# IODINE RETENTION IN COOKED CEREAL AND PULSE USING IODIZED SALT

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## ABSTRACT

**Background:** Salt is ubiquitous in foods and consumed in relatively constant amounts in our diet. Salt is essential not only to life, but to good health. The universal consistent appetite for salt makes it the ideal vehicle for iodine fortification to prevent mental retardation. Iodine is one of the essential micro-nutrient for normal growth and development. In India, no state is free from iodine deficiency. The recommended strategy to correct IDD rests upon salt iodization. There is considerable loss of iodine during transportation and storage under prevailing conditions. Also stability of iodized salt may be adversely affected by moisture, humidity, sunlight, heat, acidity and presence of impurities. Inspite of availability of fortified salt in the market, the problem of IDD continues to prevail in the country. **Objective:** To study the retention of iodine in cooked cereal and pulse using iodized salt. **Methods:** In the present study six recipes upma, namkeen dalia, chapati, parantha, puri and chhole were cooked .The methods followed were - boiling, roasting, shallow and deep frying, pressure cooking and microwave cooking. Iodine content in salt was determined by iodometric titration method. Iodine content in water and food samples was determined by colorimetric method. **Results:** The retention of iodine in cooked recipes of cereal and pulse ranged from 48.92 % to 93.42 %. Maximum retention was found during shallow frying where with addition of salt the time interval was 1 minute and 15 seconds and minimum during pressure cooking where the time interval of salt was 26 minutes. Retention during shallow frying (93.42 %), deep frying (89.60 %) and roasting (89.43 %) was found to be non significantly different. Retention during boiling ranged from 52.34 % to 59.77 %. Retention of iodine in microwave cooking was 72.87 %. **Conclusion:** On the basis of obtained results, it can be concluded that the retention of iodine depends upon type of cooking method and time of addition of salt during cooking. Thus, to prevent losses by cooking, it is advisable to sprinkle salt on food after cooking (wherever possible) rather than adding salt while cooking as is done traditionally.

**Key words:** Iodine . Retention . Cooking . Salt

## INTRODUCTION

Iodine is one of the essential micro-nutrient for normal growth and development (Kapil et. al., 2002). Iodine deficiency is the world's single most significant cause of preventable brain damage and mental retardation. Iodine deficiency disorder is a public health problem in 130 countries and affects 13 % of world's population (Vir, 2002). In India, no state is free from iodine deficiency and 200 million people are 'at risk' of IDD.

A safe daily intake of iodine is between 50 mcg to 1000 mcg (Ranganathan, 1995). About 90 % of which comes from food and 10 % from the water. The recommended strategy to correct IDD rests upon salt iodization (Debenoist, 2002). Iodine is added to salt in the form of potassium iodide or iodate either as a dry solid or aqueous solution at the time of production. Since iodine readily sublimes at ambient temperature, the effectiveness of salt iodization programs depends on the stability of the iodine carrier.

On the basis of daily salt consumption, iodized salt containing at least 15µg of iodine per gram could easily meet the daily requirement. There is considerable loss of iodine during transportation and storage under prevailing conditions. Also stability of iodized salt may be adversely affected by moisture, humidity, sunlight, heat, acidity and presence of impurities. Hence a higher level of initial iodization up to 30ppm has been recommended to take care of these losses.

The annual requirement of iodine for iodized salt for human consumption is 5.2 million tons and India is capable to iodize 13 million tons with existing infrastructure. Inspite of availability of fortified salt in the market, the problem of IDD continues to prevail in the country. To ensure that the fortified iodized salt used by the families is actually available to the human system after cooking present study was planned with the objective of studying the retention of iodine in cooked cereal and pulse using iodized salt.

## MATERIALS AND METHODS

In the present study six recipes (upma, namkeen dalia, chapati, parantha, poori and chhole) were cooked to see the effect of different cooking methods (boiling, roasting, shallow and deep frying, pressure cooking and microwave cooking) on iodine retention. Upma was cooked twice, using boiling method and microwave method.

