



# Reduced Sugar and Sugar-free Food Preservation

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## Role of Sugar in Energy Balance

Only in recent years has the amount of sugar consumed in the American diet been questioned. About half of the total energy consumed in the average U.S. diet is from carbohydrate. The most common carbohydrates are sugar and starch. About one third of our total consumption of carbohydrates is sugar (sucrose). Based on extensive studies on the roles of fat in human nutrition, health professionals recommend a reduction in total fat intake. With less fat in the diet, an increase in carbohydrate is recommended to balance energy needs. This increase is for more complex carbohydrates (starch and fiber) rather than sugar. These recommendations are stated in the *Dietary Guidelines* published in 1990 by U.S. Departments of Agriculture and Health and Human Services:

- Eat a variety of foods
- Maintain healthy weight
- Choose a diet low in fat, saturated fat, and cholesterol
- Choose a diet with plenty of vegetables, fruits, and grain products
- Use sugars only in moderation
- Use salt and sodium only in moderation
- If you drink alcoholic beverages, do so in moderation

## What is the Relationship of Sugar to Diseases?

Questions have been asked about the relationship of sugar to health problems including obesity, diabetes, heart disease, hypoglycemia, hyperactivity and cancer. To answer the questions, the U.S. Food and Drug Administration requested a review and evaluation by impartial scientists from the Federation of American Societies for Experimental Biology (FASEB). The scientists concluded that, "Other than the contribution made to dental caries, there is no clear evidence in the available information on sucrose that demonstrates a hazard to the public when used at the levels that are now current and in the manner now practiced." The statement on sugar made in the *Dietary Guidelines* follows:

“This guideline cautions about eating sugars in large amounts and about frequent snacks of foods containing sugars and starches. Both sugars and starches which break down into sugars—can contribute to tooth decay.”

“...The more often these foods—even small amounts are eaten and the longer they are in the mouth before teeth are brushed, the greater the risk for tooth decay. Thus, eating such foods as frequent between-meal snacks may be more harmful to teeth than having them at meals.”

“...Diets high in sugars have not been shown to cause diabetes. The most common type of diabetes occurs in overweight adults, and avoiding sugars alone will not correct overweight.”

## ***Sugar and Weight Control***

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Sugar provides a good source of calories. Calorie control is important because of the high incidence of obesity in the United States. It is estimated that about one in four (25 percent) of our adult population is obese. For this reason many people are attempting to limit sugar intake. From the nutritional perspective, many high sugar foods contribute relatively low levels of vitamins and minerals. The U.S. population is less active physically, thus requiring fewer calories to maintain weight. For most of us, food must be carefully selected to insure sufficient nutrients while controlling calories. Nutrient density is a method of assessing food value based on nutrients contributed compared to calories contributed. High sugar foods are not usually nutrient dense. A nutrient dense food would contribute equal or greater amounts of nutrients compared with calories.

## ***Sugar Consumption Patterns***

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The amount of sugar (sucrose) Americans eat, per person, has changed little during the last 40 years. According to the U.S. Department of Agriculture, annual per capita consumption holds steady at about 100 pounds. Less than 25 percent of this is packaged for home use. Most sugar is used in the manufacture of soft drinks, bakery products, confections and ice cream. We are, however, consuming greater amounts of other sweeteners. Many of the processed foods we consume contain sugars other than sucrose. A check of ingredient labels might include sweeteners such as fructose, corn syrup, dextrose, lactose, levulose and maltose. The annual per capita consumption for all sweeteners is estimated to be 130 pounds.

## ***Role of Sugar in Food Preservation***

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Sweeteners are considered an essential ingredient of most of the products of the canning industry, except vegetables. They act as preservatives and maintain desirable appearance, flavor, color and body in the products. Altering the type and amount of sugar in standardized preservation recipes will alter these characteristics. The principal sweeteners used in canning are sugar (sucrose), and corn syrup. The noncaloric sweetener, saccharin, is found in dietetic foods. Aspartame and Acesulfame K, noncaloric sweeteners, are approved for use in a limited number of foods.

