

Comparison of Different Types of Water Melon for Their Important Nutrients

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ABSTRACT

In the present study three different types (Green, light green and light green banded) of water melon was collected from local market of Peshawar and were analyzed for certain physical parameters (TSS, RI, pH, EC, and acidity) proximate composition and sugars content. The data indicated that TSS (6.90), acidity (10.08) and pH (5.79) were higher in light green banded while EC (472.33) was higher in Green type. RI (1.34) was found same in all types. Proximate showed higher values of moisture (91.93%) and crude fat (43.00×10^{-3} %) in light green banded while ash (9.60×10^{-3} %) and crude protein (1.75 %) were higher in green. The sugar content of green was highest among all others. It could be concluded from the data that various types of water melon along with apparent difference are also different according to their composition. So for any nutritional formulations the nutritional composition of each type should considered.

I. INTRODUCTION

Water melon (*Citrullus vulgaris*) belongs to cucurbitaceae family is locally known as Hindwana in Pashto and Turbooz in Urdu. It is a dark green or light green vegetable commonly used as a fruit in summer season. It has thick rind with high juicy pulp. The fruit ranges in size from 10 cm to 100 cm in diameter, mostly round in shape but oblong types are also available. The intense red color and the spongy formation of the pulp and high water content of mature fruits are the three prominent characteristics which make the water melon most favorite among the consumers. Especially it is useful in intense hot seasons. (Idrees, 1986).

Its centre of origin has been traced to both the Kalahari and Sahara deserts in Africa (Jarret et al, 1996) and these areas have been regarded as point of diversification to other parts of the world (Schippers, 2000). Water melon born on an annual climbing herb with thick angular branching stem. That has young villous and wooly shoot at their tips. The leaves are 7.5 – 20 cm long, deeply divided but moderately lobed, glabrous or somewhat hairy. During development the flesh color of water melon changes from white to yellowish and become juicy red when ripe. It is cultivated all over the Pakistan and all others warm countries of the world the plant like sandy or sandy loam soil. It can grow in hot dry areas like Kohat, Bannu in Pakistan. (Akhar, 1994). The data of recent years showed that the water melon has been grown on an area of 46.80 thousand ha with a total annual production of 610.5 thousand tons. And in N W F P it was grown on an area 5.80 thousand ha with a production of 78.58 thousand tons. (AS, 2008).

In order to obtain high yield of water melon, there is need to augment the nutrient status of the soil to meet the crop's need and thereby maintaining the fertility of the soil. Watermelon is a heavy feeder of nitrogen and therefore required a liberal application of NPK compound fertilizer to be applied before sowing, followed by application of nitrogenous fertilizers at 5 weeks at intervals up to flowering stage (Rice et al., 1986). Inorganic fertilizers are the most important sources of N (John et al, 2004).

Watermelon is a deliciously thirst quenching, healing super food. Juicing watermelon is especially nutritious because you can juice the entire melon fruit, rind and seeds, all of which offer incredible benefits. In fact, studies show that the most nutrient dense part of the melon is the rind, and the seeds contain beneficial fat. When only the red part it eaten, we throw away the goodness that makes this such a spectacular food. The whole fruit is also far lower in sugar than the red fruit juiced on its own.

Watermelon juice is wonderful for athletes and active people because it is deeply hydrating. Gatorade and other re-hydrating drinks cannot possibly compare with the rebalancing power of this yummy juice. Watermelon not only moistens the body and the cells, it also flushes out the kidneys, gall bladder and bladder.

The ripened fruit has 9-10 percent sugar half of which is present in the form of glucose. It contains about 94 percent water. Almost 46% of the fruit is edible. It has an important place in human diet because of having basic food nutrients. Sweet and juicy fruit is full with some of nature's most potent antioxidants. It is a dense source of vitamin C and beta-carotene (which turns into vitamin A in the body). These powerful antioxidants are the natural antidote to aging and disease causing free radicals. They are at the root of most illnesses. Vitamin C and beta-carotene neutralize these damaging molecules so that we can defy age naturally. A diet high in these two vitamins is known to reduce the risk of heart diseases, asthma, arthritis, and even cancer. They also boost the immune system and improve eye sight.

