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PRESSURE COOKING AND MICROWAVE COOKING'S IMPACT ON SELECTED LEGUMES' NUTRITIONAL QUALITY

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ABSTRACT

Legumes are extensively cultivated worldwide, and their nutritional and economic significance is acknowledged on a global scale. Heat treatments, however, are known to change the amount of nutrients in legumes. It has been noted that pressure cooking and microwave cooking are frequently used to cook legumes. On the other hand, very little is known about how these cooking methods affect the nutritional value of legumes. It is well known that green Gram and chickpeas are commonly used in Indian households. We conducted this study to investigate the effects of pressure cooking and microwave cooking on specific nutrients such as protein, total amino acid, thiamine, niacin, and pyridoxine of both chick pea and green gram using standard procedures because there is very little information on the effect of heat treatment on the nutritional quality of these two legumes. One kilogram of green Gram and chickpeas were purchased from the neighborhood market for this experimental study. They were then soaked in distilled water for twelve hours at room temperature and then drained. Following soaking, 100g of green Gram and chickpeas were pressure cooked at 120°C for 15 and 10 minutes, respectively. In a similar vein, 100g of green Gram and chickpeas were microwaved on high for 15 minutes and 20 minutes, respectively. The cooked legumes were blended without the addition of water while being stored at room temperature. Three duplicates of the cooking treatments were conducted. The samples were put through standard protocols for nutrient analysis after being aseptically packed in airtight containers. The Duncan's Multiple Range Test and Analysis of Variance were used to compare groups of people. When compared to microwave cooking, pressure cooking was found to be more effective in retaining the protein, total amino acid, thiamine, riboflavin, pyridoxine, and niacin content of chickpea and green gram.

Keywords: Legumes. Microwave Cooking, Pressure Cooking, Nutrient Content.

I. INTRODUCTION

As the second most important food source after cereals, legumes are recognized for their nutritional and environmental benefits and are valued globally as a cheap, sustainable food source (Gallego et al., 2021; Marielle et al., 2018; Maphosa and Victoria, 2017). Legumes are known for its nutritional density providing low fat source of proteins (20–45%) and carbohydrate (±60%) with essential amino acids, and dietary fibre (5–37%). Legumes also have no cholesterol and are generally low in fat, with ±5% energy from fat, with the exception of peanuts (±45%), chickpeas (±15%) and soybeans (±47%) and provide essential minerals and vitamins (Gallego et al.2021, Marielle et al. 2018, Maphosa and Victoria, 2017and Adriana et al.2016). Legumes are important for nutrition, but they are also popular for their roles in the economy, culture, physiology, and medicine because they contain beneficial bioactive compounds.

Legume crops have been grown in India for a very long time. Their high protein content has earned them the moniker "poor man's meat." Utilizing protein-rich legumes in the diet in conjunction with cereals seems like a workable strategy to end protein-calorie malnutrition in the near future, given the current state of our economic development (Khattak et al, 2008). Among the different legumes, the seeds of the green gram (Phaseolus aureus) and chicken pea (Cicer arietinum) are a significant and affordable source of legume protein that can be used in place of animal protein (Pallertier, 1994).

Legume has many nutritional advantages, but it is generally known that heat treatments and cooking reduce the amount of nutrients and phytochemicals in food products. They can, however, also reduce the amount of unwanted substances found in pulses, such as phytates, inactivate heat-labile antinutritional factors like pulse antitrypsin factors that negatively impact protein bioavailability, or modify the composition of pulse amino acids and protein digestibility (Marielle et al. 2018, Aviles-Gaxiola et al. 2018, Nosworthy et al. 2018). Most of the studies conducted so far to determine the effect of cooking on nutrient quality of legume composition have focused either on one pulse, or on limited nutrients and the results have been inconsistent.(Daur et al.2008, Barampama et al. 1995, Attia et al. 1994, Grewal and Jood,2006). In India, pressure cooking of pulses has been the most common method of cooking. Microwave cooking has also gained considerable importance as an energy-saving, convenient and time- saving cooking method (Rashid et al, 2016) . The purpose of this study was to compare the effects of pressure cooking and microwave cooking on the contents of chickpeas and green grams in terms of protein, total amino acids, thiamine, riboflavin, pyridoxine, and niacin. These two legumes were selected because they are frequently eaten in Indian homes. The values found in the cooked and raw legume samples were contrasted.

II. RESEARCH METHODOLGY

Study Design

To find out how pressure cooking and microwave cooking affected the levels of certain nutrients in chickpeas and green grams—namely, protein, total amino acids, thiamin riboflavin, pyridoxine, and niacin—an experimental study design was used. At Bhopal's Madhyanchal Professional University, this study was conducted.

