

Jelly Making.

By Mamie Cunningham.

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There are two kinds of food to which the term jelly is applied; first, that made by boiling fruit juices with sugar, and secondly, that made by adding gelatin, or similar substance, to fruit or vegetable juices. Only the former, that is, those made without the aid of special gelatinizing material, will be treated in this article.

The experiments with jelly naturally come under three divisions. These are chemistry, horticulture and domestic science. Under chemistry comes the chemical alternations involved in the formation of jelly, the composition of the juices and jellies, the change made by the addition of sugar to fruit juices and experiemnts of similar nature. To the division of horticulture belongs the testing of different kinds and varieties of fruit to ascertain their value as jelly fruits. Such experiemnts as the method of preparing the fruit, the length of time of boiling, the addition of sugar and methods of keeping the jelly belong to the division of domestic science. Topics included under the head of chemistry and horticulture are touched upon in this treatise but those relating to domestic science form the principal part.

The process of jelly making is a subject upon which very little has been written. Some of the experiment stations have made some tests in the work and all magazines and books on cooking contain recipes for jelly and possibly some few of them a few directions, but full discussions such as can be found on other topics in domestic science are very scarce. Most housewives who make good jelly do so through no skill they have acquired from books but from experience. However it must be admitted that the best instructor in the art of jelly making is experience. The kinds of fruit vary so widely in

their jellying quality, and even the same varieties differ so because of the conditions under which they were picked, the stage of ripeness, and similar reasons, that hard and fast rules can not always be given. Yet there are many general rules and principals which should be followed and there is no reason why a house wife should not be acquainted with them.

In order to understand the chemical principal of jelly it is necessary to know something of the composition of unripe fruit and the change which occurs in ripening. The constituent which given to unripe fruit its hardness is called pectose. As the fruit ripens pectose is changed to pectin by the action of heat and vegetable acids. Pectose is also changed to pectin when boiled in the presence of organic acids and calcium salts. Fruits contain both calcium salts and organic acids and the supposition is that when fruit juice is boiled the pectin combines with the calcium salts and a coagulum is formed. If the boiling is carried too far the pectin is changed to meta-pectic acid and this is the reason the the over boiled jelly fails to set. The constituents are in the best condition to form jelly when the fruit is under-ripe or just ripe. Jelly can not be made from fruit that is too ripe or juice that has fermented as pectin loses its gelatinizing power under these conditions.

The amount of pectin, acid and calcium salts in a fruit is what determines its value in making jelly. An acid fruit is considered the best unless its quantity of pectin is too small, as is the case with the strawberry. The acid taste of a fruit does not always prove that the quantity of sugar is small. For instance the currant is considered one of the sourest of fruits while the peach has a very sweet taste. Yet the chemical analysis of the peach and the currant shows the the peach contains .421 per cent acid and 5.05 percent sugar and the currant 1.805 percent acid and 6.91 percent sugar. The

currant contains the larger amount of sugar but its sweetness is more than counteracted by the acid present.

Both the peach and the strawberry are poor as jelly fruits. In the case of the latter the amount of pectin is too small to give the proper gelatinizing power. The peach contains a large quantity of pectin but it is so poor in calcium salts that coagulation will not take place. One of the easiest fruits from which to secure the right consistency is the apple and for this reason it is used as a basis for those fruits which jell with difficulty. The flavor of apples being very mild the addition of higher flavored fruits adds to the quality of the jelly. Both the grape, especially the uncultivated varieties, and the quince are excellent for making jelly but the small fruits are not so good.

Since the manufactured jellies are placed on the market in large quantities a few facts concerning them are interesting in ~~this~~ connection with home-made products. The Division of Chemistry of the United States Department of Agriculture has made some thorough tests of the composition of manufactured jelly and the result of the work is contained in chemistry bulletin No. 66. The following statements are taken from that investigation.

There are all grades of jelly on the market, from the very lowest which are composed of very little fruit, to the best which by analysis seems to be as pure as the home-made product. There are various foreign substances which may be used in the wholesale production of jelly, such as preservatives, starch, gelatinizing agent, artificial sweetening material and coloring matter. The preservatives, coloring matter and some kinds of sweetening material are very apt to be injurious while the others are harmless. The objections to the uninjurious foreign materials is that they are being sold under a false name and besides being cheaper than the material for which they

are substituted probably obtain less nutritive value. For instance, glucose is often used for cane sugar. It is not only cheaper but has a much greater sweetening power and then its value as a food is small in comparison with that of cane sugar.

