

Impact of Cooking Methods on Physicochemical and Sensory Attributes of Apple Gourd

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Abstract: An investigation was carried out to examine the influence of some cooking methods on physicochemical and sensory characteristics of apple gourd during 2016-17. For this purpose, vegetable was procured, washed, peeled, sliced and distributed in five equal lots. Four of these lots were used for individual cooking treatments (i.e. T2=boiling, T3=steaming, T4=frying and T5=microwaving), however, last lot was treated as control (i.e. T1=raw/without treatment). After cooking, all samples were used for analysis. It was found that all organic acids (%) i.e. acetic acid, citric acid, oxalic acid and tartaric acid remained significantly higher ($P<0.05$) in T4, average pH value and moisture content (%) in T2, however, ash, dry matter, fiber content (%) and total soluble solids (Brix°) in T4. Present study also revealed that T4 perceived significantly higher ($P<0.05$) score for all sensory attributes i.e. color, aroma, taste texture and overall acceptability. It can be concluded from the present study that all cooking treatments applied on apple gourd showed variable impact upon overall physicochemical and sensory properties. It can also be concluded that T4 treatment remained most suitable for maintaining the quality attributes of apple gourd followed by T5, T3, T2 and T1.

Keywords: Cooking treatments, physicochemical analysis and apple gourd.

INTRODUCTION

Vegetable is an edible part of plant that can be used as food, such as cabbage, potato, pea, spinach and apple gourd. (Pennington, and Fisher, 2009 please cite reference according journal author guidelines and enlist it in references). It is a cheapest source of energy and is rich with essential biomolecules and nutrients such as carbohydrates, protein, carotene, vitamins, iron, calcium, ascorbic acid and minerals. [1]. The vegetable can be consumed as raw or may be cooked in various ways to prepare different dishes [2].

Apple gourd or *Praecitrullus Fistulosus* is a member of gourd family which is commonly known as “tinda” in Pakistan. The term “gourd vegetable” is used to describe crop plants of family *Cucurbitaceae* which includes pumpkins, cucumbers, squash, luffa, melons and gourds [3]. The family *Cucurbitaceae* is comprises of about 118 genera with 825 species which occur widely in warmer regions worldwide. Recently, considerable health significance against ailment of many chronic diseases has been observed in gourd vegetables [4].

Vegetables can be eaten as raw or in cooked form [5], it is usually cooked in order to enhance taste and to serve bioconversion of its components to health promoting compounds. It is well known that cooking methods can affect the physicochemical attributes, sensorial properties, antioxidant content and activity of

different vegetables such as gourd, broccoli, legumes etc. According to Jongen *et al.*, [6], it is found that 80–90% of foods consumed through home cooking are semi-processed. It is needed to examine beneficial impacts of processing or cooking upon food safety, quality and palatability etc. Cooking methods not merely biotransform nutrients to health promoting compounds but it also makes food safer for consumption by distracting of pathogenic microorganisms and increasing taste. The effect of different cooking methods on food depends upon the sensitivity of the nutrient to the various processing conditions. Different cooking methods can bring great changes in physicochemical and sensorial attributes of vegetables, such as boiling, steaming, frying, microwaving, toasting, baking etc. [7,8]. Therefore, present study is planned to examine the impact of various cooking treatments on apple gourd or to observe significant changes in chemical composition, influencing the concentration and bioavailability of bioactive compounds in vegetables.

MATERIALS AND METHODS

Sample Collection

Fresh, mature and healthy apple gourd were purchased from the main market of Tandojam, kept in polyethylene bags and brought to the Laboratories of Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam.

Cooking Treatments

The conditions for cooking treatments (i.e. boiling, steaming, frying and microwaving) apple gourd were

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optimized by preliminary trial experiments. For all cooking treatments, smallest cooking time to recover similar tenderness was given to vegetable. The vegetable was properly washed to remove dirt or dust. After washing, vegetables were peeled off and sliced (0.5 cm). The slices were distributed into five equal lots. Four of these lots were used for individual cooking treatments (i.e. T2=boiling, T3=steaming, T4=frying and T5= microwaving), however, last lot was treated as control (i.e. T1=raw). The methods of cooking treatments are mentioned as under:

Raw/Control (T1)

The slices of apple gourd were used for analysis without applying any treatment.

