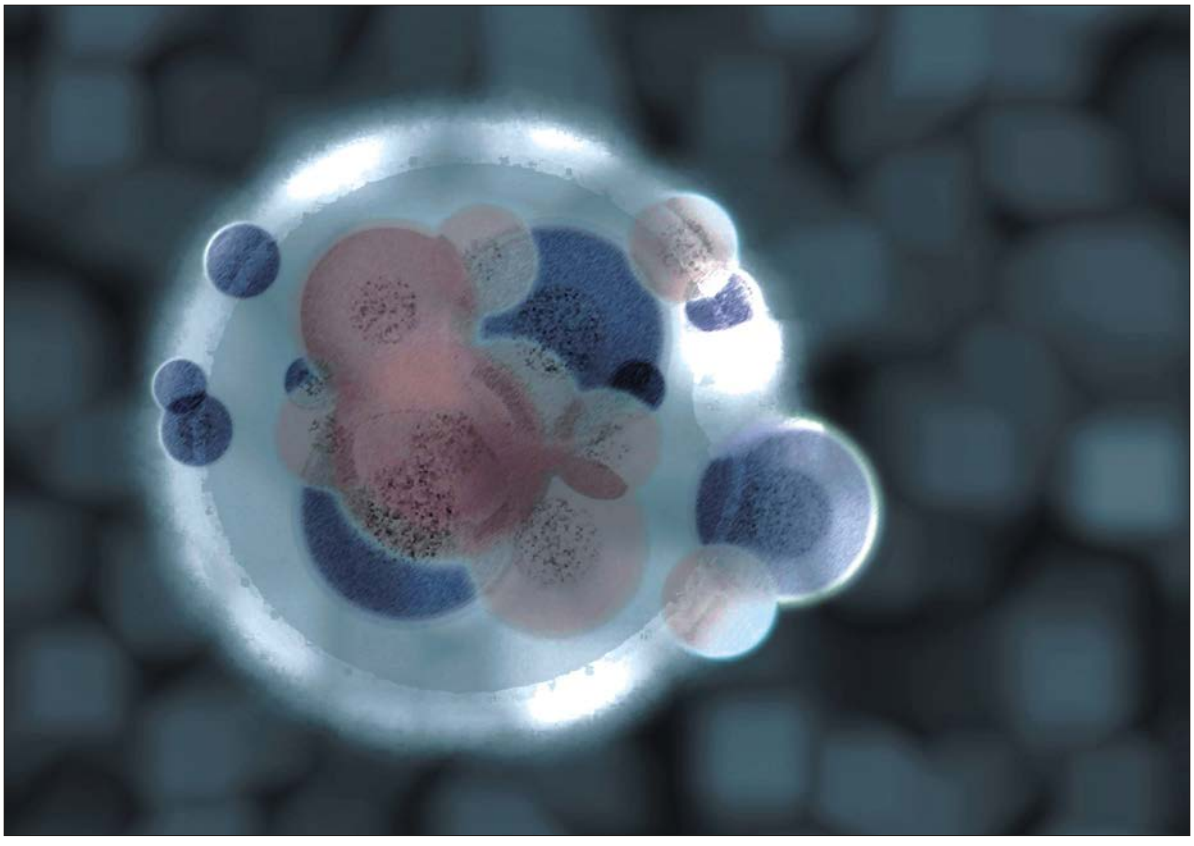

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Evaluation of Some Important Chemical Constituents of *Momordica charantia* Cultivated in Hofuf, Saudi Arabia

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Abstract: For the first time, *Momordica charantia* L. was cultivated in Hofuf, Saudi Arabia. Fruits and leaves of the plant were analyzed for protein, vitamin C, total chlorophyll, chlorophyll A, chlorophyll B, chlorophyll A and B, nitrogen, phosphorus, potassium, copper, iron, manganese and zinc. Other cultivation was performed with NPK (20% nitrogen, 20% phosphorous, 20% potassium) fertilizer and the same constituents were determined. Effect of fertilization on level of constituents was examined. The obtained results are comparable with that of the plant cultivated in other areas in the world, while others are very lower. The study concluded that the nutritional contents in the edible parts of *Momordica charantia* L. can be improved by using NPK fertilizer during cultivation and plantation. Also, the study revealed that the fruit of the Saudi plant is highly nutritious.