Starch may be added to give consistency but traces of it may be due to the starch in the fruit. This is often the means of detecting foreign fruit in jelly. For example, such fruit as strawberries contain slight traces of starch while the apple, if not too ripe, contains considerable. Since apples are often used as a basis for more highly flavored fruits if jelly labeled strawberry is found to contain starch in a small quantity it is probably due to the use of apple.

The gelatinizing agents which may be used are gelatin, agar or some fruits of high gelatinizing power. Gelatin contains considerable nitrogen and if present would bring the amount of protein far above normal. Agar has a much higher gelatinizing power and has a composition very similar to the pectin bodies of fruit. Although it is claimed that both agar and gelatin are used in jelly the samples examined by the division of chemistry showed no trace of them.

It would seem that the addition of preservatives to jelly would be very unnecessary as the consistency of the product prevents fermentation but the presence of them in the manufactured product is explained by the fact that fruit juices are often kept several weeks before being used. In this case preservatives are added to the juice to prevent fermentation. While the highest grades of jelly were found to be very pure some few of them contained preservatives. Of the cheaper grades preservatives were used in the great majority of cases.

Coloring material is generally added when the inferior fruit is used and is also important in preserving the natural color when the jellies are exposed to sunlight as is necessary when placed on

the market. It is possible by the use of coal tar color to give jelly made of starch and glucose such a good color that it will pass for the pure product. It is undoubtedly true that the manufactured jelly which is being placed upon the market is of superior quality to that of former years. Yet there is still much chance of adulteration. Care should be taken in the selection of the manufactured product, especially for the sick room, that nothing but the purest is obtained.

The first step to be considered in making jelly is the selection of the fruit and upon this depends, to a considerable extent, the success of the finished product. According to the chemical nature of fruit it is in the best condition to produce jelly when a little under-ripe. Some of the fruit, especially grapes, are the best while yet quite hard. For in the process of ripening some, or all, the pectin alters to metapectic acid and prevents jelling. Some of the cultivated varieties make good jelly having a reddish color resembling that of plums, when just beginning to color. An experiment in the use of green blackberries gave a well flavored, dark colored jelly with good consistency.

The quantity of sugar and water in fruit will vary with the season. Thus in a hot, especially sunny season the amount of sugar will be great while in a cloudy, cooler year it will be less. The amount of water in such fruits as strawberries and blackberries will be much larger after a rain and considerable, perhaps excessive boiling will be necessary to get rid of that extra supply. It is better therefore to pick such fruits on a dry day. The rule to be followed then, in selecting fruit is that it should always be fresh and a little under-ripe.

The commonest method of extracting the juice for jelly is by cooking the fruit. As a general rule the juicy fruits contain an ex-

cess of water when picked and the more that is added the harder will it be to obtain the proper consistency. For this reason the best way to prepare the juice from such fruits as currants and grapes is to crush enough of them to give sufficient liquid in which to boil them. A similar method which has been successfully tried with grapes and apples is to extract the juice without cooking the fruit at all and then proceeding in the usual manner. Another method of extracting the juice without the addition of an excess of water is to cook the fruit in a double boiler. A stone jar set in boiling water and containing the fruit to which no water has been added is one way of accomplishing this. It takes sometime for the juice to separate from the fruit, an hour in case of the blackberries, but the result is worth the trouble.

The larger fruits must be boiled with a certain quantity of water in order to obtain the juice. The proportion of water and fruit is from three to four quarts of water to eight of fruit, varying with the juiciness of the fruit. It should be cooked until soft but not until pulpy. Stirring breaks the fruit into small particles causing the juice to be cloudy and should be avoided as much as possible. The best plan is to simmer the fruit gently rather than boil too hard and long as this is apt to destroy the gelatinizing properties and break up the fruit.

In straining the liquid a double cheese cloth or flannel bag should be used. If a clear jelly is desired when the fruit is poured into the bag it should not be squeezed but the juice allowed to drain through. If after draining through it is not clear enough, or if an extra clear jelly is desired the juice may be allowed to stand awhile and then poured through the bag again, the settlings not being used. The juice which is extracted by squeezing may be used for second grade jelly, or in jam or canned fruit. The proportion of juice which should be obtained is three quarts of strained juice from eight quarts

fruit and four quarts water.

The utensils used in making jelly, as well as in any cooking of fruit, should be porcelain lined or enameled. Such metals as iron or tin are acted upon by acid in the fruit and should never be used. Wooden spoons are better than metal ones and silver knives than steel.

