Estimation of losses of iodine during different cooking procedures

Geetanjali Goindi, MG Karmarkar*, Umesh Kapil, J Jagannathan

Human Nutrition Unit, and Department of Laboratory Medicine, AIIMS, New Delhi.*

Iodine is an essential micronutrient. The human requirement of iodine is 150 mcg/ day. About 90% of this comes from food while 10% from the water. The most commonly used method of prophylaxis against iodine deficiency is via fortification of salt with iodine. At the beneficiary level iodised salt containing 15ppm of iodine is supplied. However, very few studies have been conducted to assess the losses of iodine during cooking procedures. Hence, a systematic study was undertaken with the objective to assess the losses of iodine during different cooking procedures. Fifty recipes commonly cooked in Indian families constituted the sample size. It was found that the mean losses of iodine during different procedures used was 1) pressure cooking 22%, 2) boiling 37%, 3) shallow frying 27%, 4) deep frying 20%, 5) roasting 6%, 6) steaming 20%. The findings of the present study indicate that further studies are needed in this field.

Introduction

Iodine is an essential micronutrient. The human requirement of iodine is 150 mcg/ day[1]. About 90% of this comes from food while 10% from water[2]. There are several areas in the world which have environmental iodine deficiency. Environmental iodine deficiency is caused when iodine present in the upper crust of earth is leached out by heavy rains, repeated flooding and glaciations[3]. The most commonly used method of prophylaxis against iodine deficiency is via fortification of salt with iodine[4]. At the beneficiary level iodised salt containing 15ppm of iodine is supplied. However, very few studies have been conducted to assess the losses of iodine during cooking procedures. Hence, a systematic study was undertaken with the objective to assess the losses of iodine during different cooking procedures.

Principle

The iodine present in the food catalyses the following reaction:

Ce(ic) + As(ous)------------Ce(ous) + As(ic)

Cerric ammonium sulphate (cerric ions) gets converted into cerrous ammonium sulphate (cerrous ions) in presence of arsenous acid which gets converted into arsenic acid. Inorganic iodide acts as catalyst for this reaction. Thus the change of cerric ions into cerrous ions depends on the amount of inorganic iodide present. Ce(ic) ions are yellow in colour while Ce(ous) ions are colourless. This reaction therefore can be measured

Table 1. Loss of iodine during cooking (measured in mcg/100g)

Method of cooking	Mean I_2 content of uncooked sample	Mean I_2 content of cooked sample	% change (loss) of I_2 content
Pressure cooking			
Mutton	15.0	14.5	3.33
Round gourd	6.6	5.6	15.15
Chola	8.5	7.0	17.64
Bottle gourd	5.5	4.5	18.18
Moong dal	5.5	4.5	18.18
Tori	5.25	4.25	19.04
Dal makhani	5.0	4.0	20.0
Masoor dal	6.0	4.75	20.83
Pumpkin	4.5	3.5	22.22
Arhar dal	3.6	2.75	23.61
Channa dal	6.0	4.5	25.0

colorimetrically[5].

Collection of samples

The food samples (uncooked and cooked) were obtained from the hospital kitchen of AIIMS New Delhi.

Methods

Fifty Common Indian recipes were prepared in the hospital kitchen of AIIMS using the different cooking procedures of: 1) steaming, 2) pressure cooking, 3) roasting, 4) shallow frying, 5) deep frying and 6) boiling, constituted the study sample. Iodised salt of Tata company was used for cooking of all the recipes. All of the raw ingredients required for preparation of each recipe were collected and a sample was drawn from them for estimation of their iodine content. This constituted the control group A.

The raw ingredients were cooked. A sample was drawn from cooked food, which constituted the experimental group B.

This procedure was repeated for all fifty recipes. Equal amounts of sample A and sample B were collected in triplicates, for iodine estimation.

Samples of 250mg of A and B were taken in triplicate in Pyrex test tubes (15 x 125mm). Then, 0.3ml of sodium carbonate reagent was added. The contents were dried at 110 degrees centigrade. The contents were then transferred to a thermostatically controlled furnace and were ashed at 6OO degrees centigrade for 2 hours.

Colorimetric method was used for the analysis of iodine content in the food samples[5]. The difference in iodine content of samples between the control groups and the experimental groups was estimated during the different cooking procedures of: 1) steaming, 2) pressure cooking, 3) roasting, 4) shallow frying, 5) deep frying, 6) boiling.

