



Impact Of Cooking On Nutritional Content Of Food

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ABSTRACT

Man is the apex of evolution. It requires food as one of the important constituent for survival. Food can be taken as raw and cooked too. Evidently, there are number of advantages that are why cooked food is preferred over raw food. But the methods, used for cooking by majority of Indian population are customary. Food is essential for the growth of an organism as it contains protein, carbohydrate, fats, vitamins and minerals as nutrients. Vitamins are essential for the normal growth and development of multicellular organisms. However, the deficiency of any of these vitamins leads to various diseases such as night-blindness, hyperkeratosis, keratomalacia, ariboflavinosis etc. Proteins are large biological molecules consisting of one or more chains of amino acids. Proteins perform a vast array of functions within living organisms. It is important to be aware of the resultant output of the nutrients available in cooked food. This contributes as one of the important aspects for health. During the studies conducted on various food materials, it has been observed that generally there is a decrease in nutrient value in customary cooking methods. The losses of nutrients (protein and vitamins) have been studied, in various food materials and compared for different cooking methods. The relative study regarding the changes in nutrients has been conducted. The decrease in protein and vitamins concentration has been analyzed by Lowry's method and titrimetric techniques. The study has been undertaken to see the effect of cooking on nutritional content of food.

Keywords: Conalbumin, Denaturation, Phytic acid, Phytohemagglutinin, Protein, Vitamin.

INTRODUCTION

The cost of the food with vertical rise is putting a healthy diet as a financial and nutritional investment. Thus to get most healthy contents from our foods, it is important to retain the highest nutritional portions during the preparation.

Food is essential for the growth of an organism. The food procured from the nature is rich with nutrients. These nutrients can be classified mainly into macro nutrients and micro nutrients. Macro nutrients consist of proteins, carbohydrates, fats and fiber. Proteins perform a vast array of functions within living organisms. These are seldom destroyed during cooking. Sometimes in case of heating, macro nutrients are actually

converted into harmful products. Over cooking may alter the structure of nutrients and decrease their food value [1].

The fibrous structural proteins are exceptionally stable. The globular functional proteins are quite the opposite of fibrous proteins. Hydrogen bonds are critical in maintaining their structure but these bonds are easily broken by heat and excesses of pH. When their three dimensional structure are destroyed, the proteins are said to be denatured and can no longer perform their physiological activities [2-3].

According to the Merriam-Webster dictionary, denaturation is defined as “to deprive of natural qualities: to change the nature or to modify the molecular structure of (as a protein or DNA) especially by heat, acid, alkali or ultraviolet radiation so as to destroy or diminish some of the original properties and especially the specific biological activity.”

Further, according to encyclopedia.com, “The denaturation of proteins means that the structure of protein may change when exposed to heat, acid or alkali, or bases. The denatured protein will lose their biological action, such as enzyme function, but their nutritional value will remain the same.”

Proteins are not lost during cooking as easily as vitamins. However, over cooking or cooking at high temperature will denature proteins found in food. So three factors are important.

1. Duration of cooking
2. Temperature
3. Method of cooking : (a) microwave
(b) Pressure cooker (i) direct heating (ii) solar cooker
(c) Open pan
(d) Steamed

The micro nutrients such as vitamins and minerals, essential for the normal growth and development of multicellular organisms are also influenced to change their amount, nature and behavior during cooking [4, 5].

It is also important to mention here that plant foods contain number of compounds which are collectively known as phytonutrients. Vegetables are healthier to eat raw because they contain more nutritional value and may lose that when cooked.

Thus, cooking affects nutrients. One can be, but is not sure that all of the nutrients are protected during the food preparation. As and when a cooking method is changed the nutrient composition of the food also dramatically changes. For example, at a glance if we consider the manufacturing of wheat flour, it reveals the fact that about 60% of most vitamins are lost during the bleaching and extraction. Similarly, the cooking of vegetables for prolonged periods of time can result in a loss of over half of their vitamin C content. If vegetables are heated, canned and reheated, almost $2/3^{\text{rd}}$ of the original vitamin C content may be lost [6, 7].

Now the question arises, then, why the food should be cooked? Of course, there is loss of some of the nutrients partially during cooking for e.g. the nutrients in beans and legumes leach into cooking water when they are boiled. Does this mean one should not cook the food and use it as raw? No, this is also not always true as some of

the food should be cooked and never eaten raw such as grains, dried beans (red kidney beans and white kidney beans) and eggs.