Boiling (T2)

The slices of apple gourd were boiled in tap water (100 °C) with ratio of 1:10 (w/v) on a hot plate according to the methods of Mubarak, 2005 [9].

Steaming (T3)

The slices of apple gourd were steamed by placing them under steam generated from boiling water (100 °C).

Frying (T4)

The slices of apple gourd were fried in canola cooking oil with ratio of 1:10 (w/v) on a hot plate.

Microwaving (T5)

The slices of apple gourd were microwaved by placing them in a petri plate filled with tap water with ratio 1:10 (w/v) on high for 15 minutes to the methods of Mubarak [9]. After preparation, samples were packed in polypropylene bags, labelled properly and analyzed.

Physicochemical Analysis

The pH value was determined by using pH meter (Model HI, Hanna Instruments, Italy). Total solids and moisture content (%) was determined by method of Association of Official Analytical Chemist (AOAC) [10]. Ash content (%) was determined by gravimetric method as described by AOAC [10] using muffle furnace. Crude fiber and total soluble solids content (Brix°) was determined according to the method described by Mazumdar and Majumder [11]. Organic acids (i.e. acetic acid, citric acid, oxalic acid and tartaric acid) were determined according to the method of AOAC [12].

Sensory Evaluation

The sensory evaluation of raw/cooked samples of apple gourd was carried out by the panel of 10 judges to measure the degree of preference among all treatments for various attributes i.e. color, aroma, taste, texture, and overall acceptability by a nine point hedonic scale (representing as, 9=Like Extremely, 8=Like Very Much, 7=Like Moderately, 6=Like Slightly, 5=Neither Like nor Dislike, 4=Dislike Slightly, 3=Dislike Moderately, 2=Dislike Very Much, 1=Dislike Extremely) as described by Iwe [13].

Statistical Analysis

The study was based on three replications. However, all replicates of raw/cooked samples of apple gourd were carried out in similar way in different days. The data obtained so was tabulated and analyzed according to statistical procedure of analysis of variance (ANOVA) and significant differences of the mean were further computed by the method as described by Gomez and Gomez [14] using least significant difference (LSD) at 0.05% level of probability.

RESULTS AND DISCUSSION

Physicochemical Properties

The data regarding organic acid content (%) is given in Figure 1. It was found that organic acids i.e. acetic acid, citric acid, oxalic acid and tartaric acid were significantly higher ($P < 0.05$) in T4. A study conducted by Jacobo-Valenzuela et al., [15] suggests that Cehualca squash (*Cucurbita moschata* D.) has low acidity and thus, it is categorized among low acid food. According to them, titratable acidity remained 0.64% (citric acid) at mature stage and 0.38% at ripened stage in Cehualca squash. In another study conducted by Aguilar-Gutierrez et al., [16] citric acid remained in similar range in *C. moschata*. Figure 2 shows physicochemical analysis of apple gourd cooked with different treatments. In present finding, average ash content (%) was remained significantly higher ($P < 0.05$) in T4 (i.e. 1.83%) followed by T1, T5, T2 and T3, respectively. The ash content seen in present study was higher in comparison to some studies conducted [17,18]. In another study conducted by Hussain et al., [19], the ash content was lower in comparison to present findings in *P. fistulosus*. Moisture content (%) was found significantly higher ($P < 0.05$) in T2 (i.e. 92.69%) followed by T3, T1, T5 and T4. The moisture

