American-Eurasian Journal of Toxicological Sciences 7 (4): 286-291, 2015
ISSN 2079-2050

DOI: 10.5829/idosi.aejts.2015.7.4.95331

Nutritional Prospects and Mineral Compositions of two Selected Vegetables of The Family Cucurbitaceae Cultivated in Fresh and Waste Waters From Quetta Cityin Relation to Their Significance in Human Diet

[1]Sabeena Rizwan, [1]Nelofer Jamil, [1]Saira Sahibdad, [2]Zubia Masood, [1]Madiha Shahab, [1]Faryal Nawaz, [1]Fazeela Mandokhel, [4]Shaista Hameed, [1]Ayesha Mushtaq, [1]Musarat Riaz, [3]Farhat Iqbal and [1]Muzaffar Khan

[1]Department of Chemistry, SardarBahadur Khan Women's University, Quetta, Pakistan
[2]Department of Zoology, University of Karachi, Karachi-75270, Pakistan
[3]Department of Zoology, SardarBahadur Khan Women's University, Quetta, Pakistan
[4]Department of Botany, Sardar Bahadur Khan Women university, Quetta, Pakistan

Abstract: The present study was based toelucidate the effect of waste and fresh waters on the nutritional values of two vegetable species i.e., *Cucurbita maxima* (squash) and *Cucumis sativus* (Cucumber) of family Cucurbitaceae cultivating in freshwater and wastewater from Sabzal road and Airport road of Quetta city of Pakistan. These selected species were collected and their micro and macronutrients were analyzed by using Atomic absorption spectrometric and AOAC methods. According to the obtained results, waste water *C. sativus* contained highest moisture 10.58% and ash content 9.86%, while highest values of proteins 11.8%, fats 3.41% and fibers 19% were found in waste water *C. maxima*. The higher concentration of carbohydrates that is 72.59% and energy levels like 364.16Kcal/100g were observed in fresh water squash. The values of toxic metals like Chromium, Cobalt, Manganeseand Ironin in waste water of *C. sativus* were 0.039 (Cr), 0.0856 (Co), 8.579 (Mn) and 3.044 (Fe) ppm, while in waste water *of C. maxima* were 0.025(Cr), 0.070 (Co), 7.559(Mn) and 1.034(Fe) ppm, respectively. Hence, the comparative analysis of nutritional prospects and mineral compositions of these vegetables revealed that they were rich in appreciable amount of macro and micronutrients;therefore possess high nutritional values in human consumption.

Key words: Nutritional values · Macronutrients · Micronutrients · Vegetables

INTRODUCTION

Vegetables are the fresh portions of herbaceous plants, an important food, highly beneficial for the maintenance of health and prevention of various diseases. They contain vital ingredients of food that can be successfully utilized to repair and build up the body [1]. They have a favorable influence on the physiological functions of the human beings [2]. The cucurbits are a family of healthy foods, while cucumbers in particular are a major dieting food source asIt contains 96% water with a little fiber and only a few calories.The cancer preventive benefit of cucumber has been identified by the National Cancer Institute. On the other hand,the fruits of the *Cucurbita* genus are rich sources of valuable nutrients like vitamin A, vitamin C, niacin,folic acid and iron and also free from cholesterol.Pumpkin or squash plants provide a number of nutrients and minerals which are beneficial for human health. The main nutrients are lutein and both alphaand beta carotenethat later can generates vitamin A in human body. When vegetables are being compared with other food of animal source, it has been found that the vegetable products have a lower heat value as well as lower food value but have great importance in human nutrition because its consumption in diet protects the human body from a wide range of chronic illness. So, vegetables are considered as treasure of vital nutrients that are gifted by almighty Allah to the human beings. They are the rich sources of various essential biochemical micro and macro-nutrients such as,carbohydrates, fats, proteins, vitamins, carotene and certain trace minerals [3].

Corresponding Author: Dr. Zubia Masood, Department of Zoology, University of Karachi-75270, Pakistan.

The diverse climatic conditions of Pakistan offer an excellent opportunity to grow wide varieties of vegetables and fruits in all the seasons throughout the year [1], therefore in Pakistan, more than 63 varieties of different vegetables that are distributed in 44 genera, are now grown and consumed as winter and summer vegetables such as potatoes, gourds, tomatoes, cucumbers, cabbages, brinjal, squashetc [4].

The analysis of macro and micro nutrients found in vegetables play an important role in the assessment of their nutritional significance [5]. On the other hand, the evaluation of micronutrients of vegetables is a growing trend throughout the world. Although they cannot provide any calories but play essential role in the metabolic regulation of body, they maintain body pH, osmotic regulation and are used as coenzymes involved in different metabolic pathways [6].

