda Chindo

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Introduction

Tomatoes (lycopersion *esculenntum mill*) are wonderful, popular and versatile food that comes in over one thousand varieties. They vary in shapes, colour and size. They are widely grown and used all parts of Nigeria and other part of the world. Tomatoes is one of the most important vegetable crops in the world, they are the fourth most commonly consumed fresh vegetable and are also known as a power house of nutrient. Tomatoes have fleshy internal segments filled with slippery seeds surrounded by a watery substance. They can be red, pink, or yellow, orange. green, brown or black in colour. They have a sweetness that is complemented by a slight bitter and acidic taste. They can be eaten raw or cooked like other vegetables. Cooking bring out tomatoes rich warm sweetness. Tomatoes are of low-calorie vegetables, rich in vitamins C and E, good amount of mineral,

manganese, beta carotene, minerals, excellent sources of antioxidants and dietary fiber. Based on these, often recommend in cholesterol controlling and weight reduction diet programs.

During peak season (November to February), tomatoes are in abundance and large quantities go into waste because they are highly perishable. This can be prevented by processing tomatoes into various products for storage and use at home or for commercial purposes (value added products for income generation).Tomatoes eating quality is a matter of personal preference. Tomatoes should be harvested from the vine when fully ripe (yellow/red) showing that it has reached its full balance of sweetness and acidity potential, depending on the intended use, if it is harvested before this stage, at about 60 to 80 percent of ripening, it can be ripened in the kitchen by placing the fruit in a paper bag (not plastic) out of direct sunlight to maintain the right balance of humidity.

General guidelines for tomatoes selection for use

The key factors for selecting tomatoes vary depending on the intended use and Personal preference. Here are a few guidelines.

1. Select tomatoes that have good texture, firm and ripe for use in salads and sandwiches
2. Tomatoes skin should appear bright and fully ripe for eating.
3. Tomatoes should be firm to the point that when it is squeezed with the fingertips, no deformity should be visible when pressure is release pressure
4. Tomatoes should be free of darkened or bruised areas under the skin, which may be signs of mishandling and may make the tomatoes unusable after cutting
5. Tomatoes have been linked to food borne illness caused by salmonella bacteria. It can be contaminated by bacteria from soil, water and animal sources, contamination from human sources may occur before, during or after harvest, right up to the point of consumption.

Bacteria also on the tomato skin can be transferred to its internal flesh during cutting or slicing.

Food poisoning can occur when poorly washed utensils or cutting boards (especially those used to handle raw meat) are used to slice or cut tomatoes. For this reason, it is important that hands are washed with soap and water before and after preparing produce (tomatoes) also clean equipment, utensils and cutting surfaces should be used.

6. Un ripe tomatoes may have a tangy taste and should be stored until they are properly Ripe

Unripe tomatoes

Storing fresh tomatoes

1. Ripe tomatoes retain best eating quality for 2 to 3 days if stored at room temperature and far away from sunlight as this will warm the fruit and cause more rapid softening

2. Refrigeration is not recommended for fresh tomatoes as it can cause flavor loss. Ripening can be delayed by leaving it for a short time in a kitchen surface. Flavor loss is reduced if storage last for more than three days.

3. If there is need to refrigerate tomatoes; place them in the crisper lower section in a plastic container or a paper bag with few

opening to reduce water loss. Excessive water loss is noticed in tomatoes when wrinkling or puckering of the skin appears.

Nutrient contents of tomatoes

Tomatoes contain a multitude of vitamins and minerals that add to support health. Lycopene (a carotenoid phytonutrient widely recognized for its antioxidant properties) is the most prominent mineral in tomato followed by beta-carotene. Fresh tomato and tomato products are good sources of nutrients such as carbohydrate, vitamins (B^1, B^2, C, E and K) minerals like potassium, calcium, magnesium, zinc, dietary fiber, vitamin B6, folate, fatty acid derivatives (including 9-oxo-octadecadienoic acid), vitamins A in the form of beta carotene, and phosphorus. In addition, they are a good source of chromium, pantothenic acid, protein and iron. Dietary intake of tomatoes is associated with basic nutrients benefits and more which makes it a functional food.