In addition to this, certain nutrients are released in cooking that would otherwise be unavailable. For example phytic acid is a naturally occurring chemical in grains that can partially block the availability of the grain minerals, including iron and zinc. The processing and cooking of grains lowers their phytic acid content, often by more than 50%. The sprouting of raw grains also lowers their phytic acid content. To minimize the mineral-blocking effect of phytic acid and maximize the mineral availability, grains should be sprouted or cooked rather than eaten raw. In raw forms beans contains excessively high amount of potentially toxic chemical called phytohemagglutinin. This is a lactic glycoprotein, and in sufficiently high amounts, it has been shown to disrupt cellular metabolism. It has also been observed by the researchers that optimal cooking time and temperature decreases hemagglutinin and other potentially toxic substances [8].

In case of eggs two types of proteins are present- (i) conalbumin protein can bind together with iron and blocks its availability, and (ii) Avidin protein which can bind together with biotin (B- vitamin) making it unavailable. The cooking of eggs helps denature both of these proteins, and can increase the availability of both iron and biotin from eggs. It is important to mention here that the U. S. Center for Disease Control and Prevention estimates that one of every 20000 eggs may be contaminated with the bacterium *Salmonella*, which is actually passed from infected hen to the egg before the shell is formed. Thus cooking also involves health safety.

To be or not to be? This dilemma of whether to cook the food or eat it raw is faced by every consumer. Moreover, India is the home of diverse cultures, languages, food habits and this diversity is evident in prevailing different cooking methods in the different regions of our country. Cooking methods like boiling, steaming, baking and frying etc. at times deplete number of the essential nutrients. This motivated us to undertake this work is being conducted to identify the trends in cooking to minimize the essential nutrients losses.

METHODOLOGY

Preparation and Cooking of food Samples involve: baking, boiling, steaming, microwave cooking and pressure cooking. The aqueous extracts of cooked food samples analyzed for different nutrient (vitamin, protein etc.) content by: Colorimetry, Spectrophotometric determination and Redox titration method. The amounts of protein and vitamin C in the various samples (corn, wheat, chickpea, rice, egg, potato, tomato, ladyfinger, spinach, capsicum and different milk product etc.) cooked by different methods were estimated using Lowry's method and Redox titration method respectively. The results were analyzed and compared with uncooked samples to measure the loss of nutrients.

To estimate the protein concentration in food samples cooked by various methods:

We used the Lowry's method to find out the protein concentration of various food samples first in uncooked samples and then in samples cooked by various methods. Basically it is a spectrophotometric technique in which we measure the intensity of

color developed by using colorimeter. Intensity of color developed is directly proportional to the protein concentration of the sample taken.

Procedure for Lowry's method

1. Take 2 ml of sample paste in a test tube.
2. To it add 5 ml of solution C. Leave it for 10 minutes.
3. To it add 0.5 ml of Follen's Reagent.
4. Incubate the test tubes at room temperature for 30 minutes.
5. Take their O.D. values using colorimeter.

How to prepare various solutions:

- Solution A: 0.5% CuSO_4 + 1% Sodium Potassium Tartrate in 100 ml of Distilled Water
- Solution B: 2% Na_2CO_3 (8 g) in 0.1 N NaOH (0.4 g NaOH in 100 ml distilled water)
- Solution C: Solution A + Solution B (50:1)

To estimate the vitamin C concentration in food samples cooked by various methods:

Determination of Vitamin C content by 2, 6 -dichlorophenol indophenol.

Principle:

- ❖ DCPIP (2,6-dichlorophenol indophenol) is a type of blue dye in possession of oxidizing capacity
- ❖ DCPIP loses blue color when reduced by ascorbic acid through redox reaction
 - DCPIP fades when ascorbic acid is excessive
 - DCPIP displays its original blue color once the ascorbic acid is depleted
- ❖ Therefore, the content of reduced ascorbic acid can be calculated according to the consumed DCPIP during titration
 - End point: light pinkish (persistent for 15 seconds)

RESULTS AND DISCUSSION

The present study indicates that the protein concentrations in uncooked samples of different food items vary over a wide range. It is observed that the soyabean has maximum protein concentration while the milk has minimum. Moreover, the protein content of Soyabean is very high as compared to other food items viz. rice long, chana dal, wheat, chick pea and milk. This is also consistent with the available literature.