Sample Selection

We bought one kilogram of green Gram (Phaseolus aureus) and chickpeas (Cicer Arietinum) from the Bhopal local market. To get rid of foreign material and wrinkled, moldy seeds, the legumes were manually sorted.

Sample preparation

Separately, green grams and chickpeas were soaked in distilled water for a full day at room temperature. The 600 milliliters of distilled water were used to drain and rinse the soaked seeds three times. Green gram and chick peas weighed 100g each after it was drained. The soaked chickpea seeds were pressure-cooked for 15 minutes at 120°C, and the green grams were pressure-cooked for 10 minutes at the same temperature. After allowing the legumes to reach room temperature, they were blended dry without the use of water. Both the soaked chickpea and the green gram were microwave-cooked for 20 minutes and 15 minutes, respectively, on high temperature. After allowing the legumes to reach room temperature, they were blended dry without the use of water. Every cooking method was carried out three times. The sample underwent nutrient analysis in accordance with standard protocols after being placed in sterile, airtight containers.

Nutrient analysis of the sample

The Kjeldahl method was used to determine the protein content (Raghuramalu et al., 2003).The basis for estimating nitrogen is the idea that organic nitrogen is converted to ammonium sulfate when it is broken down with sulfuric acid and a catalyst. The solution was made alkaline to release ammonium, which was then distilled into a known volume of standard acid and back-titrated. By multiplying the nitrogen value by 6.25, the protein content was found. Paper chromatography was used to evaluate the amino acids. The food was ground into a uniform powder. Using sporadic stirring, 1 gram of this powder was extracted in 100 milliliters of 70% alcohol for approximately 8 hours. Whatman No. 1 filter paper was used to filter the extract, and the clear alcoholic extract was dried in a steam bath. After filtering the residue in 10 milliliters of 10% isopropanol, the clear extract was used for spotting. 40°C was used to store this extract. This extract was used in 20 µl for either ascending or descending chromatography. By interpolating titre values on the standard curve, the amino acid content of the unknown tubes was ascertained. The average of the values for one milliliter of the test solution was then used to calculate the amino acid. High Performance Liquid Chromatography was used to determine the sample's vitamin content, specifically its thiamine, riboflavin, and niacin levels (HPLC).The oxidation of thiamine to thiochrome, which fluoresces in UV light under normal conditions and in the absence of other fluorescing substances, is the basis for thiamine assessment. The fluorescence is a direct function of the amount of thiochrome present and, thus, of the condition's originality. The native fluorescent of riboflavin in neutral pH was utilized for the riboflavin estimation. The basis for the HPLC method of determining niacin content is the following: nicotinic acid reacts with aromatic amines such as aniline and cyanogen bromide to produce a yellow-colored compound that can be measured calorimetrically. Saccharomyces carlsbergensis was used as the assay organism in a microbiologic estimation of pyridoxine (Raghuramalu et al. 2003).

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Statistical analysis

The study utilized SPSS version 13, coded tabulated data, and conducted variance analysis, intergroup comparisons, and Duncan's Multiple Range Test, with significance set at P < 0.05.

III. RESULTS AND DISCUSSION

Results of Analysis of Variance and Dunce's Multiple Range Test

Table 3.1 and Fig.1 Shows mean and SD of protein , total amino acid, thiamine, riboflavin, pyridoxine and niacin content of uncooked, pressure cooked and microwave cooked chick peas.

Model and Material which are used is presented in this section. Table and model should be in prescribed format.

Table 1: A comparison of the contents of raw, pressure-cooked, microwave-cooked, and thiamine-, riboflavin-, pyridoxine-, and niacin-containing chickpeas.

Nutrient	Uncooked chick peas (UC)	Pressure cooked chick peas (PC)	Microwave cooked chick pea (MC)
Protein g	17.14±.037	16.14±.30^{1a}	15.95±.022 ^{2a,3a}
Total amino acid (g)	7.36±.036	3.15±.047^{1a}	2.96±0.26 ^{2a,3a}
Thiamine (mg)	0.49±0.002	0.47±.002^{1a}	0.34±.003^{2a,3a}
Riboflavin(mg	0.18±0.03	0.177±.001^{1c}	0.174±.002 $^{2c\,3c}$
Pyridoxine(mg	2.36±0.29	0.66±0.00^{1a}	0.09±.002^{2a,3a}
Niacin (mg	2.86±0.01	2.62±0.22^{1c}	2.56±0.21$^{2c\,3c}$

The values in the row displaying distinct superscript letters and numbers indicate the variations in the Mean ±SE content of estimated nutrients for each group in the following tests: 1 UC vs PC, 2 UC vs MC, and 3 PC vs MC.P< 0.01 for significant group differences, P< 0.05 for significant group differences, and c for significant group differences No notable variations between the groups.

