

## A Standard Process for Cooking Rice for Experimental Purposes\*

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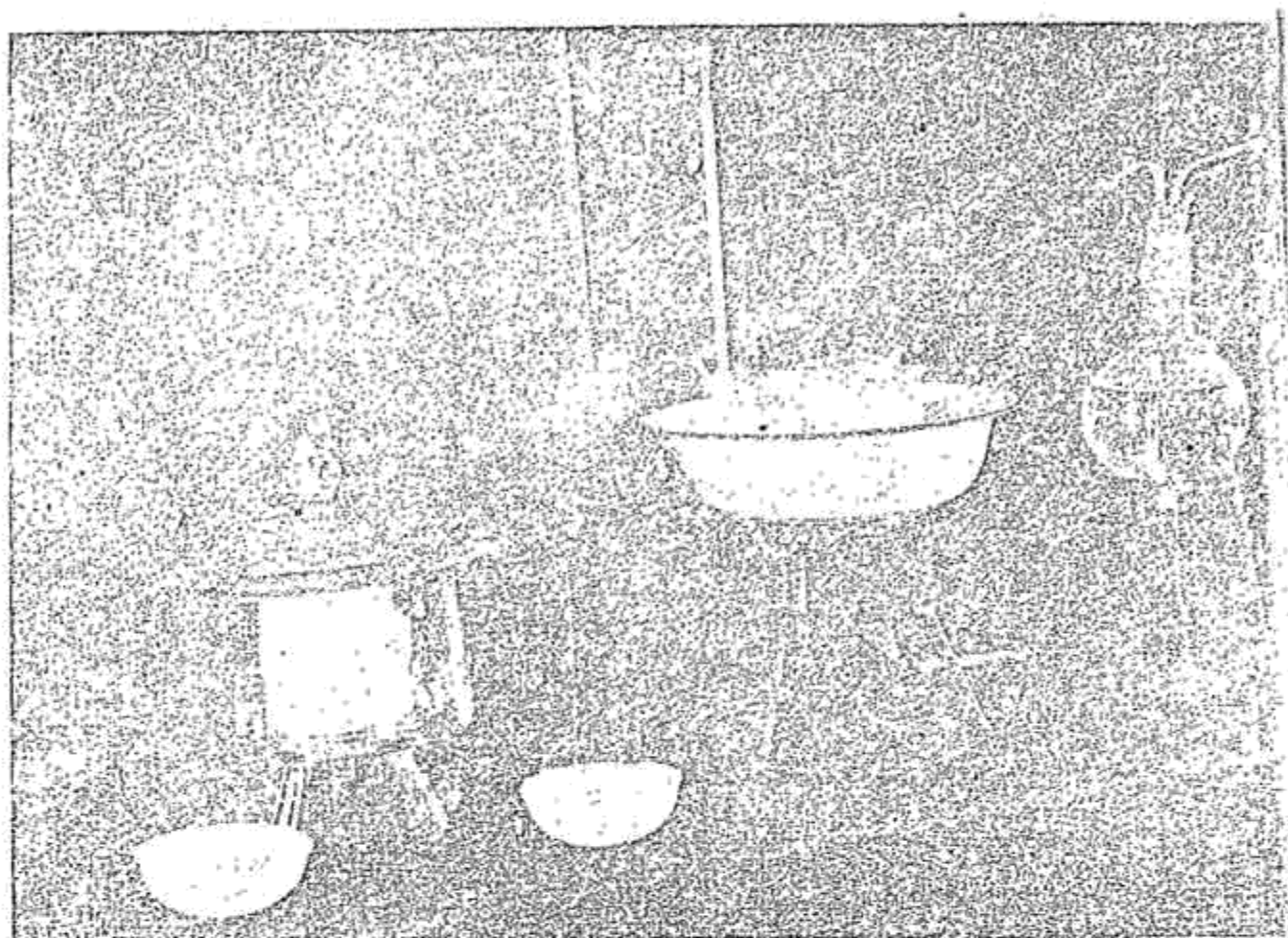
Volume expansion on cooking has generally been accepted as a factor of quality in rice. Reported values for this factor are however often vitiated by the lack of any standard technique for its determination. Kondo (1928) and Kondo and Okamura (1930, 1933, 1935, 1937, 1938) boiled rice in a kettle and determined volume by water displacement. Srinivasan and Mudaliar (1938) cooked rice in a boiling tube  $1\frac{1}{2}'' \times 8.0''$ , heated in a water bath, and measured the volume of the raw and cooked rice in a specially improvised dilatometer. Verghese (1948) during the course of an investigation on Quality in Rice, found it necessary to cook for estimating the expansion in volume and to collect the "Kanjee"—the rice water—for the determination of its density, viscosity, reducing power, starch content etc., under standard and comparable conditions and the technique for cooking rice detailed in this paper was consequently devised.