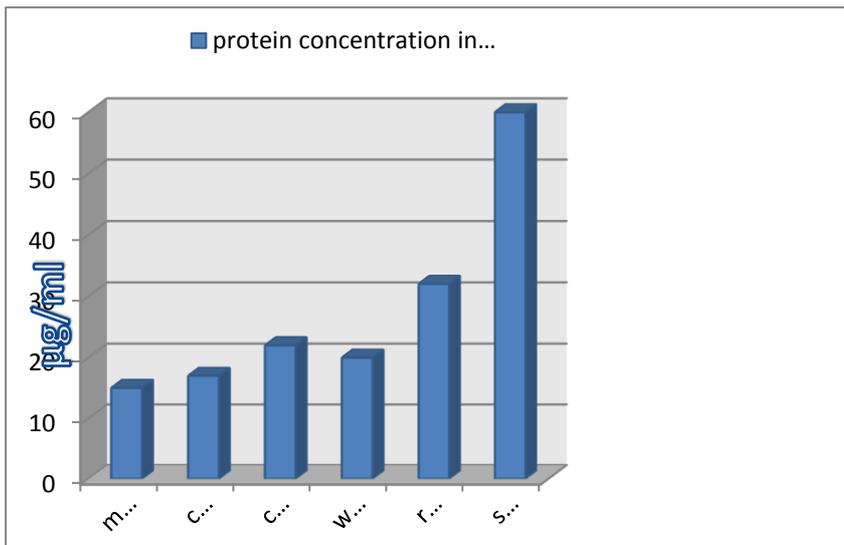


Figure 1: Protein concentration in uncooked samples

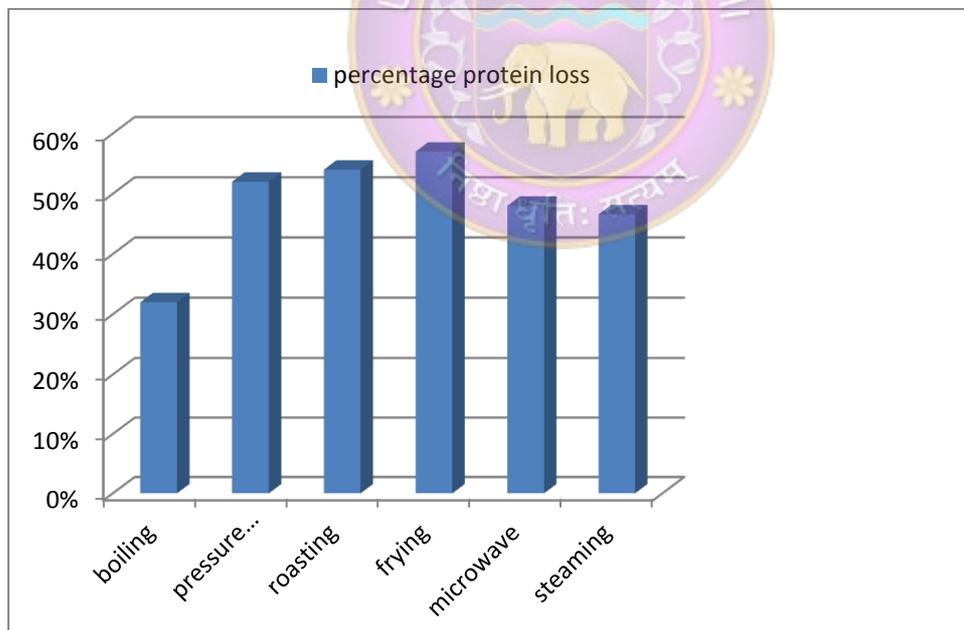


Figure 2: Percentage protein loss in different cooking methods

The graph (Figure 1 and 2) depicting the percentage protein loss of different food items using different methods of cooking shows that the maximum loss of proteins occurs by frying followed by roasting, pressure cooking, microwave cooking and steaming. However, the minimum loss is observed in case of boiling. Therefore, it can be concluded that the preferred method of cooking out of all the methods tested

should be boiling. This is contrary to the common perception that steaming is the best method for the preservation of nutrients. But the present study proves that boiling is better than steaming in reducing protein loss. This may be because of higher latent heat of steam than boiling water. This leads to higher temperatures during cooking causing protein denaturation.

For vitamins the studies have been confined up to vitamin C only. The results are depicted with the help of fact and figures in tabular and graphical form.

