International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
Volume 3, Issue 4 - 2016

Review Article

SOI: http://s-o-i.org/1.15/ijarbs-2016-3-4-33

Hibiscus sabdariffa - A natural micro nutrient source

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Abstract

Hibiscus sabdariffa is one of the most common flowering plant grown worldwide. There are more than 300 species of *Hibiscus* around the world. One of them is *Hibiscus sabdariffa* Linn which have high nutritional potential mostly leaves, calyx parts and seeds. The calyx of Roselle is used in the preparation of various drinks, jam and jellies. The nutrient evaluation of Roselle calyx's drinks revealed appreciable quantity of carbohydrate, iron, ascorbate and *β* carotene. The pharmacological studies of Roselle juice consumption significantly decreases the serum level of serum iron, total cholesterol and high density lipoprotein and increases significantly triglycerides and haemoglobin levels. The evaluation of the functional properties of Roselle seed powder incorporated in formulations of cookies exhibited improved antioxidant properties as well as high fiber content. Nutritionally, the fermented food prepared from cooked *Hibiscus sabdariffa* seeds significantly increases the levels of Mg, Na, Al, Fe, Mn and Zn. In view of its reported nutritional and functional properties of *Hibiscus sabdariffa* could be a source of active dietary constituents in the role of prevention of chronic and degenerative diseases as well to challenge the micro nutrient deficiency.

Keywords: *Hibiscus sabdariffa*, Calyx, micro nutrient.

Introduction

The Enormous changes in lifestyle, eating habits, and shifting rural habitations have a significant effect on diets in the developing countries leading to increase in various health problems. In recent decades, nutritional science has clearly demonstrated the importance of nutrition for health and general well being. Micronutrients play a vital role in health by functioning as antioxidants, such as vitamins C and E, or as components of antioxidant enzymes, such as superoxide dismutase, including Mn, Cu and Zn (Evans and Helliwill, 2001). Populations have to consume enough foods with adequate nutritional quality and safety to meet all micro- and macronutrient requirements (Kraisid and Pattanee, 2009). There have been continuous developments in the scientific foundation, which states that plants and their active dietary constituents play an important role in the prevention of chronic and degenerative diseases. *Hibiscus sabdariffa* known as Roselle is one of the underexploited food crops with nutritional and food industry processing potential (Leung and Foster, 1996). It is known in different countries by various common names, including roselle, razelle, sorrel, red sorrel, Jamaican sorrel, Indian sorrel, Guinea sorrel,

sour-sour, and Queensland jelly plant (Mahadevan, 2009). Indian vernacular names include Gongura, Lambari, Patwa, Lal-mista, Chukar, Pundibija, Pulachakiri, Pulichchai and Chukiar. It produces red edible calyces with unique brilliant red colour, when extracted (Morton, 1987 and Arab *et al.,* 2001). The calyx, stem, and leaf parts are acid in flavor. The juice from the calyces is claimed to be a health-enhancing drink due to its high content of vitamin C, anthocyanins and other antioxidants. The leaves, seed and calyx parts are valued for its nutritional and medicinal uses (Heureux and Badrie, 2004). The most exploited part of Roselle plant is its calyces which may be green, red or dark red (Schiffers, 2000). Calyces of Roselle contain nine times more vitamin C than *Citrus sinensis* (Amin *et al.,* 2008). The seed of Roselle is a valuable food resource on account of its protein, calorie, fat and also substantial amount of fiber and valuable micro-nutrients (Akanbi *et al.,* 2009). Roselle seeds are a good source of lipid soluble antioxidants, particularly γ-tocopherol (Mohamed, 2007).