### The Standard Cooking Process

*A. Chloride Bath:* This consists of a circular enamelled basin 12 inches in diameter and 8 inches deep. Enough calcium chloride solution is added to the basin so that the solution stands at a depth of  $1\frac{1}{2}$  inches from the rim of the basin. The concentration of the solution is such that it boils at  $105^{\circ}\text{C}$ . The bath is maintained at this temperature ( $105 \pm 1^{\circ}\text{C}$ .) by maintaining a constant level of solution, adding boiling water as and when the calcium chloride solution gets concentrated. The enamelled basin contained 3,700 cc. of a stock solution of calcium chloride containing approximately 27%  $\text{CaCl}_2$  by weight. The boiling point was reached in 20-30 minutes and after two estimations 400 cc. of boiling water had to be added to maintain the temperature. In the basin is placed a circular perforated porcelain plate with legs  $1\frac{1}{2}$  inches high. Thus the vessel for cooking the rice stands on this porcelain plate about 2 inches from the bottom of the basin and not directly in contact with it. Heating is done by two rosehead burners protected from air draft. When once the burners, the porcelain disc, the size of flame etc., are chosen and adjusted, determinations of cooking are done under identical conditions. Even the position of the cooking vessel on the porcelain plate is of some importance. Though the temperature of the bath is uniform throughout, attention to these minor details will produce better results, for in the words of Shaffer and Somogyi (1933) these details affect "the intensity of the heat and the effective duration of the heating period".

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\* Extract from the M. Sc. Thesis, University of Madras, 1948.



*Explanation to plate:*

1 and 2. Soaking and Washing. 3. The calcium chloride bath heated by two good roshead burners and protected from air draft by metal screens. 4, 5 and 6. Rice under different stages of cooking. 7. Desiccator containing water. 8. Beaker with the cooked and washed rice spread on one side, kept for draining. 9. Thermometer recording temperature of the bath. 10. Boiling water for rinsing the grains and for diluting the calcium chloride solution.

*B. The Cooking vessel :* A 250 cc. beaker is selected for this. A stout glass rod is placed in the beaker so that the spout is effectively closed and thus the escape of any grain or "Kanjee" during cooking is prevented. 200 cc. distilled water are taken in the beaker which is then closed with a suitable cover glass and kept on the porcelain plate in the bath. The porcelain plate can accommodate four beakers so that four samples may be handled at the same time. Complete cooking and determination of volume could be done at the rate of three samples per hour.

*C. The Cooking process :* (i) *Sampling :* From a representative sample of the available rice all broken grains, glumes, extraneous matter, bad or otherwise damaged or defective grains etc., are removed by hand picking. The material is again sampled and 20.0 gms. of whole grains are weighed into a 150-200 cc. porcelain basin.

(ii) *Washing and soaking*: To the whole rice grains in the porcelain basin about 100 cc. of distilled water are added and the grains well rubbed with fingers so as to separate and remove adhering dirt, bran or other extraneous material present. The water is then drained away and washing repeated with fresh distilled water three more times. The grains are then soaked by allowing to remain in distilled water for 10 minutes, the water being changed three times during the interval. At the end of 10 minutes the water is completely drained off.

(iii) *Rinsing with boiling water*: When the distilled water in the beaker (vide B above) is boiling the soaked grains are rapidly rinsed two or three times with boiling water. This serves to raise the cooking water quickly to boiling after addition of the grains to the beaker.