Tomatoes are renowned for their high level of the potent antioxidant lycopene, but watermelon juice is a very concentrated source as well. Scientific studies show that people who eat a diet high in lycopene are much less likely to suffer with these problems than people who don't.

The cancer preventing properties of lycopene have been extensively studied. It has been shown to protect against a growing list of cancers including prostate cancer, breast cancer, endometrial cancer, lung cancer and colorectal cancers. The American Journal of Clinical Nutrition published a study which found that people who had colorectal polyps, which is an early warning sign for colorectal cancers, had 35% lower levels of lycopene than those with no polyps.

Studies have also revealed that people are less likely to get sun burnt after increasing their levels of lycopene. It protects cells and other structures in the body from oxygen damage and even DNA damage. Vitamin B6 is vital for balancing the brain and reducing the symptoms of anxiety and depression. It is also a very good hormone regulator and helps women through their menstrual cycle. Cucumber and ginger are a delicious combination that will enhance beauty, health and overall wellbeing.

New research suggests that watermelon may produce effects in the body similar to that of Viagra, perhaps pointing the way to a natural remedy for men suffering from erectile dysfunction (Patil, 2009). Research conducted by Patil and others has recently revealed that the flesh of watermelon contains higher levels of the amino acid citrulline than researchers had thought. Until then, most of the citrulline was believed to reside in the inedible rind of the fruit. Watermelon has citrulline, more in the edible part than previously believed."

This is significant because the body converts citrulline into arginine, another amino acid that functions as a precursor to nitric oxide. Nitric oxide, in turn, plays a critical role in the dilation of blood vessels and the process of penile erection. The drug Viagra functions primarily by targeting the nitric oxide signaling pathway in the penis. Although some researcher are not in line with this that eating something that is rich in citrulline will make enough arginine that it will lead to better penile erections (Irwin Goldstein, 2009). Patil also acknowledged that four-ounce serving of watermelon contains approximately 150 milligrams of citrulline does not tell researchers what effects that much citrulline will have in the body.

Researcher evaluate the biofuel potential of juice from 'cull' watermelons - those not sold due to cosmetic imperfections, and currently ploughed back into the field. About 20% of each annual watermelon crop is left in the field because of surface blemishes or because they are misshapen. The juice of these melons is a source of readily fermentable sugars, representing a heretofore untapped feedstock for ethanol biofuels production. Studies suggest a production ratio of ~0.4 g ethanol/g sugar, approximately 220 L/ha of ethanol would be produced from cull watermelons. After extraction of lycopene and L-citrulline, two 'nutraeuticals' the 'cull' juice can still be fermented into ethanol. (Wayne,2009).

The present research based internship project was developed by keeping in view the flowing objectives: To check certain physical parameters (pH, acidity, EC, TSS) of various types water melon pulp. To determine proximate composition of these types.

II. MATERIALS AND METHODS

SAMPLE COLLECTION

Three different types of watermelon viz Green, Light green, Light green Banded were purchased from local markets of Khyber Pakhtunkhwa Peshawar. They were brought to the Laboratory of Agricultural Chemistry, Khyber Pakhtunkhwa Agricultural University Peshawar. The rinds were removed and pulp and juice were analyzed for various physicochemical parameters like moisture, crude protein, crude fat, ash, sugars, TSS(), acidity, pH and EC. Following standard analytical methods.

TOTAL SOLUBLE SOLIDS (TSS) AND REFRACTIVE INDEX (RI)

TSS and refractive index (RI) were determined by means of an Abe-refractrometer according to the standard method of A.O.A.C (2000).

Abe's refractive (Model DTM-1) was powered on and calibrated with distilled water whose refractive index was 1.33. The fresh juice was extracted from watermelon and a drop was put on the fixed prism of the refractive meter. The movable prism was then hinged off on the fixed prism that spread the drop in between. The light coming from a small bulb then viewed through the eye piece of the refractive meter, where a scale was designed showing Degree brix below and refractive index on the upper side. The reading was noted when the light with sharp edged was on middle of the cross hair made in the glass plat inside the eyepiece.

pH

pH was determined by pH meter (InoLab pH 720) according to the standard method of A.O.A.C (2000). pH meter was calibrated using two point buffers (4 and 9) calibration method. The sample (juice) was taken in 50ml beaker and pH electrode was inserted. Reading was noted when stabilized on the screen. After each reading the electrode was wiped out with small piece of cotton soaked in distilled water.