# Types of Sweeteners Used in Food Preservation

## Caloric Sweeteners

**Sucrose:** The main sugar used in food preservation is sucrose or table sugar. Sucrose is manufactured from sugar cane and sugar beets. Sucrose provides four calories per gram or 15 calories per teaspoon. Sucrose is composed of two simple sugars; glucose and fructose.

**Fructose:** Fructose is a simple sugar. When combined with glucose, it forms sucrose. Fructose tastes sweeter and has been promoted as being a help in calorie control since equal sweetness requires a smaller amount and thus fewer calories. A consumer must use less to get fewer calories. Fructose is also more slowly absorbed in the intestine and results in lower blood sugar levels sustained over a longer period of time. Fructose has been promoted as a desirable sugar for use in diabetic diets because of this effect. However, fructose provides four calories for each gram, just as other carbohydrates. Fructose costs substantially more than sucrose.

## Noncaloric Sweeteners

**Saccharin:** Saccharin was discovered in 1879 and has been used in the United States since that time, a noncaloric sweetener that is at least 200 times sweeter than sucrose. Saccharin was banned in Canada because of a possible link to cancer, but is still in wide use in the United States, though it must carry a warning label. Saccharin can give a bitter aftertaste especially if too much is used.

**Aspartame:** Aspartame is composed of two amino acids and tastes remarkably like sugar, but is 200 times sweeter than sucrose. Aspartame, also called "NutraSweet," is blended with lactose and with an anti-caking agent and is sold commercially as "Equal." One packet of Equal contains four calories. It loses its sweet taste when heated so cannot be used for cooking or baking. No flavor change is noticeable when it is used in instant hot beverages, and it can be used in warm and cold foods as well. The largest use of aspartame is in soft drinks and beverages.

Most sweetening products are a combination of nutritive (calorie containing) and non-nutritive sweeteners. A carbohydrate such as lactose or dextrose is used as a carrier for saccharin or aspartame. The amount of carbohydrate contained in the carrier is usually small (four calories per packet) and is not a concern in a diabetic diet unless a large amount of the sweetener is used. Read the label for specific information. Examples of the non-nutritive/nutritive sweeteners are Sweet n'Low, Sugar Twin, Equal and Weight Watchers' Sweeteners.

**Acesulfame K:** Acesulfame K or acesulfame potassium was approved by the Food and Drug Administration in July 1988. Acesulfame K is an organic salt, containing sulfur and nitrogen, that is 150 to 200 times sweeter than sugar. It is marketed under the brand name Sunette and as Sweet One table-top sweetener. It is used in beverages, baked goods and candies. It has a good shelf life and is relatively temperature and pH stable.

**Cyclamate:** Cyclamate is a noncaloric sweetener used in Canada but banned in the United States. It was used for a few years and was then banned because of a possible threat of cancer. However, cyclamates are still used in Canada. They are being reviewed for use by Food and Drug Administration (FDA).

The addition of sugar to canned fruit aids in retaining the shape, texture, color, appearance, and flavor of the original product. When sugar is not used or reduced in canning,

there will be slight changes in these characteristics. When canning fruit without the addition of sugar, or at reduced levels, follow the tested directions for the product being preserved. USDA Agriculture Information Bulletin No. 539, *Complete Guide to Home Canning*, is a reliable guide. This bulletin is available at your County Extension office.

## **Sugar Free**

Fruit canned for a diabetic diet should have no sugar added. Use fully ripe, firm fruit for best flavor. Fruit being prepared for canning can be either hot packed or cold packed. Hot packing is preferred because it is possible to get additional natural liquid and flavor from the fruit.

The fruit can be packed in the prepared jars in the following ways:

- ✓1. The addition of only water (water pack)
- ✓2. The extraction of juice from the fruit itself
- ✓3. The addition of other unsweetened juice
- ✓4. The addition of noncaloric sweetener to the water or juice.

To extract juice from the fruit, crush thoroughly ripe fruit, add a small amount of water, and bring to a boil over low heat. Strain through a clean cloth, then pour over fruit in jars. Fruit might also be packed with the addition of unsweetened juice from another fruit for an interesting contrast in flavor. Pears canned in unsweetened pineapple juice and peaches canned in unsweetened orange juice are two examples. The fruit juice would be counted as another fruit exchange if both the juice and fruit were consumed in amounts equal to the exchange serving size.

