

Nutritional and Microbiological Quality of Red and Golden Delicious Varieties of Apples

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ABSTRACT

Red delicious and Golden delicious apples were procured from different marketing locations were analyzed for nutritional and microbial quality. 10 samples were analyzed for proximate composition and 10 samples were examined for surface contaminants using standard techniques. The highest weights of large, medium and small sized apples belonged to Red delicious variety. Peeling reduced both volume and pH of apple juice extracted. The energy, carbohydrates, fat, protein and fiber contents were high in Golden delicious variety while ash contents were high in Red delicious. Bacteriological analysis showed that gram +ive bacteria were the dominant strains associated with apple surface. The most common genus of fungi grown on the surface was Aspergillus and Penicillium. It was observed that washing with cold running tap water reduced the microbial contamination on apple surface.

Key words: Apple, Proximate Composition, Microbial Quality, Decontamination.

1. INTRODUCTION

Apple is a highly nutritious fruit containing essential food elements such as carbohydrates, protein, fat and water. Apart from its energy value, apple is a good source of soluble and insoluble fiber [1]. Apples are a widely consumed, rich source of phytochemicals, epidemiological studies have linked the consumption of apples with reduced risk of some cancers, cardiovascular disease, asthma, and diabetes due to strong antioxidant activity. (2). Besides nutritional merits, apple may get contaminated during growth, harvest, transportation and further processing & handling with microbes from soil, air, water or animal wastes. Handling in stores and retail markets could also add more microorganisms to the surface of the fresh produce. Fruit flies could transmit *E. coli* to uncontaminated apple wound (3). Among microbes, *Penicillium expansum*, a fungus is a major causative agent of post harvest decay in apple, since it produces patulin, a mycotoxin known to cause harmful effects in humans (4). Washing with water alone reduces the recoverable population of microbes by almost 2 logs from the starting population (Wisniewsky *et al.*, 2000). In India, published work on nutritive value and microbial contamination of apple is scanty though it is the most popular fruit and is sold at considerably high price. It was therefore considered necessary to assess the nutritive value of different apple varieties and to examine microbiologically the surface contaminants.

2. MATERIALS AND METHODS

Nutritional qualities of common apple varieties studied. Samples of apple were collected from different market locations of Srinagar (Jammu and Kashmir.)

2.1 Nutritional analysis

Red delicious and Golden delicious were the most common and easily available varieties in Srinagar (Jammu and Kashmir.). A survey of different markets was done for the purpose of weighing apples of Red delicious and Golden delicious varieties for grading. For measuring the percentage composition of different apple parts, a total of ten samples five from each variety were randomly selected and cut into flesh, peels and seeds and then weighted. Randomly selected ten samples of apples were used for juice extraction. The samples were weighed and then peeled off. Five from each variety were subjected to juice extraction with and without peels and pH values were also

determined. The nutrient contents of total twenty one samples of Red delicious and Golden delicious were determined. Dried samples of apple flesh, peels and seeds were ground. Powdered apple flesh was used for analyzing protein, fat, carbohydrates and ash using Official Methods of Analysis (6). While peels were analyzed for fiber content. To calculate the energy of a sample, the percentages of carbohydrates, protein, and fat were multiplied by 4.15, 5.65 and 9.40, respectively and the sum of these values was taken as gross energy (7).

2.2 Microbiological analysis: For microbiological examination, samples were collected in polythene bags and stored at 4°C till analysis in the laboratory. For bacterial analysis, standard protocols were used (8). For the bacterial isolation, nutrient agar was used as a medium. The apple sample collected from different marketing locations was inoculated on agar medium by wet swabbing. After incubation of samples on nutrient agar, bacterial isolates were examined by gram staining. Viable count was done to count the live bacteria and ten fold serial dilution was used. Isolation of fungi was done on saboured agar. The contaminants were drawn from the apple surface with sterilized loop from punctures, cut and infected parts and applied by streaking method. A total of ten fruit samples were inoculated on Petri dish with moist cotton to maintain high relative humidity and incubated at 25°C for 3 days. The fungal isolates were examined by the morphological characteristics. Apples from each variety were used to determine the effect of washing with cold running tap water. The washing time for each variety was 2, 3, 4 and 5 minutes and microbial count was determined by inoculating the samples on nutrient agar at 37°C for 24 hours. One way Analysis of Variance technique was applied to know the difference due to varieties in chemical composition of apple flesh. Two way Analysis of Variance was used to describe the effect of apple sources on bacterial growth and varieties. Proper tabulation and Mean ± SE were worked out.

3. RESULTS AND DISCUSSION

To determine the nutritional potential of apple flesh, it was chemically analyzed. The composition of flesh of different varieties of apple for gross energy, moisture, carbohydrate, protein, fat and ash is shown in Table 1. The gross energy contents of Red delicious, and Golden delicious were 63.41 and 69.72 kcal/100g, respectively. It was observed that the mean moisture contents in both varieties were close to each other (82.68-83.77 %). The carbohydrate, protein and fat contents were higher in Golden delicious variety. The overall ash contents ranged from 1.3-4.6. Earlier observations suggest that the proximate composition of edible portion of apple and indifferent apple varieties the percentage of water was 84.1, carbohydrate 14.9, protein 0.3, ash 0.29 and fat 0.4 (9). The differences in the above report with the results of the present study could be due to difference in varieties, availability periods and environmental factors.