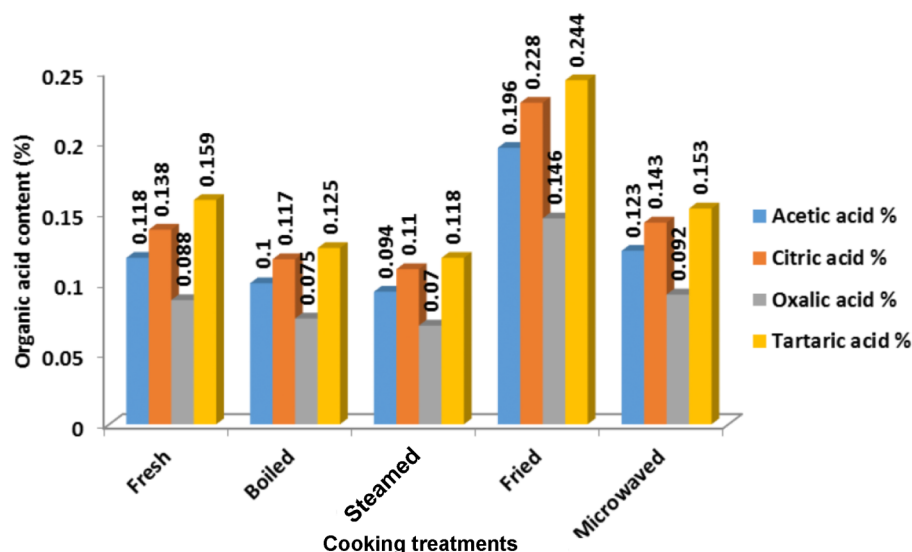


Figure 1: Effect of different cooking treatments on organic acid content (%) of apple gourd.

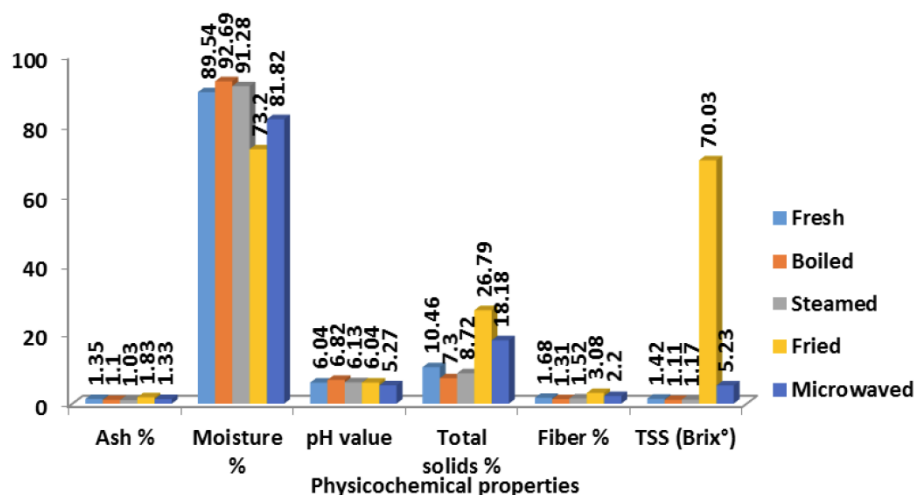


Figure 2: Effect of different cooking treatments on physicochemical properties of apple gourd.

content (%) recorded in apple gourd in *C. moschata*/winter squash (i.e. up to 93.00%). The average pH value remained significantly higher ($P < 0.05$) in T2 (i.e. 6.82) followed by T3, T1, T4 and T5. Similar findings were also seen in various studies on *C. moschata* in which pH value were ranged from 5.40 to 6.40 [17,15, 20]. Whereas, the changes in pH value of fruits or vegetable pulp is associated with enzymatic ripening and anti-oxidation reported by Sonu and Rao [21]. Total solid and crude fiber content (%) were significantly higher ($P < 0.05$) in T4 (i.e. 26.79% and 3.08%, respectively) followed by T5, T1, T3 and T2. Similar findings were recorded by See *et al.*, [22] in *C. moschata*. The total soluble solids were found significantly higher ($P < 0.05$) in T4 (i.e. 70.03 Brix°). Other treatments i.e. T5, T1, T3 and T2 showed lower values for total soluble solids. Comparatively lower total

soluble solids were reported in *C. moschata* [20, 23] (i.e. 8 to 11 and 7.0 to 8.7 °Brix, respectively). In another finding [24, 25] lower dietary fiber content in *C. moschata* was seen. Similar findings were indicated by Saikia and Mahanta [25], who reported both positive and negative impact of cooking on bottle gourd and teal gourd. (Last sentence must be rephrased).