Noncaloric sweeteners do not help retain color or texture in home preserved fruits. The use of an antioxidant such as ascorbic acid will result in better color when no sugar is used. Saccharin can produce an unwanted aftertaste and aspartame loses the sweet flavor when heated. Acesulfame K may give the best product if sweetened before processing, however the best results are generally achieved by adding sweetener at the time of eating if a sweetened product is desired. Many individuals prefer fruit canned with the addition of no sweetener (water pack).

## **Reduced Sugar**

The amount of sugar added to canned fruit can be reduced from the level suggested in the recipe to none, or any level between. The safety of the final product does not depend on the sugar content except for jams and jellies and the processing time is not affected by the level of sugar. Many people have reduced the sugar added in canned fruits to about half the suggested amount and find the product retains acceptable flavor, texture, appearance, shape and color.

## **Canning Containers**

Always use standard canning jars. Other glass jars may not tolerate the heat processing. Pint jars are usually the most appropriate size container for sugar-free fruits unless fruit is being canned without sugar for several members of the family. Half-pint jars are also available. The half-pint jars must be processed the same time as the pint jars. A jar is currently appearing on the market which has a pint and a half capacity. The processing time for these jars would be the same as for quart jars.

### ***Prepare***

Wash fruit thoroughly, but don't allow it to stand in water. Peel, core or pit fruit and then slice or halve. Small fruits might be canned whole.

### ***Pack***

Fruit which is hot packed is generally preferred, however, it might be safely cold packed as well.

### ***Hot Pack***

Preheat fruit over low heat in a small amount of water or juice. Pack into jars and cover with the cooking liquid to within one-half inch of top of jar.

### ***Cold Pack***

Pack raw fruit into jars. Add fruit juice or water to within one-half inch of top of jar.

### ***Seal***

Wipe any pieces of fruit from jar rim. Place lid, according to the manufacturer's directions.

### ***Process***

Fruit is placed on a rack in a container of hot water to the depth that covers the jars at least one inch.

The processing time should be determined from a reliable canning guide such as Home and Garden Bulletin No. 8. Altitude adjustment for processing time should be added for any elevation 1,000 feet or more above sea level.

## **Canning Procedures**

### **Vegetables**

Sugar is not added to most canned vegetables. A few recipes such as stewed tomatoes, tomato catsup, relishes and sweet pickles require sugar. All of these products require a heat treatment, so use of aspartame is not recommended. Saccharin might be used as a sweetener, however, some experimentation with amounts might be required to achieve an acceptable product.

**CAUTION:** Do not alter the amount of high acid ingredients, particularly vinegar or tomatoes, since safety of the product can be affected.

The directions given in any reliable canning guide can be used for canning vegetables. Canning vegetables requires the use of a pressure cooker. Processing times should include the addition of the altitude adjustment.

## **Freezing Fruits**

Any fruit which can successfully be frozen with the addition of sugar can be frozen without sugar. Follow the directions given in any reliable freezing guide and if the sugar. USDA in Home and Garden Bulletin No. 10, "Home Freezing of Fruits and Vegetables," is a reliable source of information and is available at your county Extension office.

Some fruits such as strawberries, raspberries and blueberries are preferred without the addition of any sweetener. Some of the more sour fruits might require added noncaloric sweetener. Caution should be used in adding saccharin because the addition of too much causes a bitter flavor. The fruit can be frozen dry or packed in water or juice with or without noncaloric sweetener. For convenience, in a diabetic diet, fruit can be packaged in one exchange size servings individually in small freezer bags or jars. This provides a simple way of serving fruit and does not require thawing a large package of frozen fruit. Unsweetened fruit juices also freeze well.

### ***Select***

Select fully ripe but firm fruit.

### ***Wash***

Thoroughly wash fruit. Never allow fruit to stand in water. Lift from water and drain.

### ***Pare***

It may be necessary to peel or trim and remove pits or seeds or stems. Cut fruit in the desired size pieces.

### ***Pretreat***

To keep light-colored fruit from darkening, it is desirable to treat with an anti-darkening agent. Pure ascorbic acid or commercial preparations containing ascorbic acid are frequently added. This is very effective in preserving color and flavor of fruit and adds nutritive value. Other treatments such as lemon juice, salt water, steam and blanching might also be used. The noncaloric sweetener may be added with the anti-darkening agent or the fruit may be frozen without added sweetener.