Table 1 Mean (±SE) percent proximate components of flesh of red delicious and golden delicious varieties of Apple

Apple Variety	Energy Kcal/100g	Moisture	Carbohydrate	Protein	Fat	Ash
Red delicious	63.41±5.14ab	82.68 ± 0.80	9.30±2.00	2.22± 0.13	1.92±0.56	4.6±0.50b
Golden delicious	69.72±3.09b	83.72±0.80	9.42±0.80	2.30±0.12	2.12±0.58 (0.60-4.40)	1.70±0.10a (1.10-1.70)

The values in parenthesis are ranges.

The volume of the juice extracted and its pH with and without peels are shown in Table 2 and 3. The apples of Red delicious variety were usually large in size and were juicier than golden delicious varieties. The percentage of juice was therefore, higher in this variety. The volume of juice extracted with peels was higher than juice extracted without peels. The hand peeling removes some volume of flesh along with peels and that probably decreased the volume of juice. The pH of apple juice of all the varieties was acidic. Red delicious was more acidic than golden delicious. The pH values of juice extracted before peeling of both varieties ranged from 3.92-4.86 and the pH values of juice extracted after peeling ranged from 3.31-4.29. The pH of juice of all varieties was more acidic when it was extracted without peels. This could be due to certain compounds in the peels that reduced the acidity. In previous studies pH values of apple juice from Red delicious and Golden delicious were determined and it ranged from 4.1-4.9 with peels (10). After weighing of apples, these were graded on the basis of their weight. Among two varieties, the highest weights of large, medium and small sized apple belonged to Red delicious variety.

Table 2 Mean (\pm SE) weights of an apple, volume of juice and pH of red delicious and golden delicious varieties of Apple with peels.

Apple variety	Weight /Apple	Juice volume mL/apple	Percentage of juice extracted	Juice pH
Red delicious	255.84 \pm 12.05	152.55 \pm 8.87	54.21	3.74
Golden delicious	142.14 \pm 15.05	61.38 \pm 5.60	42.31	4.16

Table 3 Mean (\pm SE) weights of an apple, volume of juice and pH of red delicious and golden delicious varieties of Apple without peels

Apple variety	Weight /Apple	Juice volume mL/apple	Percentage of juice extracted	Juice pH
Red delicious	242.82 \pm 11.05	134.55 \pm 8.87	43.21	3.18
Golden delicious	133.15 \pm 17.06	56.38 \pm 5.60	37.31	3.97

Microbiological examination included the identification of bacteria and fungi. The bacterial growth characteristics along with viable colony of both varieties is shown in Table 4. Red delicious variety showed variability among samples purchased from different markets. Viable count ranged from 80 X 10⁵ to 116 X10⁵/ml. In Golden delicious variety, 50 percent samples had gram +ive bacterial growth. Bacterial growth was highly dependent on the sources and varieties of the apple. Gram -ive bacteria are pre-dominantly present on apples (11). Fungal contamination of different types of fungi present on the surface of apple varieties has been presented in Table 5. The most common genus of fungi grown on the surface were Aspergillus, Mucor, Rhizopus and Penicillium. While some samples did not show any growth of fungi. Microbes Aspergillus and Penicillium are the most dangerous species of fungi, producing toxin namely aflatoxin and patulin (12). Randomly selected samples from both varieties were subjected to washing treatment at different time interval. Samples were then washed with sterilized normal saline and bacterial count was determined by inoculating the samples on nutrient agar.

Table 4 Bacterial growth characteristics and viable count of red delicious and golden delicious apple varieties.

Red delicious	Golden delicious
Bacterial growth- Viable count	bacterial growth- viable count
Gram+ive,-80x10 ⁵	Gram+ive, bascilli- 110x10 ⁵
Streptococci- 95x10 ⁵	Gram-ive,bascilli - 75x10 ⁵
Streptobacilli- 110x10 ⁵	Staphylococci- 116x10 ⁵

Table 5 Number of samples found contaminated with different genus of fungi .

Apple Variety No. of samples	Aspergillus	Mucor	Rhizopus	Penicillium	No Growth
Red Delicious10	4	3	2	3	2
Golden Delicious 10	2	5	3	2	3

4. CONCLUSIONS

The results of apple grading revealed that, Red delicious contained most of the large sized apples than Golden delicious. Peeling reduced both volume and pH of apple juice extracted, Apple flesh had higher energy contents of Golden Delicious variety. . While carbohydrate, protein and fat contents were high in Golden Delicious variety, significant amount of bacteria and fungi has been associated with apple varieties, careful culling of apples before purchasing is recommended because damaged, cuts and punctures on surface create an opportunity for bacterial colonization and Washing with water alone for 3 to 5 minutes under running tap water reduced the recoverable population of microbes from starting population.

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