(iv) *Cooking*: The rinsed grains are then transferred carefully to the boiling water in the beaker. Boiling commences within a minute. Cooking is allowed to proceed for 14 minutes when it is considered complete. For arriving at this standard cooking period G.E.B. 24 considered to be one of the best varieties of rice in South India, was taken as the standard variety. The time taken for the complete cooking of this variety of rice is 14 minutes. It is true that all varieties of rice do not completely cook within the time specified. But, if the cooking is continued till complete cooking takes place in all cases, then the expansion in volume would be a function of the time of cooking and inherent varietal differences. The author found it more accurate to cook all the varieties for the same period of time under specified conditions. Volume expansion on cooking would thus be a direct test of quality of the different varieties. Extension of time of cooking beyond 14 minutes also resulted in most cases in the breaking up of the grain. The time of cooking is therefore kept constant in all the estimations.

(v) *Washing of cooked rice*: At the end of 14 minutes' cooking, the beaker is removed from the bath and the calcium chloride adhering to the outside completely washed away. The contents of the beaker are then transferred to a 900 cc. beaker containing about 600 cc. of distilled water. This prevents all further heating of the rice grains by the hot "Kanjee". Further the "Kanjee" sticking on to the cooked rice is thereby removed. This is particularly important in bad quality rices, especially new rices which often cook to a pasty mass and yield a thick gruel. The combined effect of these two sources of error is sometimes appreciable. The rice grains rapidly settle to the bottom of the 900 cc. beaker. The supernatant liquid is drained off. The grains are washed two times more with 600 cc. distilled water. The grains are then spread on one side of the beaker.

(vi) *Draining*: Thereafter the beaker is kept inclined for a couple of minutes. Most of the water is thus drained away. Further drainage is effected by keeping the beaker inclined in an atmosphere saturated with



water vapour so that during the time taken for complete draining of the water, the cooked rice grains do not lose the imbibed water by evaporation and shrink and thus lose in volume. This draining is done by keeping the beaker inclined in a desiccator containing water on the surface of which is placed a suitable porcelain basin. The water draining from the rice is discharged into this basin. Draining like this has also the advantage that cooked rice can be kept for longer periods of time after cooking and before it is convenient to determine volume.

*D. Determination of Volume:* The volume of the rice before and after cooking is measured in a volumenometer (Vergese 1949). The above process of cooking is adopted when the volume of the cooked rice is to be determined. If, however, the "Kanjee" — rice water — is required for experimental purposes, the following alteration in the technique is made at stage C (v) above.

After 14 minutes' cooking in the chloride bath the beaker containing the cooked rice is removed from the bath and the calcium chloride adhering to the outside completely washed off. The "Kanjee" is then transferred through a funnel to a 200 cc. volumetric flask. When all the "Kanjee" is thus poured off, the cooked grains in the beaker are washed four times with small quantities of water and the washings transferred to the funnel. Finally the grains are also transferred. Washing of the grains on the funnel is continued till about 200 cc. of the extract are obtained. The flask is then removed, cooled in running water and the contents made up to volume and well mixed. The flask is then left undisturbed for about half an hour by which time most of the suspended matter — fragments of cooked rice — settle down to the bottom. From the supernatant liquid a clear extract can be obtained by centrifuging. The author found it convenient to use an "Ecco" centrifuge — radius of arm 14.0 cms., length of centrifuging tubes 11.0 cms. and capacity 100 cc. 15 minutes' centrifuging at 3,000 revolutions per minute is usually sufficient to give a clear extract.

If determinations of viscosity, reducing power, starch content etc., of the extract are to be determined, special care should be taken to avoid the least possible contamination of the several apparatus used in the complete process. Contamination with calcium chloride from the chloride bath is the common experience. This can be completely avoided by keeping the beaker covered while cooking and washing off completely the calcium chloride adhering to the outside of the beaker after its removal from the bath. The chloride solution should also be kept boiling smoothly by the use of good rosehead burners.

The author has been using the standard process of cooking rice for the last eight years and has always obtained reliable results.

**Summary:** A standard process for cooking rice for experimental purposes is described. In this process 20.0 gms. of whole rice grains are carefully sampled out, thoroughly cleaned and washed and then soaked for 10 minutes in cold distilled water. The grains are then rapidly rinsed with boiling distilled water and transferred to a 250 cc. beaker containing 200 cc. of boiling distilled water. The beaker rests on a porcelain plate in a bath of calcium chloride maintained at  $105^{\circ} \pm 1^{\circ}\text{C}$ . The rice is cooked for 14 minutes, washed and drained free of water in an atmosphere saturated with water vapour and its volume determined in a volumometer. The procedure for collecting the "Kanjee" — rice water — under standard conditions is also described.

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