The juice should not be allowed to stand long enough for fermentation to begin or the pectin will lose its gelatinizing power. Better success is obtained if only a small quantity of jelly is made at one time for in making a large quantity the process of evaporation is so slow that the formation of ^{meta-}pectic acid takes place and consequently the gelatinizing power is destroyed. For the same reason it is not a good plan to simmer the juice but it should be boiled steadily all the time.

There are two general methods of adding sugar to the juice. The first method is that of adding the sugar after the juice has boiled from ten to twenty minutes. The sugar is heated before being added so as not to lower the temperature of the boiling juice any more than can be helped. In the other method the sugar is added to the juice and stirred until dissolved, before boiling. The principle of the first method depends upon the fact that cane sugar is changed to glucose and dextrose is boiled too long and this condition is not a desirable one. By adding the sugar later in the process so that it is not cooked so long this danger is avoided and the jelly is of better quality.

There are several ideas in regard to the amount of sugar that should be used. Some authorities add equal amounts of sugar and juice while others use only half the amount of sugar. When the smaller amount of sugar is used the fruit juice must be boiled until concentrated enough to give the proper proportion of sugar. Jelly made this way has more of a tart taste and is all right if such a taste is

agreeable. The danger of adding too much sugar is that the jelly is apt to crystallize, or candy. Never more than an equal part of sugar should be used and if the fruit contains a high percentage of sugar the quantity should be less.

Jelly can be made from some fruits with out the addition of sugar and this method is sometimes used by manufacturers. The experiment which was made to prove this was with apples. The fruit was run through a small press and then strained. The juice was then simply boiled down until the right consistency was reached. Of course a large amount of juice was necessary to make a fair amount of jelly, twelve parts of juice making one part jelly. Jelly made in this manner has a very tart taste which is especially pleasing to some people.

There are several ways of testing jelly to learn when it has reached the right consistency. One common method is to drop some of the juice upon a cold plate to see if it will "set", or a similar plan, to watch the juice as it drops from the spoon and note the consistency. One can usually become so expert in testing jelly by either of these plans that a poor result is rarely obtained. Another method that is very often given in recipes for jelly is testing by the length of time. This, however, is very uncertain as fruit varies so in general conditions.

The best method by which to make the test is with the saccharometer, or sirup gauge. This is an instrument used to ascertain the amount of sugar present in any solution. It is a graduated tube with a weighted bulb, registering from 0° to 50°. If it is placed in pure water the bulb will rest on the bottom of the vessel but as sugar is added the bulb will begin to rise and the proportion of sugar will be registered. In testing fruit juice when the bulb registers 25 the sugar is in the right proportion to form jelly. This holds true no

matter what kind of fruit it used. By means of the saccharometer and care in boiling there is little danger of making a failure.

All glasses or utensils into which the jelly is poured should be sterilized before using. Sterilizing does not simply mean dipping in hot water but boiling for fifteen or twenty minutes. The glasses should be placed in cold water and brought to the boiling point gradually. When the jelly is ready to be poured into them they should be taken from the boiling water and set in a shallow pan containing hot water, or a hot cloth wrapped around them.

As fermentation germs require oxygen and the consistency of jelly does not admit oxygen to the interior, jelly is not attacked by spores and yeast plants. Yet it should be protected from mold, dust and evaporation. One of the simplest ways of covering the jelly is by the use of paraffin. If it is poured over the top thick enough, about one fourth of an inch being sufficient, and care is taken that it is not jarred loose from the edges, the probabilities are that the jelly will be kept free from molds. The great objection to paraffin, however, is that if molds once start they will develop in it and the result is the jelly is worse off than with no cover at all. Results with jelly kept from last fall until this spring show that where mold once gets a start under the paraffin the taste of it penetrates through the whole glass. In glasses that were not covered at all the mold only acted as a cover and the jelly was in perfect condition. A better method than that of the use of paraffin alone is to place paper dipped in alcohol directly over the jelly and then pour paraffin over that. Alcohol destroys the mold which may find its way through the cover in case it is cracked or jarred loose from the edges.

There are few delicacies more pleasing and useful than well flavored jelly of good consistency. Yet unless they are well flavored and especially of good consistency they have little place in the diet-

ary. Jellies that are hard and tough or thin and sirupy are a dissap-
pointment in the extreme and had better not be used at all. By
following some reliable directions and with a little experience it is
possible for the majority of housewives to have a supply of perfect
jelly ready for instant use.