### ***Pack***

Cold fruit should be packed in containers which are moisture and vapor proof. Rigid containers lend themselves to easier stacking in the freezer, however, plastic freezer bags or freezer wrap of sufficient thickness and glass jars provide good packaging for frozen food. Seal according to directions for packaging materials.

### ***Freeze***

Freeze fruits soon after they are packed. Put them in the freezer as you have them ready, with space for air circulation between containers. Freeze at 0° F or below.

## **Vegetables**

Most vegetables which are normally cooked also freeze well. No changes are needed in the directions for use in a diabetic diet or sugar reduced diet.

## **Dehydration**

### **Fruits**

Dehydrated fruits are commonly processed without the addition of sweeteners. The typically concentrated-sweet flavor in dried fruit is due to the loss of liquid. The serving size of the dehydrated fruit might seem very much smaller because of the loss of large amounts of water. The sugar content is essentially the same after drying as in the fresh fruit per piece, but much more concentrated.

## **Fruit Leather**

Fruit leather provides an interesting and fun diversion from the other forms of dried fruit. It can be made without the addition of sugar. If the fruit is very tart, non-caloric sweetener can be added to the puree prior to dehydration.

### ***Select***

Select fully ripe, not over-ripe fruit. Sort and wash.

### ***Prepare***

Remove stems. Cut away blemishes and pare or peel if necessary. Pit, core or remove seeds if necessary. Cut fruit into slices or chunks that can be pureed or ground; make the puree immediately to avoid excessive browning.

## **Fruit Puree**

### ***Cooked Method***

The retention of color of light fruits is better by using the cooked method. This method is recommended for hard fruits that must be softened before being pureed. Cook pieces of fruit in a heavy pan for 15 minutes, or until soft, using a minimum amount of water to keep fruit from sticking. Puree fruit when cool or grind in a food mill, using the finest blade. Soft fruit can be pureed then heated for 10 min. to inactivate enzymes and retain color and flavor.

### ***Uncooked Method***

Puree pieces of raw fruit in blender. This method is faster but less satisfactory for retaining original color and flavor.

### ***Canned Fruit Puree***

Any canned fruit is suitable for fruit leather. Puree or grind drained whole fruit.

### ***Preserving Fruit Color***

The color of light fruit leather such as apple, peach, apricot, pear and banana can be preserved by adding ascorbic acid or sodium bisulfite\* as follows:

## **Ascorbic Acid**

**Crystals:** Add ¼ teaspoon to 2 cups puree and mix well.

**Tablets:** Crush 750 milligrams, add to 2 cups puree and mix well.

**Commercial mixtures containing ascorbic acid:** Follow label instructions for individual product.

## **Sodium Bisulfite\***

Add ¼ teaspoon to 2 cups of puree and mix well. Sodium bisulfite can be purchased at the drugstore.

\*Sodium bisulfite can cause severe allergic reaction to a few sensitive people. It is recommended that sensitive individuals avoid sulfites.

## **Adding Noncaloric Sweetener**

The addition of noncaloric sweetener or a variety of spices is optional and a matter of taste preference.

### ***Drying***

Line a shallow pan approximately 12"x 17" with plastic wrap. Pour 2 cups of puree on pan and spread by tipping pan to an even thickness of  $\frac{1}{8}$  to  $\frac{1}{4}$  inch. Make thickness as uniform as possible. Dry in oven, dehydrator or sun. After sufficient drying, leather should feel pliable and leathery. For convenience, puree four exchanges of fruit, and pour onto four plastic-lined plates or pie tins. After drying, roll individual servings in plastic wrap.

### ***Storing***

Fruit leather can be rolled like a scroll within plastic wrap. Store in plastic freezer bags or tightly sealed containers in a cool, dry place. For long-term storage, refrigerate or freeze.

## **Vegetables**

Dehydrated vegetables can be substituted directly for fresh, canned, or frozen vegetables in a diabetic or reduced sugar diet. Serving size should be determined after rehydration.