Sample preparation:

a) Raw sample – All the raw ingredients were weighed separately and dried in oven maintained at $40^0$C, and then powdered in mixer.

b) Cooked sample- All the raw ingredients were weighed separately and cooked, and then dried in oven, and powdered in mixer.

Estimation of iodine in salt:

Iodized salt of TATA company was used for cooking all the recipes. The iodine content of salt was analyzed using the iodometric titration method as described by Tyabji (1995).

Estimation of iodine in water and food samples:

The iodine content of water and food samples was estimated using colorimetric method (Raghuramulu, 2003). The samples were fixed with potassium carbonate, ashed with zinc sulfate, and then iodine was determined by colorimetric method with Ce-As-I catalytical reaction.

Double distilled water was used for all the experiments.

## RESULTS AND DISCUSSION

Iodine content of salt (TATA) ranged from 33.9 ppm to 34.9 ppm. Ranganathan (1995) reported that iodized salt at the consumer level should have iodine content more than 15 ppm. Average iodine content in salt (TATA) was found to be 34.56 ppm (table 1).

**Table 1: Iodine content of salt (TATA) and water**

| Sample | Iodine content |
|---|---|
| Salt | 34.56 ± 0.57 ppm or µg/gm |
| Water | 8.00 ± 2.0 µg/L or 0.008 ppm |

Iodine present in water is found to be 0.008 ppm (table 1). Raghuvanshi (1994) reported that iodine content of hand pump water and artesian well water in Pantnagar ranges from 0.004-0.012 ppm and 0.0066-0.015 ppm respectively.

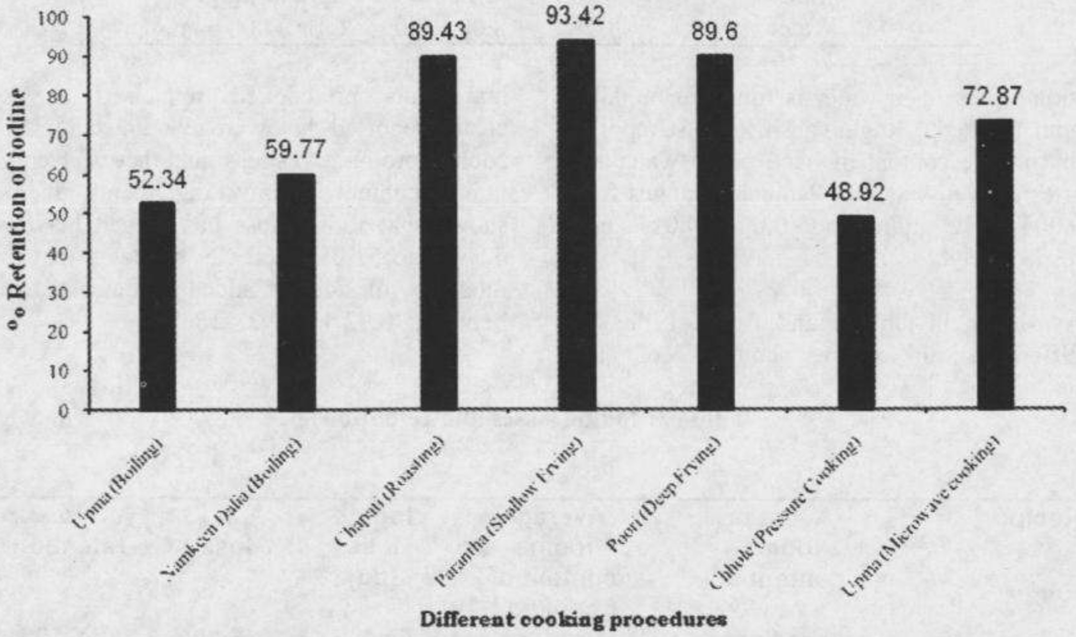
As shown in table 2 and figure 1 there is difference in iodine content of raw ingredients and cooked products. It is very clearly reported that average iodine content of cooked product was less than that of average iodine content of raw ingredients. It has shown that iodine loss has ranged between 6.58 % to 51.08 %. It can be stated that the retention of iodine added through salt is between 48.92 % to 93.42 %.