Table 1: nutritive constituents of tomato, its role in nutrition and corresponding impact on health

Constituents	Established or proposed effect on human wellness
Vitamin C (Ascorbic acid)	Prevent scurvy, aids wound healing, healthy immune system
Vitamin K	Helps in keeping bones strong and healthy. It also prevent hemorrhage
Vitamin E (tocopherol)	Prevent heart disease, diabetes
Folate	Prevent birth defect, cancer, heart diseases
Fibre (dietary and total)	Diabetes, heart diseases
Potassium	Prevents hypertension, stroke arteriosclerosis
Chromogenic acid	Lower blood pressure in patient with hypertension
Naringenin	Stimulates DNA repair in prostate gland, thereby prevent prostate cancer
Carotenoids (including Bata carotene, lycopene)	Plays role in the prevention of cancers including pancreatic, skin, lung and breast
Glutamic acid	Metabolism of sugars and fats epilepsy, mental retardation muscular dystrophy, ulcers, and hypoglycemic

Source: Babalola (2010)

Health benefits of Tomato

1. **Cardiovascular Support:** Tomatoes reduces risk of heart diseases. This is an area of health benefit in which tomatoes truly excel. The antioxidant support and relation of fats in the bloodstream. Dietary intake of tomatoes, consumption of tomato extracts, and supplementation with tomato phytonutrients (like lycopene) have all been shown to improve the profile of fats in our bloodstream.

2. **Supports Bone Health:** Bone health is another area of growing interest in tomato research. Interestingly, the connection of tomato intake to bone health involves the rich supply of antioxidant in tomatoes.
3. **Anti-Cancer Benefits:** While not well researched for all cancer types, tomatoes contain Lycopene which has cancer preventing properties. Tomatoes also have antioxidants that provide strong anti-inflammatory support.
4. **Other Health Benefits:** Includes tomatoes have been linked with reduced risk of some neurological diseases (including Alzheimer's disease) in multiple studies. Tomato-containing diets have also been linked in a few studies with reduced risk of obesity.

Food processing and preservation

processing and preservation is a set of physical, chemical and biological processes that are performed to prolong the shelf life of foods and at the same time retain the features that determine their quality, like colour, texture, flavorand especially nutritional value. Food preservation is achieved by destroying enzymes and micro organisms using heat (blanching pasteurization), or preventing their action by removal of water, increasing acidity or using low temperatures.

Food is processed and preserved for:

1. The family food security depends on the regular supply of diversified and adequate food in terms of quantity and quality during the whole year.
2. The production of the majority of food is on a seasonal basis (practiced in certain period of the year). For this reason, we have to think of how to make the food availability during off season.
3. Food can rot (go bad) in different ways; by internal reactions between its components, by the reaction of the components with water and air or through enzymatic and

toxic effects, due to the development of micro organisms and to the presence of chemical elements. Food processing is done to slowing down the rotting process interfering into the physical and chemical reactions, reducing the development of unwelcome micro-organisms.

4. Increasing the food flavour;
5. Making the food more attractive for the consumer;
6. Facilitating its commercialization.

In summary: The food processing and preservation allows increasing the food availability beyond the area and the period of Production, guaranteeing its supply and increasing the food security at National and Household level.

Methods of food preservation

Food can be preserved using any of the following techniques cooking, oiling, adding chemical preservatives, sterilizing, freezing, drying, salting, fermenting and germinating.

Methods of preserving tomatoes

Tomatoes are generally considered to be acidic, but their pH can vary depending on the level or degree of ripeness and the variety. In general the more ripe the tomato, the higher (less acidic) is the pH. The pH of ripe tomatoes ranges from 4.3 to 4.9.

a. Freezing Tomatoes: Tomatoes may be frozen whole, sliced, chopped or puree. Tomatoes can be freeze raw or cooked, as juice or source or in a recipe of your choice. However since freezing causes loss of flavor, tomatoes should be well season just before serving:

1. Select firm, ripe tomatoes for freezing, sort the tomatoes, do away with spoilt ones.

2. Wash in a clean water and dry using a paper towel

3. To peel, just run the tomatoes under warm water in the kitchen sink and the skin will slip or peel off easily

4. Do not blanched for freezing, packed in a container and keep frozen. To use the frozen tomatoes, remove from the freezer a few minutes before use.

Sealed Tomatoes ready for Freezing.

b. Sun Drying: Drying removes most of the moisture from the tomatoes thus micro-organisms cannot grow and enzyme action is slowed down. Dried foods should be stored in airtight containers to prevent moisture from rehydrating the products and allowing microbial growth.

Method for sun drying tomato

1. Select tomatoes that are ripe, red, have firm texture and are free of diseases and mould

2. Wash the freshly harvested tomatoes in clean water in a large bucket/ plastic bowels

3. Cut the tomatoes into slices 0.5 cm thick

4. Sun-dry by spread the sliced tomatoes on a clean wooden, plastic, chromed or non-stick coated drying trays on raised plat form. Do not use galvanized screening as it could react with the acid in tomatoes.

5. During sun drying, the air must circulate around and under each tray so the trays should not be stacked, the netting should also be raised above the trays so that it does not touch the tomatoes.

6. Turn the tomatoes from cut side up to cut side down once a day for even or uniform drying. If the temperature at night drops below daytime temperature, bring the trays indoors or place them in a dry, sheltered area at night. This step is important; it prevents the dried tomatoes from reabsorbing moisture and making it darker.

