



Review Article

Health Benefits, Characterization and Biochemical Analysis of Beet Root Powder

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ABSTRACT

Beet root is used since ancient times but with advancement people are moving back to organic. Among all the variety dark red color is widely used for human consumption. This study was conducted to analyze physical and chemical composition of locally harvested beet root in order to get physicochemical and mineral content present. Due to betalin it is now used in food industry as natural colorant after spray drying of powder. Health benefits of beet root are discussed in this article. It is low in calories because of low fat and high in fiber. Ash content was 1.27%, protein 1.83%, fat was 0.30%. Content of fiber was 1.9% and carbohydrates was 7.59%. pH has impact on color and it was 6.3. Vitamin A, C and E are present in significant amount in beet root along with calcium, iron, potassium and zinc.

INTRODUCTION

Scientific name of beet root is *beta vulgaris* belongs to Chenopodiaceae family. Root is the edible part of *beta vulgaris*. It is available throughout year in Asian countries. As it is cool season vegetable that can tolerate high temperature too so can be stored easily. Deep red color in beet root is promoted by low temperature. In summers its harvesting time is 75 to 90 days and in winters it is 100-120 days [1]. Beet root contains a compound betalin that is water soluble and contain nitrogen in it, it has two class of compounds betacyanin that gives red violet color and betaxanthin yellow orange color. Up to 90% betanin is present in beet root that gives deep red color to beet root [2]. At same time betalin is sensitive to light, heat and

energy even oxygen. Betain disturbs process of inflammation due to antioxidant properties. Antioxidants basically protect body from free radicals that are produced by food, environmental exposure or by smoking [3]. Beet root has gained attention because of its nutrition content and use in therapeutics. Initially nitrates found in beet root were mainly focused as it helps in maintaining high blood pressure and deal with oxidative stress and also used as drink in many athletes. Red beets are one of the most nutritious vegetables usually used as a side with main meals. It contains antioxidants, work as anti-inflammatory and also detoxify body. In this way it helps prevent many chronic diseases like cardiovascular, hypertension and

diabetes [4]. Beet root is rich in various active compounds like saponins, betalins, phenolic compounds, flavonoids and carotenoids. Betalin is nitrogen rich pigment that give deep red color to beet root. This is used as natural coloring agent in food industry like to give color to tomato products like ketchup. Moreover, this betalin will oxidation and peroxidation of lipids in this way protect human body in stress related illness. Its antioxidant content will have anti-viral and anti-bacterial properties [5]. Beet root is famous as athletic food as it contains nitrate and sugar content that boost energy. It is mostly used as food like salad, pickles and juice than for sugar production. Main sugar source in beet root is sucrose with glucose and fructose in small amount [6]. Beet root was collected from local market of Lahore, Pakistan. Beet roots were cleaned properly in order to remove any foreign material, peeled and cut into slices. 1kg sliced beet roots were spread on stainless steel tray lined with aluminum foil at 105° for 24 hours till crisp beet roots were obtained. Then sliced dried beet roots were crushed in mixer grinder.