**Table 2: Iodine losses and retention**

| Recipe | Average iodine content of raw ingredients (µg) A | Average iodine content of cooked product (µg) B | Iodine loss (µg) C=A-B | % loss $\frac{C \times 100}{A}$ | % retention $\frac{B \times 100}{A}$ |
|---|---|---|---|---|---|
| *Upma* | 174.23 ± 27.93 | 91.18 ± 10.97 | 83.05 | 47.66 | 52.34 |
| *Namkeen* | 218.74 ± 11.05 | 130.72 ± 2.62 | 88.02 | 40.23 | 59.77 |
| *Dalia* | 98.69 ± 6.41 | 88.25 ± 5.76 | 10.44 | 10.57 | 89.43 |
| *Chapati* | 103.19 ± 7.16 | 96.4 ± 6.04 | 6.79 | 6.58 | 93.42 |
| *Parantha* | 104.64 ± 3.43 | 93.75 ± 4.33 | 10.89 | 10.40 | 89.60 |
| *Poori* | 215.46 ± 9.47 | 105.40 ± 1.84 | 110.06 | 51.08 | 48.92 |
| *Chhole* | 174.23 ± 27.93 | 126.95 ± 18.87 | 47.28 | 27.13 | 72.87 |
| *Upma* (micro-wave) | | | | | |
| CD at 5% | | | | 4.684 | |
| S.Em. ± | | | | 1.592 | |

Upma was prepared using two methods having same ingredients, in first method cooking time of salt was 12 minutes and in second method (microwave cooking) it was 4 minutes. Less cooking time had better retention of iodine. Upma and namkeen dalia were prepared using similar cooking method, in upma salt was cooked for 12 minutes and in namkeen dalia for 10 minutes. There is slight variation in % retention, it was more for namkeen dalia (59.77 %) which was cooked 2 minutes less than upma (52.34 %). Chhole had shown lowest (48.92 %) iodine retention because it had the highest cooking time. High retention was seen in chapati (89.43 %), parantha (93.42 %) and poori (89.60 %) which had relatively less cooking time than other recipes. Poori and chapati had similar retention though poori had been cooked for less time as compared to chapati. However, poori had been cooked at high temperature due to deep fat frying.

**Figure 1: Percent retention of iodine in different cooking procedures**




Goindi e.t al. (1995) reported mean retention of iodine in different cooking procedures ranges from 63 % (boiling) to 94 % (roasting). Retention in boiling, roasting, shallow frying, deep frying and pressure cooking ranges from 33.34-72.00 %, 92.16-96.73 %, 50-95.84 %, 76.70-84.32 % and 33.34-96.70 % respectively.

For comparison of iodine retention in different cooking procedures ANOVA was used. Critical difference (CD) at 5 % and f-value was found to be 4.684 and 139.804 respectively. Statistical analysis showed non significant difference between iodine retention of upma and chhole, chapati and parantha, chapati and poori, and parantha and poori.

The results of present study are non significantly different for roasting, shallow frying and deep frying. Low retention was found in boiling and pressure cooking, medium retention in microwave cooking and high retention in roasting, shallow frying and deep frying. This could be due to the fact that during boiling, water is used for cooking the food. Salt is hygroscopic in nature and hence, it absorbs water and the iodine present in the salt is leached out and lost while water is not required as a cooking medium during roasting, shallow frying and deep frying. Apart from water, time duration for which salt is cooked also plays a major role in iodine retention. Time of cooking of salt is higher in boiling (10-12 minutes) and pressure cooking (26 minutes), medium in microwave cooking (4 minutes) and minimum in deep frying (50 seconds), shallow frying (1 minutes 15 seconds) and roasting (1 minutes 15 seconds).

## CONCLUSION:

It can be concluded that the retention of iodine depends upon type of cooking method and cooking time of salt. Thus, to prevent iodine losses by cooking, it is advisable to sprinkle salt on food after cooking (wherever possible) rather than adding salt while cooking as is done traditionally.

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