The micro nutrient composition of *Hibiscus sabdariffa* calyx, seed and leave parts varies between studies, probably due to different varieties, genetic, environmental, ecology and harvest conditions of the plant. The nutrient composition of *Hibiscus sabdariffa* calyx and seed was different depending on Ecotype (Atta *et al.,* 2013). Many researchers had done the photochemical analysis of Roselle by various methods. The Roselle calyx is also rich in malic acid, anthocyanins, ascorbic acid and minerals, especially Ca and Fe, but low in glucose (Jung *et al.,* 2013). Table 1 gives the micro nutrient elements of *Hibiscus sabdariffa* calyx. The leaves of red and yellow roselle contained appreciable quantities of carotene, fair levels of iron, ascorbic acid, phosphorus and calcium with traces of tannins, phytates and cyanide. But the leaves from red calyx plant had higher protein, carbohydrate, ash, carotene and iron than those from yellow calyx plant. The seeds of both varieties had high levels of calcium, phosphorus and fair quantities of iron, sodium, riboflavin and ascorbic acid. The seeds from yellow calyx plant contained more protein, ash, iron, phosphorus, carotene and thiamine than those from the red calyx plant. The seeds from yellow calyx plant also had lower levels of tannins, phytates and cyanide than those from the red calyx plant (Nnam and Onyeke, 2003). The Proteins of roselle seeds are of good quality especially from the boiled seeds and are not influenced by the agro ecological region (Ghislain *et al.,* 2014). Table 2 gives the micro nutrient composition of differently processed Roselle seed. The nutrient and toxic substances in red and green species of *Hibiscus sabdariffa soaking in wood ash* were low in antinutritional content. Both the varieties soaked in wood ash showed increase in the potassium content. These factors support the consumption of the calyces will have no adverse effect on the body system (Adanlawo and Ajibade, 2006). Moreover boiling reduces the level of anti nutrients and toxic substance with retention of most micro nutrients in amount sufficient to meet our dietary requirement. But boiling beyond 5 minutes reduces B carotene level in vegetables (Musa and Ogbadoyi, 2012).

Table 1: **Proximate composition of *Hibiscus sabdariffa* calyx**

Components	$Purple	^red	^Green
Moisture	10.74	7.60	6.24
Crude fat	8.21	2.01	2.17
Ash	7.24	12.24	6.83
Crude fiber	6.78	4.69	6.75
Crude protein	11.26	4.01	6.45
Carbohydrate	55.57	68.75	71.56

$Ajala Lo *et al.* (2013) ^Adanlawo and Ajibade (2006)

Table 2: Mineral composition (mg/kg) of raw and processed roselle seeds cultivated in Cameroon (Ghislain *et al*., 2014)

Sample	Ca	Mg	K	Na	P	Fe	Zn
D2I	1750	1985	30.52	22	10.58	137.3	63.5
D2II	1920	2083	272.7	14	35.82	147.5	76.1
D3I	1054	1670	26.45	21	20.73	145.02	21.3
D3II	1160	1989	232.6	15	80.60	169.22	10.13
D4I	1710	1895	31.8	24	90.78	140.01	46.91
D4II	1860	2090	272.7	18	18.92	152.5	52.6
D5II	1260	1898	205.45	21	40.52	148.7	69.8
D6II	1262	1850	206.9	20	42.03	149.03	70.11

D2I and D2II =raw roselle seeds, D3I and D3II = boiled roselle seeds, D4I and D4II = toasted roselle seeds, D5II= toasted for 7 min after soaking for 12 h, D6II= toasted for 14 min after soaking for 12 h. I= agro ecological area I (Adamaoua region). II= agro ecological area II (West region).

Table 3: Mineral composition (mg/100g) of *Hibiscus sabdariffa* calyx

Constituents	[#]Dry Purple calyx	[@]Dried red calyx	[@] Dry yellow calyx	[*]Dry Green calyx
Calcium	280.00	3.00	3.00	21.58
Manganese	195.40	1.00	1.07	ND
Iron	58.80	833.00	800.67	3.37
Phosphorous	34.50	22.0	23.33	15.05
Sodium	80.70	15.33	16.01	48.19
Zinc	81.40	1.17	1.37	16.28
Copper	ND	0.70	0.78	ND
B carotene	ND	285.29	281.28	ND
Thiamine	ND	24.67	Trace	ND
Riboflavin	ND	0.95	0.96	ND
Ascorbic acid	31.24	53	56.83	12.50
Potassium	160.50	ND	ND	49.59
magnesium	ND	ND	ND	47.54
Nickel	ND	ND	ND	3.57