7. To prevent contamination during sun drying, cover with mosquito netting.

   Use hot air dryer where available and if product is for commercial purposes.

8. Use solar dryer where available for a better quality product. Redness should be maintained after sun-drying.

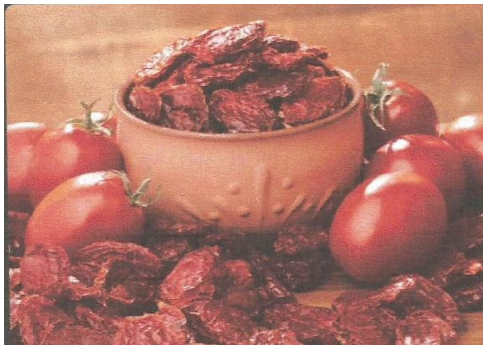
9. Fresh Sun-dried tomatoes

c. Tomato powder

1. Mill the dried tomatoes using a dry mill.

2. Sieve using fine sieve to obtain fine tomatoes powder/flour.

3. Package and seal in plastic bags, airtight jars or other suitable containers and store in cool dry place.



Method of sterilizing packaging materials (Plastic, Jars, Lids, corks and Bottles) used for tomato preservation

1. Wash the bottles, plastics, lids and corks with soap and water. Wash well with running water (tap water).
2. Half fill cooking pot with water, cover and boil for 15 minutes

3. Put lids, bottles, plastics and corks inside boiling water, boil for 5 minutes.
4. Take out the packaging materials from the boiling water using a clean wooden spoon.
5. Put them turned upside down on a clean cloth, out of air currents in order to avoid breakage. Allow them to cool.
6. Do not touch inside the pots/bottles, plastics, lids or corks with your hands.
7. Put the label on the Plastics/bottles (type of preserves, date of production, used ingredients, etc.).
8. The containers are now ready for use
9. All containers are filled up to ⅓ to allow for air circulation.

Tomatoes utilization

Tomato paste

Ingredients:

10 Fresh red matured Tomatoes

2 matured red tatasai

½ teaspoon of salt

2 Teaspoon sugar

1 milk tin vegetable oil

Sterilized bottles

Candle wax

Method

1. Wash tomatoes to remove dirt, seeds. Rinse in clean water
2. Wash tatasai, remove seeds
3. Grind tomatoes, tatasai and bring to boil.
4. Add two tablespoon sugar, simmer for thirty minutes
5. Add the vegetable oil, cook till water evaporate
6. Sterilize bottle, package cook tomatoes ⅓full and pasteurize in boiled water
7. Turn bottles upside down and seal edges with candle wax or sealing machine
8. Can be stored in a dry place for up to six months if not opened, once opened, it should be consumed at once.

Tomatoes pulp

Ingredient

Ripe, red and firm textured tomatoes that are free of diseases and mould

Method

1. Wash the freshly harvested tomatoes in clean water in a large bucket
2. Place the tomatoes in a cooking pot, add water and boil until they are soft and the skin peels off easily but do not peel them

3. Remove the tomatoes from the pot using a large perforated spoon and place them in another container

4. Mash using a large wooden spoon

5. Use a large household sieve to separate the tomatoes pulp from seeds and skin
6. Discard the skin and the seed or feed them to your animals and store the pulp.
7. Pulp can be used to make tomatoes jam and ketchup.

Tomatoes ketchup (a)

Ingredients: For 1kg ketchup

420g tomatoes pulp

150g sugar

300g vinegar

300g salt

70g onions

30g garlic and any other desired spices (blended) and mix well

Method

1. Put all the mixture on fire and boil, stir continuously with a wooden or metal spoon until mixture thickened
2. Allow mixture to cool after boiling
3. Pour into bottles or plastic packs and seal with lids or sealing machine
4. Put bottles or plastic packs in a pan of cold water
5. Continue cooling the bottled or plastic packs by changing water in the pan
6. Ketchup can be stored at room temperature for six months if not opened
7. Use as a tasty sauce.

Tomatoes ketchup (b)

Ingredients

2.5 kg tomatoes

3-4g garlic (15 to 16 medium garlic cloves)

3-4g ginger (3 pieces of about

3 inch ginger)

5-7 dry red chillies (deseeded and halved)

½ cup apple cider vinegar or white vinegar

1 tbsp salt

6-7 tbsp sugar

Method

1. Rinse the tomatoes well in clean water.
2. Slice the top eye parts of the tomatoes, roughly chop the tomatoes.
3. Discard spotted parts or peels.
4. Peel and rinse the garlic, ginger and roughly chop them.
5. Halve and deseed the dry red chilie.
6. In a large pot, casserole or a 4 to 5 litre pressure cooker, put all the chopped tomatoes, add the ginger, garlic, red chillies, vinegar, salt and sugar.
7. Mix well and cook on low to medium flame on the stove top until the tomatoes soften.
8. Keep on stirring at intervals.
9. When the tomatoes soften, switch off the fire. This softening takes about 25 to 27 minutes.