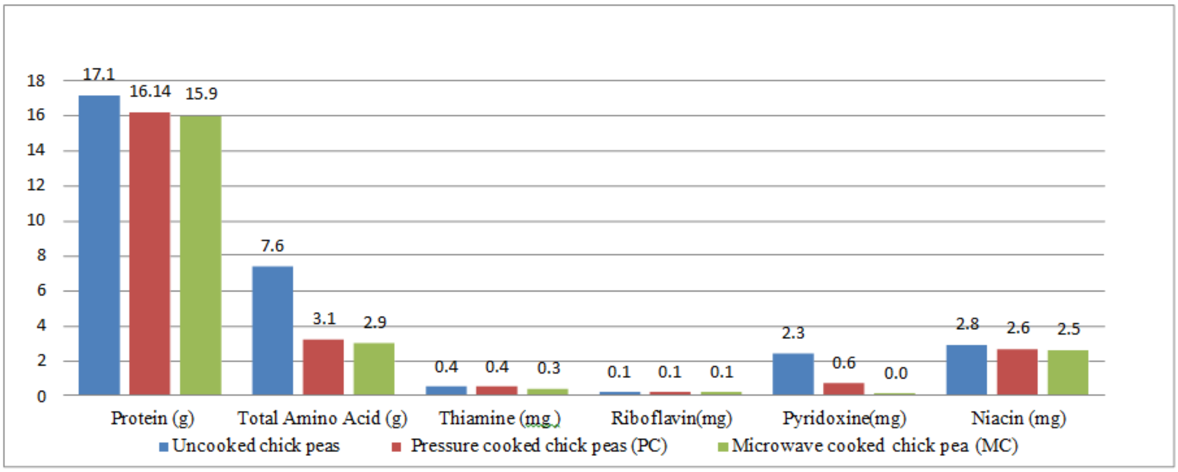

Figure 1: Nutrient content of uncooked, pressure-cooked and microwave cooked chick pea

The protein content of uncooked chickpea (17.14±.037g) decreased when it was cooked using pressure cooking (16.14±.30g) and microwave cooking (15.95±.022g), with pressure cooking showing the highest retention (P<0.01). This is shown in table 3.1 above. In a similar vein, when compared to uncooked chick peas, the total amino acid content of pressure-cooked (3.15±.047g) and microwave-cooked (2.96±0.26g) chick peas was significantly (P<0.01) lower due to heat processing techniques. 7.36±0.036 g). When chickpeas were microwave-cooked, the retention of amino acids was the lowest (P< 0.01). These findings suggest that the food matrix and/or protein structures are altered during processing (Gallego et al., 2021).

Uncooked chickpeas had a thiamin and pyridoxine content of 0.49±0.002 mg and 2.36±0.29 mg, respectively. When compared to microwave-cooked chickpeas (P<0.01), pressure-cooked chickpeas demonstrated the highest retention of thiamine (0.47±.002 mg) and pyridoxine (0.66±0.00 mg) after cooking. Chickpeas cooked

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in the microwave had a thiamine content of 0.34±.003 mg and a pyridoxine content of 0.09±.002 mg. Niacin and riboflavin losses in pressure-cooked and microwave-cooked chickpeas did not differ significantly.

IV. RESULTS AND DISCUSSION

Nutrient-dense legumes, like green Gram and chickpeas, are essential parts of the human diet. Recent research has shown that cooking and preparation techniques can have an impact on food's nutritional value. These two procedures cause a number of interactions and changes in its constituents, some of which are beneficial and some of which are negative. The main goals of traditional home preparation of legumes like chickpeas and green grams are to enhance their flavor and make them easier to digest. The nutritional value of it is not given much thought. Seldom has the nutritional makeup of chickpeas and green grams been examined in relation to cooking times. Therefore, understanding the changes that food undergoes from preparation to table is crucial for both scientific research and consumer decision-making regarding how to cook and prepare these healthful legumes. Numerous studies have been carried out to examine the effects of food preparation and cooking techniques on the stability of nutrients in food since the early 1900s. The findings of these studies are highly inconsistent, which makes consumers wonder what the best methods are for preserving food's nutritional value when it comes to preparation and cooking (Adriana et al.2016).Two processes can cause nutrients to be lost during cooking: first, they can leach into the cooking medium or be degraded by chemical changes like oxidation (Otemuyiwa et al.2018, Berechet and Segal, 2007). Therefore, it is crucial for today's consumer to understand how these foods are prepared and how the various methods of preparation affect the food's nutritional quality.