Total acidity (as citric Acid)

Total acidity was determined by standard method of A.O.A.C (2000). Water melon Juice was extracted from the three samples and filtered through Wattman No.4 paper. 10 ml from each sample was taken into 250 ml conical flask. 100 ml of distilled water was added. The mixture was titrated against 0.1N NaOH to pH 8.1 using pH meter probe as an indicator.

$$\%acid = \frac{Eq. Wt. of acid \times 0.1 NaOH \times titer}{10 \times wt. of sample}$$

Moisture (%)

Moisture was determined by oven drying method of A.O.A.C (2000). Edible part of watermelon was knifed out and extra water was extracted by pressing. Then 2 gm of each sample was weighted accurately in cleaned Petri dish (w1) and partially covered Petri dishes were placed in oven at 105 °C for 8 hrs. Samples in Petri dishes were transferred in desiccator for cooling. The cooled samples were then weighed (w2). Percentage of moisture was calculated as followed.

$$\%Moisture = \frac{Loss in W \times 100}{Wt of sample}$$

% Crude Fat

Crude fat was determined by ether extract method using Soxhlet apparatus. 2 gm of dried sample was wrapped in filter paper, placed in thimble and then introduced in the extraction tube. Weighed, cleaned and dried receiving flask was filled (1/3rd) with petroleum ether (boiling point 40-60 °C) and fitted into the apparatus (James, 1985). The extracted fat at the end was dried in oven and result was reported on %age basis by using the following formula;

$$\%Crude\ fat = \frac{(Weight\ of\ flask + oil) - (wt\ of\ empty\ flask) \times 100}{Weight\ of\ sample}$$

Ash %

Cleaned empty crucibles were placed in a muffle furnace at 660 °C for an hour, cooled in dessicator and then weighed (W1). 1 gm of each sample was placed in crucibles (W2). The samples were charred over the burner with the help of blowpipe. The crucibles were then placed in a muffle furnace at 600 °C for 3 hours. After the complete ignition the furnace was turned off. The crucibles were cooled and weighed (W3). Percent ash was calculated as follows:

$$\%Ash = \frac{Weight\ of\ ash \times 100}{Weight\ of\ sample}$$

% Crude Protein:

Protein can be determined by estimating the nitrogen content of food material where Kjeldahl method is commonly used. A.O.A.C (2000)

Digestion

Weighed 0.5 g of dried sample in a filter paper and transferred into Kjeldahl flask. Fifteen ml of concentrated sulphuric acid and 8g (7g potassium sulphate + 1g copper sulphate) of digestion mixture was added. The mixture was heated until a clear residue was obtained.

Distillation

The digest was cooled and transferred into a 100 ml volumetric flask. Volume was made upto the mark with distilled water. 10 ml of dilute was pipetted into Markam still distillation apparatus. 10 ml of sodium hydroxide (50%) was added gradually through the funnel and the mixture was heated by steam. The ammonia so released was collected as ammonium hydroxide in a receiving flask containing about 20ml of 4% boric acid solution and a few drops of modified methyl red indicator. After 15 minutes of distillation, the receiving flask was removed for titration.

Titration

The distillate was titrated against 0.05N HCl solution till the appearance of the pink color. The readings were noted and experiment was repeated in case of blank (without sample, using all the reagents). Nitrogen content was calculated as followed.

$$\%N = \frac{(S - b) \times N \times 0.014 \times D \times 100}{Wt\ of\ sample \times V}$$

Where S= volume of standard acid used for the sample titration.
standard acid used for blank titration.

B= volume of
N= normality of acid

D= sample dilution after digestion

V= volume of the digest taken for the distillation after dilution.

0.014= meqt. Wt of nitrogen.