10. When the mixture is slightly hot or warm, blend the puree with an immersion blender or in a regular blender. If using a regular blender, then don't add too hot of the tomato mixture.
11. Make a smooth puree by straining using a strainer which is not very fine directly into a pot or a large sauce pan.
12. Re-boil the ketchup under low heat.
13. Pour the hot tomato ketchup in the sterilized jar.
14. Close tightly with the lid.
15. Let the ketchup cool and be kept aside for some hours or a day.

16. Store in the refrigerator and use after 1 or 2 days.
17. Serve tomato ketchup with any snack or appetizer.

Tomato Juice

Ingredients

1.4 kg very ripe garden tomatoes

2 Tbsp sugar (to taste)

1 teaspoon salt

Pinch black pepper

Bottles (sterilized for canning)

Method

1. Wash tomatoes and make a cross (X) in endways as shown
2. Dip in boiling water for about 2 -3 minutes until skins split
3. Take the tomatoes out from water, allow to cool and peel off skin and discard
4. Put skinned tomato and all other ingredients in pot and simmer for about 20minutes
5. Force mixture through a sieve and boil for another five to 10 minutes
6. allow to cool, Save Juice or preserve in the refrigerator or can

Tomato Jam (a)

Ingredients

1kg Tomato pulp
1 Kg Sugar
pinch or two of salt
2 tbsp Lemon Juice

Methods

1. Mix tomato pulp and sugar, place in a large cooking pan
2. Place the pan on the fire, allow to boil and stir continuously to avoid burning or sticking to base.
3. Boil until the mixture is thick
4. Add two tea spoon of lemon juice to every kilogram of jam, the lemon juice help the jam to set.
5. To test if Jam is set, take some jam in a spoon and dip into a cup of cold water, if the drop remains whole, the jam is ready. If it spreads out in the water, the jam needs further boiling.
6. If jam does not set even after additional boiling, add pectin (a thickening agent, one gramme of pectin to one kilogramme of tomato pulp)

7. If jam is to be stored for a year or more, a chemical preservative known as sodium benzoate has to be added at a concentration of 100 mg for each kilogram of jam. It should be added near the end of boiling point process.
8. Pour into sterile jars or bottles while it is still flowing
9. Fill sterile jars to within 3 cm from brim of the jar
10. Loosely cover the jars with lids and set aside for about five minutes to allow trapped air to escape. Tighten the lids and turn jars upside-down for two to three minutes to heat the lids to kill any germs

11. Allow the jars or bottles to cool to room temperature before labeling. Jam can be stored at room temperature for up to one year if not opened.

Tomato Jam (b)

Ingredients

2 Tbsp Juice
1Kg Ripe Tomato
3/4 Kg Sugar
a pinch or two of Salt
1Lemon

2 pcs of Cinnamon sticks (optional) Crush into coarse powder
5-6 Cloves (Crush into coarse powder)

Method

1. Treat tomatoes as for 1-3 of tomato juice
2. Chop tomato into very fine pieces or blend in a processor for few seconds.
3. Take a heavy bottom large pan. Pour tomatoes into it and boil for about 15 minutes in medium high flame to reduce liquid.
4. Add sugar, cinnamon and cloves powder. Mix well; bring mixture to boil stirring frequently in between. As it thickens, stir consistently and reduce the flame. Make sure not to overcook. Jam will thicken as it cools.

5. When the jam has reached a thick sauce consistency, add lemon juice, mix well and turn off flame. Cool for about 10 minutes; pour into clean sterilized glass bottles or jars.
6. When it cools completely, close the lid and refrigerate / store in a cool dry place.
7. Use when required for bread , buns, chapatti, etc

Problems to be encountered if tomato products are not properly handled

a. Mould growth on product particularly on the surface of jam: Not enough sugar added.

b. Poor hygiene: make sure utensils are properly clean and jars sterilized to prevent contamination which may lead to food poisoning.

Conclusion

Tomato are highly perishable and plentiful when in season, therefore there is the need to process and preserve to prevent wastage and prolong it shelf life at the same time retain the features that determine their qualities, like colour, texture, flavor and especially nutritional value. Tomatoes preservation is achieved

by destroying Enzymes and micro organisms using heat and also preventing their action by removal of water, or increasing acidity or using low temperatures. Processing and preservation of tomatoes using the above recipes can be carried out for both home consumption and income generation.

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