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# Effect of Different Processing Time on Resistant Starch Content of Selected Tubers

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**Abstract:** Resistant starch (RS) is a powerful nutrient to our body and it has many health benefits. The consumption of resistant starches may improve glucose and lipid metabolism and can reduce the risk of diabetes and related diseases. A study was conducted to find out the effect of different processing time on resistant starch content of selected cooked tubers such as potato (*Solanum tuberosum),* cassava (*Manihot esculenta)* and elephant foot yam (*Amorphophallus paeoniifolius)*, which were commonly consumed in Northern province, Sri Lanka. These tubers were processed by conventional cooking method for different processing time such as 15, 20 and 30 minutes and the changes in resistant starch content with different processing time was estimated. An enzyme method using amyloglucosidase and pancreatic α-amylase enzymes was used to estimate the resistant starch content. Results revealed that the mean RS content of raw potato, cassava and elephant foot yam were 26.05(±0.18), 12.64(±0.76) and 26.66(±0.53) g/100 g dry sample, respectively. Resistant starch (RS) content of potato, cassava and elephant foot yam tubers cooked for 15 minutes were 5.79(±0.22), 5.48(±0.04) and 6.98(±0.44)g/100 g dry sample, respectively. Resistant starch (RS) content of selected cooked tubers was significantly lower than their respective raw tubers and their RS content was decreased with increasing processing time. Resistant starch (RS) content of selected tubers cooked for 15 minutes was higher than the tubers cooked for 20 and 30 minutes, respectively. Tubers processed for less than 15 minutes have higher RS content, but their palatability is low. Therefore, the selected tubers can be processed for minimum processing time of 15 minutes to obtain higher level of resistant starch with good sensory properties.

**Key words:** Processing Time · Resistant Starch · Tubers

## INTRODUCTION

Resistant starch (RS) is among the bioactive compounds attracting consumer's interest, especially, those at risk of diabetes and other related diseases. Resistant starch (RS), by definition, is a fraction of the starch that is not broken down by enzymes in the small intestine. It then enters the large intestine where it becomes the substrate for bacterial fermentation producing short chain fatty acids (SCFAs), [1]. Resistant (RS) is a powerful nutrient to our body. When RS is added to food, it can increase fiber content without affecting texture and taste and also increase satiety and decrease hunger along with altering the secretion of hormones related to food digestion [2]. Resistant starch (RS) lowers the caloric content of foods when it is used to replace flour. It delivers between 2-3 kilocalories/gram versus 4 kilocalories/gram [3]. It is a valuable tool for formulators of reduced-calorie foods. Resistant starch (RS) may help increased fat oxidation after a meal; it leads to lower fat accumulation. A possible metabolic effect of resistant starch that may affect body weight [4]. It encourages the growth of healthy bacteria in the bowel and discourages the growth of potentially harmful bacteria and therefore, is called "prebiotic fiber" [5]. Because RS-supplemented diet may significantly increase the populations of *Lactobacilli*, *Bifidobacteria*, *Staphylococci* and *Streptococci* and act as the substrate for growth of the probiotic microorganisms, decrease the *Enterobacteria* population and alter the microbial enzyme

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metabolism in the colon [6]. The fermentation of natural resistant starch reduces intestinal pH and the production of potentially harmful secondary bile acids, ammonia and phenols [7]. Processing time influences the resistant starch contents of tubers. Longer processing time reduces the resistant starch contents in many food samples. Shorter processing time helps to retain more resistant starch. During the long processing time, the amount of digestible starch increases in small intestine due to more hydrolysis in starch. The gelatinization of starch granules by long time heat processing strongly influences their susceptibility to enzymatic hydrolysis and reduces the resistant starch content [8]. The aim of our study is determination of resistant starch contents of selected tubers available in Northern Province, Sri Lanka and finds the effect of different processing times on resistant starch content of above tubers.

## MATERIALS AND METHODS

Materials were selected for this study based on the availability and consumer preference. Three tubers commonly consumed in Northern Province of Sri Lanka such as potato (*Solanum tuberosum),* cassava (*Manihot esculenta)* and elephant foot yam (*Amorphophallus paeoniifolius)* were selected for this study. Samples were purchased from local market. Initially resistant starch content of raw tubers was estimated. Then these tubers were processed by conventional cooking method for different processing time such as 15, 20 and 30 minutes and the changes in resistant starch content with different processing time was estimated. The resistant starch (RS) content was estimated according to the procedure developed by the McCleary and Monaghan [9]. It is simple, well explains procedure and accepted by both AOAC and AACC associations. In this method resistant starch and non-resistant starch contents were estimated by an enzyme method using amyloglucosidase and pancreatic α-amylase enzymes. Standard curve for glucose was estimated by 3, 5-dinitrosalicylic acid (DNS acid) method. Miller's method [10] was used for the development of standard curve. AOAC [11] method was used for estimation of moisture content to each processing time.