Key words: *Momordica charantia*, bitter melon, plant analysis

INTRODUCTION

Momordica charantia a member of the cucumber family-Cucurbitaceae, is commonly known as bitter melon and more than other twenty nick-names. It is a tropical plant currently distributed across the globe but mainly concentrated in Amazon, East Africa, Asia, Caribbean and throughout South America. The plant is adapted to a wide variation of climates although production is best in hot areas[1]. Concerning with condition requirements of cultivation, the plant is similar to the cucurbita crops especially in irrigation, fertilization and weather. Bitter melon is an annual, slender, climbing plant with long-stalked leaves. The fruit appears as a warty gourd, usually oblong and resembling a small cucumber. The Latin name Momordica means "to bite" (referring to the jagged edges of the leaf, which appear as if they have been bitten). All parts of the plant, including the fruit, taste very bitter. It is a revolutionary plant for its versatility as foodstuff and therapeutic applications. Although the seeds, leaves and vines of Bitter Melon have all been used as food and remedy, the fruit is the safest and most prevalent part of the plant used. From the viewpoint of nutritional value, the fruit is highly nutritious due to the iron and ascorbic acid content. Tender fruits of the plant are eaten as vegetable in stew or are pickled; they are used also for flavoring food dishes. The leaves and fruits have both been used occasionally to make teas and beer, or to season soups in the Western world. Some fruits of the plant have bright red seeds due to a high lycopene content that can be used as an natural food colorant[2]. Also, leaves and stems of the plant are used as camel fodder. For a very long time ago, bitter melon has been widely utilized in traditional medicine for many treatments. Recently, many phytochemicals in the herb have been identified and clinically demonstrated, which exhibit many medicinal activities such as antibiotic, antimutagenic, antioxidant, antileukemic, antiviral, antidiabetic, antitumor, aperitive, aphrodisiac, astringent, carminative, cytotoxic, depurative, hypotensive, hypoglycemic, immunomodulatory, insecticidal, lactagogue, laxative, purgative, refrigerant, stomachic, styptic, tonic, vermifuge (http://www.ran.tree.com).

Due to the versatility of bitter melon, the plant was cultivated in Hofuf oasis, Saudi Arabia for the first time. The soil of the area is sandy, low organic matter content and deficient in nitrogen and phosphorus[3].

The main objectives of this study were to determine macro and micro constituents of *Momordica charantia* cultivated in Hofuf, assessing the nutritional value of the plant, studying the effect of NPK fertilizer on the level of constituents and comparing the chemical constituents of the Saudi plant with those grown in other areas in the world.

MATERIALS AND METHODS

The plant was cultivated in two consequent seasons under greenhouse and drip irrigation conditions. Part of cultivation was treated during cultivation and plantation

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with 350 kg ha^{-1} NPK fertilizer. By the end of the season, fruits and leaves were sampled, oven dried at 70°C and crushed into powder form. Protein content was determined according to the improved method of Kjeldhal[4]. Contents of total chlorophyll, chlorophyll A, chlorophyll B and chlorophyll A and B were determined in the upper leaves by extraction in 80% acetone and measured calorimetrically according to method of Kirk and Allen[5]. Determination of vitamin C was performed applying the AOAC's method[4] using 350 Corning colorimeter. For nitrogen analysis, samples were digested according to the method of Chapman and Pratt[6] and total nitrogen content was determined using Kjeldhal method[4]. Phosphorus content was determined using the method of Jackson[7], which is calorimetrically determined using 350 Corning colorimeter. According to the method of Knudsen and Pratt[8], potassium content was determined by PFP Jenway flame photometer. For trace elements analysis, the method described by Edward[9] was applied using 2380 Perkin-Elmer atomic absorption spectrophotometer. The obtained data were subjected to statistical analysis of variance according to the procedure outlined by Gomez and Gomez[10]. The least significant differences at 5% level (LSD 5%) between contents of constituents in fertilized and non-fertilized plant were calculated.