## **Jellies and Jams**

Four ingredients are essential in making typical jelly and jam products—fruit or fruit juice, pectin, acid and sugar. Some fruits are normally high in both acid and pectin. Sugar must be present in rather large proportions to precipitate the pectin and cause a gel to form. Jellies and jams made with reduced or no sugar and traditional pectin will not have the typical gel formation. Gelatin can be used to give body and firmness to the jelly when sugar is reduced or omitted. Some recipes for low-sugar or sugar free jam call for the use of the traditional pectin products. Without sufficient sugar, these jam recipes still produce an only somewhat set or thickened jam.

A few new pectin and pectin-like products are appearing on the market which require no or less sugar. Low methoxyl pectin can form a gel with much less sugar. Sure-Jell Light Fruit Pectin and Mrs. Wages Light Home-Jell are two such products.

## **Reduced Sugar**

Sure-Jell Light contains low-methoxyl pectin which causes a gel with about one-third less sugar than regular pectin. Mrs. Wages Lite Home-Jell does not require the addition of any sugar, however, it is recommended that some sugar will improve the taste quality of the jam or jelly.

## **Sugar Free**

Mrs. Wages Lite Home-Jell can also be used with no added sugar or with noncaloric sweetener. Recipes are given for both jams and jellies.

A pectin-like product is available from the MCP Foods Company called Slim Set. It is cooked with crushed fruit or juice resulting in a modified jelly or jam. Noncaloric sweetener can be added if desired, depending on taste preference. The product does contain small amounts of available carbohydrate. An average fruit ( $\frac{1}{2}$  cup per fruit exchange) contains 10 grams carbohydrate, which is equal to 40 calories. When prepared according to the directions, the product would yield 2 grams of carbohydrate and 8 calories per tablespoon.



Modified starch products can also be used to thicken jams with reduced sugar content. Directions indicate that a small amount of sugar used in the preparation will improve flavor, color and texture. However, for a sugar-free diet, use of saccharin only gives an acceptable product.

The following recipes incorporate several of these suggestions. A little experimentation might be required to find a preferred jelly or jam.

### ***Jelly***

2 cups unsweetened fruit juice  
4–6 teaspoons unflavored gelatin  
2 Tablespoons lemon juice (may be omitted with tart fruits)  
Artificial sweetener equivalent to the sweetness of one-half to one cup of sugar

Sprinkle the gelatin over the cold fruit juice in a large saucepan. Add lemon juice and stir over high heat until boiling. Boil exactly one minute. Remove from heat. Add artificial sweetener. Pour into sterilized jars and seal. Store in refrigerator. Yield: Approximately 2 cups.

### ***Jam***

1 quart fruit  
2 Tablespoons lemon juice  
1 package powdered pectin  
Artificial sweetener equivalent to 1 cup sugar

Crush fruit, place in large saucepan and add lemon juice. Stir in powdered pectin and stir until boiling. Boil 1 minute stirring constantly. Remove from heat; add artificial sweetener. Pour into sterilized jars and seal. Store in refrigerator.  
Yield: Approximately 3 cups.

### ***Fruit Buffer***

1 quart unsweetened fruit puree  
¼ teaspoon ground cloves  
¼ teaspoon ground allspice  
2 Tablespoons lemon juice  
Artificial sweetener equivalent to 1 cup sugar

Place fruit puree in large saucepan; stir in spices and lemon juice. Cook slowly until thickened, stirring frequently. Remove from heat. Stir in sweetener. Pour into sterilized jars and seal. Store in refrigerator. Yield: Approximately 3 cups.

### ***Peach-Pineapple Spread***

4 cups drained peach pulp (procedure as below)  
2 cups drained unsweetened crushed pineapple  
¼ cup bottled lemon juice  
2 cups sugar (optional)

This recipe may be made with any combination of peaches nectarines, apricots, or plums.

This recipe may be made without sugar or with up to 2 cups, according to taste or preference. Non-nutritive sweeteners may be added. If aspartame (a low-calorie nutritive sweetener) is used, the sweetening power of aspartame may be lost within 3 to 4 weeks.