Sensory Evaluation

The findings pertaining to sensory evaluation are presented in Figure 3. The average score for color remained significantly higher ($P < 0.05$) in T5 and T4 i.e. 7.61 and 7.39 followed by, T2, T3 and T1. It is obvious that color is an indicator of certain changes in fruit and vegetable [26]. The parameters such as, color, soluble solids, acidity and pH are impart quality effects in fruit and vegetable. Flavor quality of the commodity

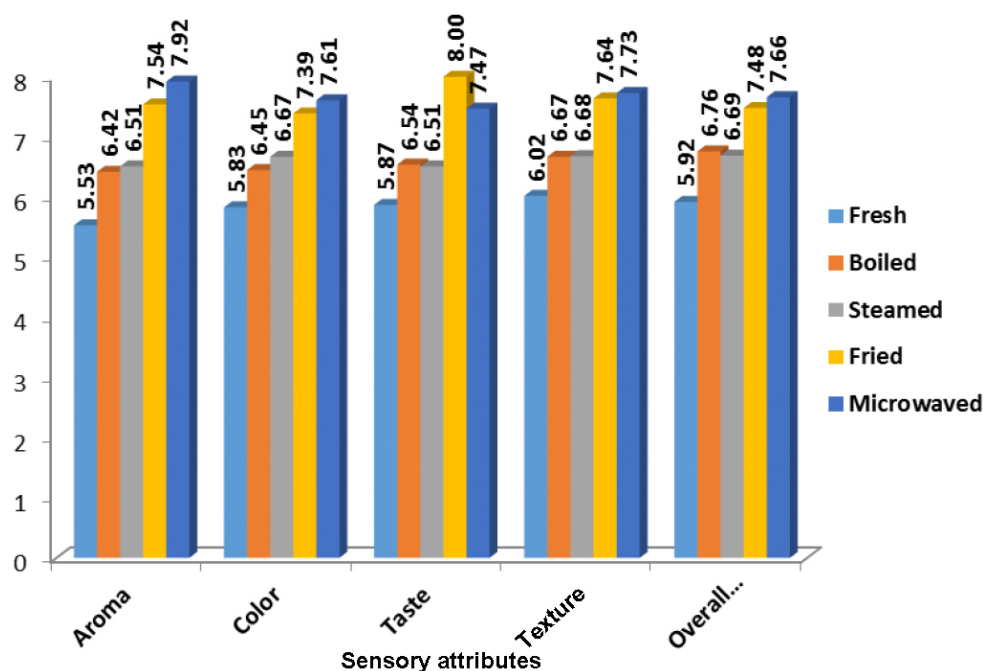


Figure 3: Effect of different cooking treatments on sensory attributes of apple gourd.

which determines their value to consumers depends on the content of sugars, organic acids, phenolic compounds, volatiles etc. The average score for aroma remained significantly higher ($P < 0.05$) in T4 and T5 i.e. 7.92 and 7.54 followed by T3, T2 and T1. The average score for taste remained significantly higher ($P < 0.05$) in T4 and T5 i.e. 8.00 and 7.47 followed by T2, T3 and T1 (control/raw apple gourd) i.e. 6.54, 6.51 and 5.87, respectively. This is clear that cooking treatments brought significant changes within the chemical attributes of vegetable. Similar manner of changes in cooked gourd vegetables were also noticed by Aminah, and Permatasari [27]. However, according to Sultana *et al.*, changes occur in foods might be due to the structural decomposition of the compounds or owing to the cooking methods applied on vegetables [28]. The average score for texture remained significantly higher ($P < 0.05$) in T5 and T4 i.e. 7.73 and 7.64 followed by T3, T2 and T1. The average score for overall acceptability remained significantly higher ($P < 0.05$) in T5 and T4 i.e. 7.66 and 7.748 followed by T2, T3 and T1. Cooking ultimately affects the sensory quality [21]. According to the findings obtained from present study, it can be stated that different cooking methods shows variable effects on overall quality of vegetable as reported by Sengul *et al.*, [29], They evaluated impact of cooking on different vegetables such as, cabbage, beet root, turnip and broccoli and found variable effects upon properties of these vegetables.

CONCLUSIONS

In conclusion, the present study confirmed that different cooking treatments have considerable impact on physicochemical properties of apple gourd. All cooking treatments applied on apple gourd i.e. boiling, steaming, frying and microwaving showed variable impact on physicochemical and sensorial properties. Present study also concludes that cooking treatments i.e. frying and microwaving perceived higher score for sensory attributes such as color, aroma, taste, texture, and overall acceptability in comparison to all cooking treatments.

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