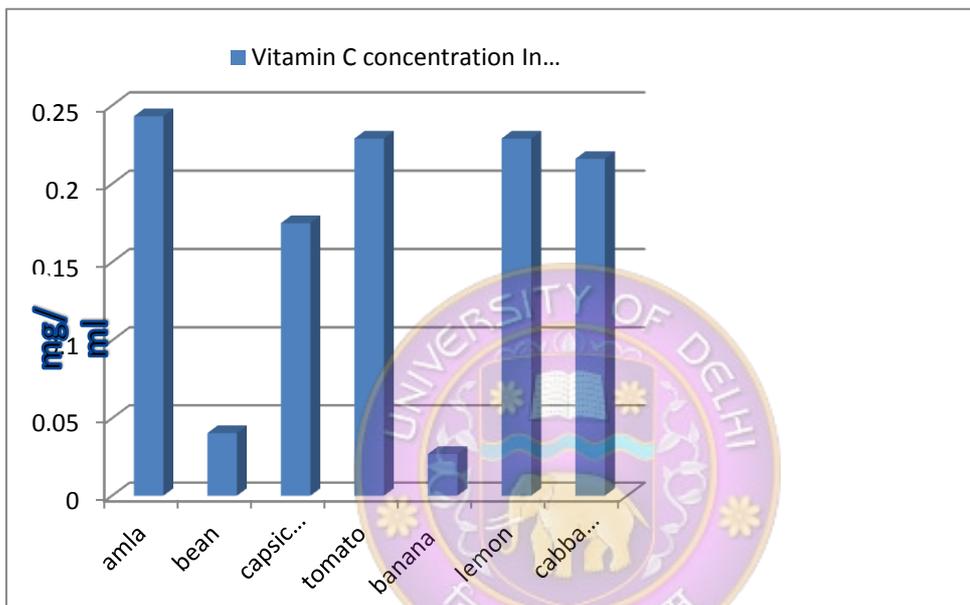


Figure 3: Vitamin C concentration in uncooked sample

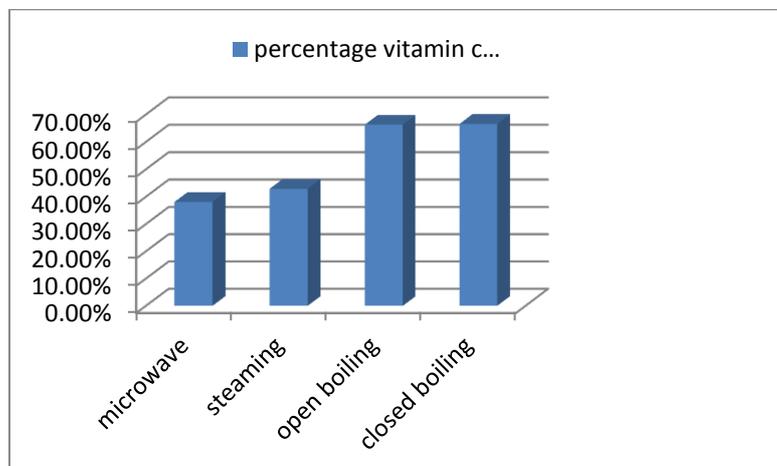


Figure 4: Percentage vitamin C loss in different cooking methods

In case of Vitamin C the graph (Figure 3 and 4) depicting the percentage loss reveals that the loss is more in boiling and lesser in microwave cooking. The general pattern in decreasing order is boiling, steaming and microwave. Similar studies may further be conducted to establish the nutrients losses during cooking.

CONCLUSION

India is home of diverse cultures, languages, food habits and this diversity is evident in prevailing different cooking methods in the different regions of our country. Cooking methods like boiling, steaming, baking and frying etc. at times deplete no. of the essential nutrients. This work is being conducted to identify the trends in cooking to minimize the essential nutrients losses. This innovation will be worth proved only when such information would be channelized and provided to the major proportion of the population. We don't believe in literary meaning of innovation but want to give a clear indication that this project is innovative by action. The variation in results with variable trends in cooking will reflect the minimization in loss of essential contents of food. This will clearly develop a pace to follow the same by the users. When the different cooking methods were adopted during analysis. It was observed that there are definite loses of various nutrients present in the food materials. The loss is exhibited not only as per the cooking habit but by virtue of the region also. To maintain the proper nutrient contents it is advised to go with appropriate cooking habit in different region with environmental conditions.

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