RESULTS AND DISCUSSION

The results of chemical and statistical analysis for fruits and leaves are shown in Table 1 and 2. Irrespective of fertilization treatment, the obtained results for protein content in fruits are comparable with that cited in http://216.239.37.104 that was 18.02%. Other studies revealed that Chinese bitter melon contained only 0.91% protein (http://216.239.53.100). Also, approximately similar quantities of protein were recorded that ranged between 1.6 and 2.1% (www.indmedplants-kr.org) and 0.9%[11]. It is appeared that the Saudi plant was rich in protein. Content of vitamin C in bitter melon grown elsewhere recorded higher values than that cultivated in Saudi Arabia, which varied from 88 to 96 mg/100 g (www.indmedplants-kr.org) and 88 mg/100 g[11]. USDA (Nutrients Database for Standard Reference) (http://www.naturalhub.com) classify melon (cantaloupe or scientifically known as *Cucumis melon* L.) that contain from 25 to 42 mg/100 mg vitamin C as very good source of vitamin C, consequently, the Saudi plant can be also considered as a very good source of vitamin C. Nitrogen level in Saudi plant varying between 2.31 and 2.44% which is lower than that recorded in http://www.rain.tree.com that was 3.38%. Also, phosphorus content in this study that is varied from 137.7 to 15.30 μg g^{-1} is lower than that values recorded by http://www.rain.tree.com that ranged between

Table 1: Some chemical constituents in fruit of bitter melon and the least significant differences at 5% level ($LSD_{0.05}$) values

Constituents	Amount in fertilized	Amount in non-fertilized	$LSD_{0.05}$
Protein (%)	15.23	14.40	0.471
Vitamin C (mg/100 g)	36.37	31.00	2.926
Nitrogen (%)	2.44	2.31	0.074
Phosphorus (μg g^{-1})	153.00	137.70	13.720
Potassium (%)	2.30	2.18	N.S.
Copper (μg g^{-1})	2.60	1.85	0.113
Iron (μg g^{-1})	32.33	12.35	4.719
Manganese (μg g^{-1})	5.65	2.38	0.146
Zinc (μg g^{-1})	10.50	7.76	0.185

Table 2: Some chemical constituents in leaves of bitter melon and the least significant differences at 5% level ($LSD_{0.05}$) values

Constituents	Amount in fertilized	Amount in non-fertilized	$LSD_{0.05}$
Chlorophyll A	0.390	0.340	NS
Chlorophyll B	0.390	0.290	1.850
Chlorophyll A and B	0.788	0.607	NS
Total chlorophyll	1.037	1.023	NS
Vitamin C (mg/100 g)	39.600	33.000	0.093
Nitrogen (%)	2.590	2.450	N.S.
Phosphorus (μg g^{-1})	156.600	124.660	0.007
Potassium (%)	1.430	1.200	13.820
Copper (μg g^{-1})	1.210	0.900	0.047
Iron (μg g^{-1})	11.700	9.1	0.114
Manganese (μg g^{-1})	1.330	0.97	0.225
Zinc (μg g^{-1})	3.650	3.05	0.052

320 and 8333 μg g^{-1}. Contents of potassium, iron and Copper in the plant cultivated elsewhere recorded 1.52%, 18.0 μg g^{-1} and 1.8 μg g^{-1}, respectively (www.indmedplants-kr.org), which was lower than that of the Saudi plant. The plant thought to be a good iron source that due to the high iron content of the tropical soils. Other study revealed that copper content in fruit of bitter melon grown elsewhere was 35.5 μg g^{-1} (http://www.topark.org), which is higher than that for Saudi plant.

Concerning with levels of LSD 5%, as depicted in the Table 1 and 2, the values of potassium in fruits and total chlorophyll, chlorophyll A and nitrogen are not significant. The significant values for other constituents in fruits and leaves are presented in Table 1 and 2. Since chlorophyll increase the growth of the plant, the formation of protein and vitamin C, to some extent, were not effected pronouncedly by NPK fertilizer. While NPK fertilizer increases the acidity of soil, bioavailability of minerals will increase. Hence, minerals in *Momordica charantia* are significantly enhanced by NPK fertilizer.

Plantation of *Momordica charantia* in Hofuf oasis of Saudi Arabia was being proved by this study. It can be successfully cultivated with or without fertilizer. Plant content of protein and vitamin C were comparable with that grown elsewhere. Where, its content of minerals was higher than those reported which, further enhanced by using fertilizers.

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