It is commonly known that enhancing the digestibility and palatability of food typically requires food processing. Foods are processed using a wide range of techniques, and the techniques used can either increase or decrease the food's nutritional value. Microwaving, roasting, boiling, steaming, and pressure cooking are some of the most widely used cooking techniques (Adriana et al.2016, Li et al. 2019). When something is pressure cooked, the steam is trapped inside the pressure pot and builds up pressure on the food. The boiling water's temperature rises due to a buildup of pressure, reaching a temperature of over 100 degrees Celsius, which speeds up the reaction (Otemuyiwa et al. 2018). Pressure cooking is well known to decrease the amount of anti-nutrients and increase the digestibility of starch (Adriana et al. 2016). The impact of pressure cooking on the loss of nutrients, however, has not always been consistent. While some studies (Deol and Bains, 2010) found that foods cooked under pressure retained more nutrients, other studies (Raju et al., 2017) found that there was a greater loss of vitamins.

Microwave processing, a method of heating products through electromagnetic fields, has gained attention in both academia and industry due to its unique dielectric heating mechanism. This process generates heat within the product due to molecular friction, resulting in faster, homogenous heat delivery than traditional methods. However, studies have shown that microwave heating can negatively impact vitamin content and protein denaturation, despite its advantages in speed and ease of cooking.

In this context, the present experimental study was conducted to evaluate the effect of pressure cooking and microwave cooking on specific nutrients such as protein, total amino acid, thiamine, niacin and pyridoxine in both chick pea and green gram. The study shows that both pressure cooking and microwave cooking resulted in loss of protein and amino acid, the loss being higher in microwave cooked chick pea and green gram when compared to uncooked chick pea and green gram.

Protein availability in foods is crucial for biological processes. The study found significant loss in protein and amino acid retention in microwave cooked chick pea and green gram due to higher dielectric constant of proteins and peptides. Microwave treatment affects protein degradation and accelerates reactions. Pressure cooked chick peas showed higher protein and amino acid retention, indicating pressure treatment is generally less destructive to food and ingredients. The present study also examined the effect of pressure cooking and microwave cooking on the vitamin content of chick pea and green gram. Such systematic studies on the effect of cooking methods on vitamins is of paramount importance since vitamins are organic compounds and vital nutrients that cannot be synthesized and thus must be obtained through the diet. Although vitamins are usually needed in minute amounts for normal physiological functions such as maintenance, growth, and development, insufficient intake of vitamins gives rise to specific deficiency syndromes (Lee et al, 2018) .

The study evaluated how different cooking techniques affected the vitamin content of the chosen legumes and found that both techniques had a detrimental impact on the thiamine and pyridoxine contents of chickpeas and green grams. But when it came to pressure-cooked legumes versus microwave-cooked legumes, the loss was greater. These findings align with numerous research studies that demonstrate the advantageous impact of steaming and pressure cooking in maintaining nutritional value while cooking (Adriana et al,2016). The study's trend of thiamine loss is in line with Berechet and Segal's (2007) findings, which also showed that thiamine was destroyed by heat processing. Surprisingly, the results revealed that there was no discernible difference between the niacin and riboflavin content of chick peas cooked under pressure and in the microwave. However, pressure cooking and microwave cooking were found to significantly reduce the amount of niacin and riboflavin in green gram, with the loss being greater in the microwave-cooked variety. Microwave power, which may be the primary cause of vitamin degradation, is blamed for the notable loss of B vitamins in microwave-cooked legumes (Barba et al,2015,Raju et al 2017). Nonetheless, more research and investigation are required to determine the cause of the erratic pattern showing that microwave cooking reduces the riboflavin and niacin content of green grams and chickpeas.

V. CONCLUSION

The results of the study showed that although cooking green beans and chickpeas under pressure or in the microwave reduced their protein, total amino acid, thiamine, riboflavin, pyridoxine, and niacin content, the loss was greater when the beans were cooked in the microwave. It was discovered that pressure cooking was more successful in retaining the nutrients that were evaluated in green grams and chickpeas. Thus, it's critical to promote cooking techniques that guarantee the retention of proteins, vitamins, and other nutrients. Otherwise, for a balanced vitamin and nutrition intake, foods heated or cooked in contemporary technology, such as a microwave, should be combined with foods like raw fruits, vegetables, and sprouted legumes.

Nutrient-dense legumes like green Gram and chickpeas are crucial for human diets. However, cooking and preparation techniques can impact their nutritional value. Traditional home preparations aim to enhance flavor and make them easier to digest, but the nutritional makeup of these legumes is often overlooked. Understanding the changes in food from preparation to table is essential for scientific research and consumer decision-making. Studies have shown inconsistent results, leading consumers to question the best methods for preserving food's nutritional value.

The study found that both pressure and microwave cooking techniques negatively affect the vitamin content of chickpeas and green grams, with pressure-cooked legumes showing greater loss than microwave-cooked legumes. This aligns with previous research indicating the benefits of steaming and pressure cooking in maintaining nutritional value. However, there was no significant difference in niacin and riboflavin content between chickpeas cooked under pressure and microwave, with microwave power potentially causing vitamin degradation.

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