Yield: 5 to 6 half-pints

**Procedure:** Thoroughly wash 4 to 6 pounds of firm, ripe peaches. Drain well. Peel and remove pits. Grind fruit flesh with a medium or coarse blade, or crush with a fork (do not use a blender). Place ground or crushed fruit in a 2-quart saucepan. Heat slowly to release juice, stirring constantly, until fruit is tender. Place cooked fruit in a jelly bag or strainer lined with four layers of cheesecloth. Allow juice to drip about 15 minutes. Save the juice for jelly or other uses. Measure 4 cups of drained fruit pulp for making spread. Combine the 4 cups of pulp, pineapple, and lemon juice in a 4-quart saucepan. Add up to 2 cups of sugar, if desired, and mix well. Heat and boil gently for 10 to 15 minutes, stirring enough to prevent sticking. Fill jars quickly, leaving ¼-inch headspace. Adjust lids and process.

Recommended process time for Peach-Pineapple Spread in a boiling-water canner:

Process Time at Altitudes of:					
Style of Pack	Jar Size	0-1,000 ft	1,001-3,000 ft	3,001-6,000 ft	Above 6,000 ft
Hot	Half-pints	15 min.	20 min.	20 min.	25 min.
	Pints	20 min.	25 min.	30 min.	35 min.

### ***Refrigerated Apple Spread***

(made with gelatin)

2 Tbsp. unflavored gelatin powder  
 1 quart bottle unsweetened apple juice  
 2 Tbsp. bottled lemon juice  
 2 Tbsp. liquid low-calorie sweetener  
 Food coloring, if desired

Yield: 4 half-pints

**Procedure:** In a saucepan, soften the gelatin in the apple and lemon juices. To dissolve gelatin, bring to a full rolling boil and boil 2 minutes. Remove from heat. Stir in sweetener and food coloring, if desired. Fill jars, leaving ¼-inch headspace. Adjust lids. Do not process or freeze. Caution: Store in refrigerator and use within 4 weeks.

**Optional:** For spiced apple jelly, add 2 sticks of cinnamon and 4 whole cloves to mixture before boiling. Remove both spices before adding the sweetener and food coloring.

### ***Refrigerated Grape Spread***

(made with gelatin)

2 Tbsp. unflavored gelatin powder  
 1 bottle (24 oz.) unsweetened grape juice  
 2 Tbsp. bottled lemon juice  
 2 Tbsp liquid low-calorie sweetener

Yield: 3 half-pints

**Procedure:** In a saucepan, soften the gelatin in the grape and lemon juices. Bring to a full rolling boil to dissolve gelatin. Boil 1 minute and remove from heat. Stir in sweetener. Fill jars quickly, leaving ¼-inch headspace. Adjust lids. Do not process or freeze. Caution: Store in refrigerator and use within 4 weeks.

## ***Freezer Jam***

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The popularity of freezer jam has increased over the last several years. The fresh fruit flavor is retained since no cooking is required for freezer jam. The gel is usually less firm. The proportion of sugar in regular freezer jam is about the same as in cooked jam.

### **Reduced Sugar**

The following recipe is from General Foods and uses approximately one-third the sugar of regular freezer jam and low methoxyl pectin.

#### ***Frozen Strawberry Jam***

4 cups prepared fruit (1  $\frac{3}{4}$  quart fully ripe)

1  $\frac{3}{4}$  cups sugar

1 package Sure-Jell Light Fruit Pectin

1 cup light corn syrup

Stem and thoroughly crush, one layer at a time, about 1  $\frac{3}{4}$  quarts strawberries. Measure 4 cups into a bowl. Measure sugar. Combine pectin with  $\frac{1}{4}$  cup sugar. Gradually add pectin mixture to fruit, stirring vigorously. Set aside for 30 minutes, stirring occasionally. Add corn syrup; mix well. Gradually stir in sugar until dissolved. Ladle quickly into scalded containers. Cover at once with tight lids. Let stand at room temperature overnight; then store in freezer. Small amounts may be covered and stored in refrigerator up to three weeks. Makes 6 cups or 6 (8 oz) containers.

### **Sugar Free**

No recipes are presently available for frozen jam made with artificial sweeteners or with no sugar added. However, the following statement is from the NutraSweet Center, G.D. Searle & Co:

“EQUAL can be used in making freezer jams and jellies. It should be added at the end of preparation, just before the mixture is placed in the freezer.”

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