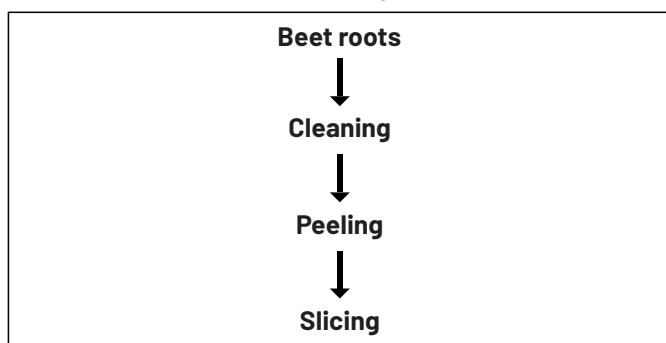


Figure 1: Flow chart of Drying protocol used for drying beet root

The chemicals used in analysis and glass wears required in proximate analysis were used from university institute of diet and nutrition sciences, University of Lahore. To calculate moisture content, crude fat, carbohydrates, crude fiber and ash AOAC 2005 method was used [7]. Kjeldal technique was used to calculate protein content by AOAC 2005 [8]. pH was measured by standard method in which pH meter was first dipped in standard solution [9]. Vitamin C was determined by taking 10ml beet root juice mixed with 2.5 ml of 10% metaphosphoric acid solution with distilled water until solution become 100ml. 10 ml from this suspension was titrated with 2,6-dichlorophenolindophenol dye till rose pink color sustained for 15 sec. vitamin C concentration was determined by mg/100ml [10]. Table 1 shows proximate analysis of beet root powder in which moisture content was 79% which support our idea of beet root powder that can be stored for long time as compared with fresh beet root. Ash content was 1.27%, protein 1.83%, fat was 0.30% which was minor amount. Content of fiber was 1.9% and carbohydrates was

7.59%. pH has impact on color of beet root. Color degradation was not present as our sample pH was 6.3. At pH more than 8 degradation is present which shows that it can't be used get red beet color that is used in food industry [11].

Table 1: Proximate analysis of beet root powder

Proximate	Values
Moisture	79.2 ± 0.06
Ash	1.27 ± 0.001
Protein	1.83 ± 0.003
Crude Fat	0.30 ± 0.0001
Crude Fiber	1.9 ± 0.33
pH	6.33
Carbohydrates	7.59 ± 0.04

Values are mean ± SD (n=3)

Table 2 shows presence of potassium, calcium, low level of sodium that are beneficial for heart health. Presence of iron make it good for anemia. Zinc is also present that is important for immune functioning [12].

Table 2: Mineral analysis of beet root powder

Minerals	Values
Calcium	12.5 ± 1.2
Iron	0.78 ± 1.2
Potassium	31 ± 0.29
Sodium	73 ± 1.2
Zinc	0.14 ± 0.1
Phosphorus	195 ± 0.71

Values are mean ± SD (n=3)

Table 3 shows presence of vitamin A, C and E in significant amount.

Table 3: Vitamin analysis of beet root powder [9]

Vitamins	Values
Vitamin C	4.9 mg
Vitamin E	0.30mg
Vitamin A	36 IU

Health benefits of beet root in various clinical trials like anti-oxidants, anti-depressant, anti-cancer, anti-hypertensive, anti-hyperglycemic, hepatoprotective and immune modulatory [13]. Hepatoprotective effect via presence of flavonoids like rutin and epichatechin in beetroot that act as antioxidants and have impact on reactive oxygen species [14]. Anti-diabetic effect of beet root is due to presence of nitric oxide that increase insulin secretions by increasing pancreatic blood flow Whereas nitric oxide present in beet root also helps to lower blood pressure [15]. Vitamin C is water soluble vitamin so body can't store it. It is helpful in decreasing rate of mortality in critically ill patients by reducing chances of organ failure and improving rate of survival. It is also an antioxidant so help in removing free radical from body [16]. Vitamin E is fat soluble vitamin that trap peroxy radical and so break

oxidation change being a strong antioxidant. In critically ill patients' serum vitamin E levels are low like in case of COVID19 that make that illness more badly [17]. Vitamin A is famous as vision related function but it also plays an important role in immunity. It protects mucosa and epithelial integrity and also play role in growth and development [18]. Root vegetables are not allowed for hypertensive patients but beet root contains nitrites that are converted to nitric oxide that dilate vessels so help in lowering blood pressure [19]. It preserves brain function, heals gastric ulcers, increase output of urine due to high amount of potassium present [20].

CONCLUSIONS

Purpose of making beet root powder via fresh local beet root is to extend shelf life of beet root. It has natural coloring agent that is now being used in food industry. Moreover, beet root is a good source fiber, protein and carbohydrates along with minerals and vitamins. Beet root is produced locally so it is cheap and under estimated as compare to its enormous health benefits for human health. It can be used in many aliments without any side effects. It contains significant amount of minerals like sodium and potassium and rich in vitamins.

Authors Contribution

Conceptualization: NN, MB

Writing-review and editing: NN, MB, TN, MNA

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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