[@]Nnam and Onyeke (2003) [#] Ajala Lo (2013) [*]Adanlawo and Ajibade (2006)

Effects of consumption on some biochemical parameters

Hibiscus sabdariffa L. from the malvaceae family found in many tropical areas have a good nutritional potential (Morton *et al.*, 2000). Its hypocholesterolemic, antihypertensive, antioxidant, cardio protective, hepatoprotective effects have been investigated in mice, rabbits and rats (Chen *et al.*, 2004; Hirunpanich *et al.*, 2006; Ologundudu *et al.*, 2009). However, little studies have been done in humans. Consumption of 1 liter of hibiscus calyx juice per day (half in the morning half in the evening) significantly decrease total cholesterol and high density lipoprotein and increase level of hemoglobin and it is harmless on the liver (Ghislain *et al*., 2011).

Functional Application of Roselle on food products

Different food products, fermented foods and hot and cold beverages of *Hibiscus sabdariffa* are widely used in different countries. Mostly calyx parts were used in beverages. In Sudan, the dry calyx is used to produce a flavorsome and healthy drink and dried calyces are used for tea, jelly, marmalade, ices, ice cream, sorbets, butter, pies, sauces, tarts, and other desserts (Duke and Ayensu, 1985). The seeds have also been used as an aphrodisiac coffee substitute. Roselle seed is a valuable food resource as it has an excellent source of dietary fiber. Cookies incorporated with Roselle seed powder exhibited improved antioxidant properties. Cookie with 20 % roselle seed powder added showed higher content of total dietary fibre (5.6 g/100 g) as compared with control cookie (0.90 g/100 g) (Nyam *et al.*, 2012). The seeds are subjected to a solid-state fermentation process to produce a meat substitute condiment called "Furudu" in Sudan (Yaquob *et al.*, 2004), "mungza ntusa" in Nigeria (Omobuwajo *et al.*, 2000), "bi-kalga" in Central Burkina and datou in Mali (Bengaly *et al.*, 2006). Bouba-Adji Mohamadou *et al.*, (2008) studied the effect of fermentation of Mbuja (traditional fermented condiment) prepared from cooked *Hibiscus sabdariffa* seeds. The result revealed that *Bacillus* and lactic acid bacteria were the main species occurring in the fermentation process. And fermentation increases the levels of Mg, Na, Al, Fe, Mn and Zn in the seeds. Mbuja could therefore contribute to meet the daily-required needs in most mineral while providing bacteria of possible probiotic effect to the organism. (Ahmed and Abozed, 2015) studied the crackers incorporated with roselle calyx residue after juice extraction and compared with control crackers. The results suggested that Roselle calyx residue is a potential functional food ingredient high in fiber content and antioxidants activity that may be processed into flour and used in food applications, such as baked goods. (Kilima *et al*,. 2014) studied the Roselle calyx extracts blended at various proportions of fruit (mango, papaya and guava) juices. Blending of tropical fruit juices with roselle extract have improved mineral composition and antioxidant properties of fruit juices as roselle is a good source of calcium, magnesium and iron. Antioxidants acts as free radical scavengers inhibit lipid peroxidation and other free radical mediated process, therefore, consumption of roselle-fruit juices with high anthocyanin will protect human body from several diseases attributed to the reactions of free radicals.

Conclusion

The result of this review revealed that Roselle is one of the cheap foods, capable of providing a natural micronutrient source and natural antioxidant potential, as well as enhancing mineral availability. This result will serve as base data for nutritionists and traditional medical practitioners who may be looking for an alternative source of micro nutrients to combat deficiency diseases.

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How to cite this article:
Thongam Chanu Anel, Rocky Thokchom, M. Sylvia Subapriya, Jenita Thokchom and Sanasam Sanjay Singh. (2016). *Hibiscus sabdariffa* - a natural micro nutrient source. Int. J. Adv. Res. Biol. Sci. 3(4): 243-248.