Results and discussion

The results of iodine content of raw and cooked samples was computed and the losses of iodine during differentcooking procedures was calculated. The losses of iodine during different cooking

Rajmah	7.9	5.9	25.3
Lobia	7.6	3.3	56.5
Boiling			
Chicken	12.5	9.0	28.0
Peas	9.2	6.4	30.43
Noodles	5.8	4.0	31.03
Potatoes	5.4	3.7	31.48
Rice	5.0	3.4	32.0
Kadhi	2.4	0.8	66.66
Shallow frying			
Scrambled egg	18.0	17.25	4.16
Peas curry	9.0	8.0	11.11
Uppama	6.0	5.2	13.33
Lady’s finger	8.5	7.0	17.64
Makhana	8.5	7.0	17.64
Potato chips	5.2	4.2	19.23
Capsicum	5.0	4.0	20.0
Dosa	4.0	3.0	25.0
Cabbage	5.0	3.7	26.0
Vegetable biryani	5.0	3.7	26.0
Bitter gourd	4.5	3.0	33.33
Noodles	6.0	4.0	33.33
Brinjal	4.1	2.7	34.14
Beans	4.0	2.2	45.0
Carrot	2.0	1.0	50.0
Spinach	5.0	2.4	52.0
Deep frying			
Kachori	12.75	10.75	15.68
Shahi Paneer	11.5	9.5	17.39
Vada	3.5	2.83	19.14
Lauki Kofta	6.25	5.0	20.0
Paneer Kofta	12.5	10.0	20.0
Vegetable Pakora	5.6	4.4	21.4
Mathi	7.5	5.75	23.3
Roasting			
Mutton seekh kabab	15.25	14.75	3.27
Mutton tikka	14.75	14.15	4.06
Chicken seekh kabab	16.0	15.0	6.25
Paneer Tikka	11.25	10.45	7.1
Chicken tikka	17.5	16.25	7.14
Chicken	12.75	11.75	7.84
Steaming			
Dhokla	11.0	9.0	18.18
Idli	2.6	2.0	23.07

procedures is shown in Table 1.

It was found that the percent loss of iodine:

- ranged from 3.3% (mutton) to 66.66% (lobia) during pressure cooking
- ranged from 28% (chicken) to 66.66% (kadhi) during boiling
- ranged from 4.16% (scrambled egg) to 50% (carrot) during shallow frying
- during deep frying ranged from 15.68% (kachori) to 23.3% (mathi)
- during roasting ranged from 3.27% (mutton seekh kabab) to 7.84% (chicken).
- during steaming ranged from 18.18% (dhokla) to 23.07% (idli)

The mean losses of iodine during different cooking procedures used were:

1. pressure cooking 22%,
2. boiling 37%,
3. shallow frying 27%,
4. deep frying 20%,
5. roasting 6%,
6. steaming 20% (Table 2).

Table 2. Mean losses of iodine during different cooking procedures

Type of cooking procedure	Mean I_2 content of uncooked sample	Mean content of cooked sample	Mean % change (loss) in I_2 content
Pressure cooking	6.68± 2.85	5.31± 2.98	21.92± 10.56
Boiling	6.71± 3.57	4.55± 2.81	36.6± 14.79
Shallow frying	5.74± 3.89	4.89± 3.80	26.74± 13.80
Deep frying	8.51± 3.70	6.89± 3.13	19.55± 2.50
Roasting	14.58± 2.25	13.72± 2.18	5.94± 1.85
Steaming	6.8± 5.93	5.5± 4.94	20.62± 3.41

In the present study, the losses of iodine were assessed. The mean losses of iodine during different cooking procedures ranged from 6% to to be minimum (3.2% to 7.84%) while maximum loss of iodine was found during boiling (28% to 66%).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. Hence the losses of iodine during boiling were more than during roasting.

Considering the losses of iodine during cooking in the present study, more studies are required with larger sample size to make suitable modifications, if any, for recommending the amount of iodine to be added to salt to meet the daily requirement.

Estimation of losses of iodine during different cooking procedures

Geetanjali Goindi, MG Karmarkar, Umesh Kapil, J Jaganathan

Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 225-227

References

1. DL Mahesh, YG Deosthale and BS Narasinga Rao.In: MG Karmarkar, CS Pandav, MMS Ahuja, eds. Environment, Genetics and Thyroid Disorders. New Delhi, 1990: 127-132.
2. EM Maeyer, FW Lowenstein, L Thilly. The control of endemic goitre. WH0, Geneva, 1979.
3. BS Hetzel. In: The story of iodine deficiency. New Delhi, 1989: 21-35.
4. WHO/ SEARO. Iodine deficiency disorders in South East Asia SEAR0 Regional health papers No. 10. New Delhi, 1985.
5. MG Karmarkar, CS Pandav, KAVR Krishnamachari. In: Principle and Procedure for Iodine Estimation and Laboratory Manual. Indian Council of Medical Research , New Delhi, 1986: 6-9.