% crude protein = % N x 6.25

Reducing and Non- Reducing Sugar:

Reducing and non-reducign sugars were determined by fehling test method. Fahling A was prepared by dissolving 34.65g of $CuSO_4 \cdot 5H_2O$ in 500ml of distilled water. Fehling B was made by dissolving 173 g of

sodium Pot. Tartrate +50 g NaOH in 500ml of distilled water. Methyl blue was used as indicator for determining the end point.

2 g of dried edible portion was taken in 100 ml volumetric flask and volume was made upto the mark with distilled water. 20 ml of the solution was taken in conical flask and 10 ml of I N HCl was added. The solution was then neutralized with 10 ml of NaOH and the volume was made upto 100 ml. The solution was transferred into burette. 5 ml of Fehling A and 5 ml of Fehling B solutions along with 10 ml of distilled water in a conical flask was taken and kept under burette and was boiled. After boiling titration was started against the sample solution till the color changes to red. The reaction was test with ethylene blue as indicator till red color persists.

Reducing sugar

2 g of the sample was taken and dissolve it in 100 ml of distilled water. The solution was then transferred to burette. 5 ml of Fehling A and 5 ml of Fehling B solution along with 10 ml of distill water was taken in a conical flask then heated. After boiling sample solution was started from the burette drop by drop till the color becomes brick red in the flask. A drop of methylene blue was added as indicator in the boiling solution for checking the color stability.

III. RESULTS AND DISCUSSIONS

To have an insight of nutritional composition of three different types of water melon available in local market of Peshawar seemingly green, light green and light green banded were collected form various local shops. They were analyzed for total soluble solids (TSS), refractive index (RI), pH, proximate, acidity, total sugar, reducing sugar and non reducing sugar. The data was summarized in the form of tables and were discussed as under.

TOTAL SOLUBLE SOLIDS (TSS), REFRACTIVE INDEX (RI)

TSS and Refractive index (RI) which was related to juice concentration was measured for all the three types of water melons (Table-1). The data showed variation in the TSS and RI values. The TSS data ranged from 5.86 to 6.90 °Brix with respective RI value of 1.34. The green type had smaller amount and the light green banded contained the highest amount of total soluble solids. A TSS amount (nearly 8.00 °Brix) of water melon was also reported by White (2003) while studying the effect of mulching on water melon production. The variation in TSS amount of the three types might be due their different kinds or that might be due to soil variability in the growing sites (Horst et al, 2006). Also the difference in TSS would be related to repining stages of the melons (Ammawath et al, 2009).

Table 1 Total Soluble Solids (TSS °Brix), Refractive Index (RI) of Water melon Types

<i>Samples</i>	<i>T.S.S</i>	<i>R.I</i>
<i>Green</i>	5.86	1.34
<i>Light Green</i>	6.80	1.34
<i>Light green banded</i>	6.90	1.34

pH, EC and Acidity

pH, electric conductivity (EC) and acidity are the quality parameters, which are mainly related to the ionic strength and active or bounded hydrogen ions concentration. Those are best for fruit maturing monitoring and they are also depending on types of fruits. The present data (table-2) showed Acidity values ranged from 7.60% to 10.08%, EC from 342.33 to 472.33 ds and pH of the samples were ranged from 5.37 to 5.79. Similar data had been reported by Vizae and Collin, 2003.

Table 2 pH, EC (ds) and Acidity (%) of watermelon juice

<i>Sample</i>	<i>Acidity</i>	<i>EC</i>	<i>pH</i>
<i>Green</i>	7.60	472.33	5.62
<i>Light Green</i>	7.70	429.66	5.37
<i>Light green banded</i>	10.08	342.33	5.79

Proximate Composition

The data related to proximate composition is illustrated in table 3. The various types of water melon contained moisture content ranged from 90.95 to 91.93%. The Light green banded contained the highest moisture content followed by light green. Ash content was in the range of 7.00 to 9.60%, Crude protein from 0.56×10^{-3} to 1.75×10^{-3} % and Crude fat among the different types were ranged from 03.00×10^{-3} to 43.00×10^{-3} %. Crude fats was maximum in light and light green types while green type was highest in case of ash and crude protein content. Similar data of 0.6% protein, 0.15% crude fats and 0.25% of ash had been reported by Perkins-Veazie et al. (2006). The present data was some how lower than Perkin-Veazie et al. that may be due to types and soil difference (Horst et al, 2006)