All the experiments were performed in triplicates. Results were expressed by means of values ±standard deviations of three separate determinations. Comparison of means was performed by CRD (Complete Randomized Design) followed by using in SAS package (Statistical Analysis System) version 9.1 and MS-Excel 2007. Beside this, significant different were estimated to 95% confidential interval ($P<0.05$).

## RESULTS AND DISCUSSION

Table 1 shows that resistant starch(RS), non-resistant starch, total starch and moisture contents of the selected raw tubers. The highest total starch content was observed in potato compare to cassava and elephant foot yam. The total starch contents of the potato, cassava and elephant foot yam samples were 83.82(±0.35), 69.12(±0.60), 75.96(±0.12) g/100g dry sample, respectively. The highest resistant starch content was observed in elephant foot yam [26.66(±0.53) g/100g dry sample] followed by potato [26.05(±0.18) g/100g dry sample] and cassava [12.64(±0.76) g/100g dry sample]. The potato and elephant foot yam contained similar amount of resistant starch content and both of these contain higher amount of resistant starch when compared to cassava.

The highest resistant starch was observed in potato samples cooked for 15 minutes [5.79(±0.22) g/100g dry sample] followed with samples cooked for 20 minutes [5.55(±0.17)g/100 g dry sample] and 30 minutes [5.55(±0.35)g/100g dry sample],respectively. When the processing time increases, the resistant starch reduces. In a high-moisture content and long processing time environment, amylase leaches from the granules, increasing the solubility of starch and thereby its susceptibility increases [12]. If the solubility of starch increases, that leads to reduce the resistant starch contents.

In cassava, the highest resistant starch was observed in samples cooked for 15 minutes [5.48(±0.04) g/100g dry sample] followed by samples cooked for 20 minutes [3.67(±0.38) g/100 g dry sample] and 30 minutes respectively [3.50(±0.03) g/100g dry sample]. These values were calculated based on cooked sample weight.

In elephant foot yam, highest resistant starch content of cooked elephant foot yam was observed in samples cooked for 15 minutes [6.98(±0.44) g/100g dry sample] followed by samples cooked 20 minutes [5.79(±0.07) g/100 g dry sample] and 30 minutes [4.69(±0.48) g/100g dry sample], respectively. Table 2 shows the moisture content, resistant starch and non resistant starch contents of normal cooked selected tubers processed by different processing time.

Table 1: Resistant starch, non-resistant starch, total starch and moisture contents of the selected raw tubers.

| | Raw samples | | | |
|---|---|---|---|---|
| Tuber | Moisture (%) | Resistant Starch (%)* | Non- resistant Starch (%)* | Total Starch (%)* |
| Potato | 82.12(±0.08)[a] | 26.05(±0.18)[a] | 57.32(±3.11)[a] | 83.82(±0.35)[a] |
| Cassava | 55.28(±0.87)[c] | 12.64(±0.76)[b] | 56.48(±1.36)[b] | 69.12(±0.60)[c] |
| Elephant foot yam | 80.33(±0.24)[b] | 26.66(±0.53)[a] | 49.30(±1.19)[c] | 75.96(±0.12)[b] |

Mean of values ±SD. (standard deviation) (n=3). Different letters between treatments show significant difference (P<0.05).* On dry weight basis.

Table 2: Moisture content, resistant starch and non resistant starch contents of normal cooked selected tubers processed by different processing time.

| Processing time | Moisture content (%)* | RS (%)* | Non- RS (%)* |
|---|---|---|---|
| Potato | | | |
| 15 min | 84.71 | 5.79(±0.22)[a] | 76.58(±0.24)[a] |
| 20 min | 86.20 | 5.55(±0.17)[a] | 72.37(±3.06)[ba] |
| 30 min | 86.56 | 5.55(±0.17)[a] | 77.47(±0.93)[b] |
| ]Cassava | | | |
| 15 min | 68.02 | 5.48(±0.04)[a] | 53.54(±0.24)[b] |
| 20min | 67.59 | 3.67(±0.38)[b] | 54.35(±0.11)[b] |
| 30 min | 68.90 | 3.50(±0.03)[b] | 57.98(±0.20)[a] |
| Elephant foot yam | | | |
| 15min | 82.85 | 6.98(±0.44)[a] | 66.20(±0.93)[ab] |
| 20 min | 84.78 | 5.79(±0.07)[ba] | 72.45(±3.99)[a] |
| 30 min | 76.76 | 4.69(±0.48)[b] | 61.82(±3.30)[b] |

Mean of values ±SD. (standard deviation) (n=3). Different letters between treatments show significant difference (P<0.05).* On dry weight basis.

## CONCLUSION

Resistant starch content of selected raw tubers was significantly higher than their respective cooked tubers. Resistant starch content of all tubers was decreased significantly with increase in processing time. Higher level of resistant starch content was obtained in all tubers during 15 min processing when compared to longer processing times. Therefore, the selected tubers can be processed for minimum processing time of 15 minutes to obtain higher level of resistant starch with good sensory properties.

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