Table 3 Proximate composition (% Moisture, Ash, Crude Protein and Crude Fat)

<i>Sample</i>	<i>Moisture</i>	<i>Ash x 10⁻³</i>	<i>Crude Protein</i>	<i>Crude Fats x 10⁻³</i>
<i>Green</i>	90.95	9.60	1.75	03.00
<i>Light Green</i>	90.13	8.00	1.31	23.00
<i>Light green banded</i>	91.93	7.00	0.56	43.00

Sugars

Total sugar, reducing sugar and non-reducing were presented in table-4. The range of total sugar was from 5.21% to 7.16%, reducing sugars were from 5.0% to 5.5% and that of non-reducing sugars were from 0.02% to 1.55% in different types. The sugar quantity was high in green type as compare to others. Sugars content with individual reducing and non reducing components were also studied by Perkins-Veazie et al. (2006) who reported total sugar of 6.20%, sucrose as non-reducing part of 1.21% and reducing sugars in form of fructose, glucose and maltose, as 5.99% in water pulp, which was inline with the present study.

Table 4 % Total, Reducing and Non-Reducing Sugars

<i>Sample</i>	<i>Total Sugar</i>	<i>Reducing sugar</i>	<i>Non reducing sugar</i>
<i>Green</i>	7.16%	5.5%	1.66%
<i>Light Green</i>	6.47%	5.0%	1.47%
<i>Light green banded</i>	5.21%	5.2%	0.02%

V. LITERATURE CITED

Agri. State. of Pak., 2007-2008.Govt.of Pak. Ministry of Food and Agri. Islamabad.

Ammawath, W.,Y.B.C.Man, S.Yusof and R.A Rahman.2003-04.Effects of variety and stage of fruit ripeness on the physicochemical and sensory characteristics of deep-fat-fried banana chips. Deptt, of Food Tech. Uni Putra Malaysia, 43400 UPM Serdang, Selangor DE, Malaysia.

- Davis, A.R., Fish, W. and Perkins-Veazie, P., 2003. A rapid hexane-free method for analyzing lycopene content in watermelon. *J. Food Sci.* 68, pp. 328–332.
- Idrees, M., 1986. effect of N, P and K on the growth and yield of watermelon. M.Sc (Hons) Thesis, Deptt. Horti. NWFP Agri. Uni. Peshawar.
- Jarret, B., R. Bill, W. Tom and A. Garry, 1996. Cucurbits Germplasm Report, pp: 29-66. Watermelon National Germplasm System, Agri Service, U.S.D.A.
- Javed, M.A., 1994. Studies on composition and metabolism of lipids in seeds of *Citrullus* species. Ph.D Thesis, Uni of the Punjab, Lahore Pakistan.
- John, L.W., D.B. Jamer, L.T. Samuel and L.W. Warner, 2004. Soil Fertility and Fertilizers: An Introduction to Nutrient Management, pp: 106–53. Pearson Education, India.
- Perkins-Veazie, P.; Collins, J. K.; Davis, A. R.; Roberts, W. 2006. Carotenoid Content of 50 Watermelon Cultivars. *J. Agric. Food Chem.*; (Article); 2006; 54(7); 2593-2597.
- Rice, R.P., L.W. Rice and H.D. Tindal, 1986. Fruit and Vegetable Production in Africa, pp: 221–2. Macmillan Publications.
- Schippers, R.R., 2000. African Indigenous Vegetable, pp: 56–60. An overview of the Cultivated species. Chatthan, U.K.
- Snedecor, G.W. and W.G. Cochran, 1967. Statistical Methods, 6th edition, p:465. Iowa State University Press U.S.A.
- Veazie, P.P and J.K Collins 2003. flesh quality and lycopene stability of fresh cut watermelon. *Arti. South Centr. Agri. Research lab US Deptt of Agriculture.*
- Wayne, W. F., B. D. Bruton and V.M. Russo. (2009). Watermelon juice: a promising feedstock supplement, diluent, and nitrogen supplement for ethanol biofuel production. USDA_ARS, South centr. Agri. Res. lab, Lane, Ok USA.

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