The variation in the level of macro and micronutrients is may be due to the quality of water used for irrigation in the today's world. Water with good quality is scarce because of overwhelmed population so marginal quality water will have to be considered for agricultural use. Such irrigation practices provide us very good yield of crop because it contains large amounts of organic and inorganic elements. Among the organic substances that are mostly present in the sewage water are carbohydrates, lignin, proteins, soap, detergents and their decomposition products, while inorganic substances includes certain non-essential heavy metals such as Ar, Cd, Cr, Cu, Hg, Zn and Pb etc. that could be transferred to animal and human beings through food chain [7]. In Pakistan, the vegetable production that is irrigated with waste water is now reaching about 25% [8]. On the other hand, the vegetables irrigated with tube well water contain less accumulation of heavy metals and macronutrients because of lack of such toxic substances and contaminations that are mostly present in large amount in waste water. So such species grown with tube well water possess metal ions below their permissible limits, which are safe for human consumption. Waste water irrigation, the disposal of solid waste, applications of sludge, the exhaust by vehicles and industrial activities are the primary sources of the contamination of soil with heavy metals. So there is an increased uptake of metals by fruits and vegetables, which are grown on this type of contaminated soil and water in worldwide. The concentration of heavy metals may also vary due to difference in the absorption capacity of various vegetables for different heavy metals[7,8]. Hence, a present study was conducted is to evaluate the amount of macro and micro nutrients in the above mentioned two vegetablesinorderto provide a comparison between nutritional qualities of the vegetables grown in fresh water and waste water of Quetta for human beings.

MATERIALS AND METHODS

Sampling: The vegetable samples (cucumber and squash) were collected from the local market of Quetta (Sabzal road) grown in waste water while the samples grown in fresh water were collected from the farm (airport road) to which there is supply of tube well water. The collected samples of vegetables were washed with distilled waterthen those samples were placed in the oven to dry them grinded and were stored in the polyethylene bags until used for the analysis of macronutrients and micronutrients using the method reported by Farooq *et al.* [9].

The macronutrients such as proteins, fats, carbohydrates and crude fibers of the vegetable samples were analyzed through various methods. The moisture content of samples was determined by using weight difference method while Crude fiber was determined by the digestion of samples first with acid and then with alkali followed byKhattak [10]. Protein was determined by biuret method, as followed byAgbaire and Emoyan[11]. Acid hydrolysis technique was used for the determination of fat in vegetable samples. The ash content of vegetable samples was determined using weight difference method followed by Hanif *et al.* [1]. Carbohydrates were determined by difference method, which is the sum of percentages of moisture, protein, fats, crude fiber and ash were subtracted from hundred. This parameter was determined according to Hussain *et al.* [3]. In energy value of samples was calculated by using a method which is (9 x fat) + (4 x carbohydrate) + (4 x protein). This content was determined through a method followed by Hussain *et al.* [12].

For this determination, the method of Wet digestion was used. The working standard solution of Iron "Fe" manganese "Mn" cobalt "Co" and chromium "Cr" were prepared using stock standard solutions having 1000ppm of element in 2N nitric acid. The atomic absorption spectrophotometer was first calibrated and then elements were measured. For each element, the calibration curves were prepared. The measured values were then compared to that of standard curves in order to determine the micronutrients in each sample.

Statistical Analysis of Data: For observing the variations between means of two vegetable samples cultivated in two different water resources was analyzed by 2 sample t-test using Minitab version 17.1 statistical software.

RESULTS AND DISCUSSION

Edible vegetables are an essential component of human diet containing vital macro and micronutrients that play an important role in human metabolism. Taking in to account this importance of vegetables in human diet, two selected species of cucurbitaceous family i.e., *Cucurbita maxima*and *Cucumissativus* from the different Quetta regions of Pakistan were analyzed for their nutritional values for human consumption. The result of this analysis showed that variation were observed in the concentration of macro and micronutrients values among these vegetables cultivated in fresh and waste water environments as shown in Tables 1-2 respectively.

Macronutrients Analysis: If we look at the overall percentage of carbohydrate composition of selected vegetable species, it was found highest (72.59%) in squash (*C. maxima*) grown in fresh water, followed by the squash grown in waste water having value that is 71.21% > fresh water Cucumber(*C. sativus*) that is 66.77%, but least in waste water cucumber that is 65.78%, respectively. The obtained value of carbohydrate of *C. maxima* in the present study was found to be greater than that of reported value (67.87%) by Hussain *et al.* [13], which obtained value of carbohydrate for *C. sativus* was a little bit higher than reported value (64.62%) of Hussain *et al.* [12].

In the present investigation, the protein content was found highest(11.8%) in *C. maxima* (waste water squash), followed by fresh water squash (11.7%) and thenwaste water cucumber (11.5%), while least in fresh water cucumber (11.4%). Protein values of these two species were found to be greater than thosereported by Hussain *et al.* [12,13] for *C. maxima* (5.59%) and*C.sativus* (10.57%), respectively. So the result of this work analyzed an adequate amount of protein in these vegetables.

According to the obtained results, the fat concentrations werefound to be 2.0% and 2.3% in *C.sativus*cultivating in fresh water and waste water, respectively. This obtained value was found similar to those reported by Hussain *et al.* [12]. On the other hand, *C. maxima* contained 3.0% and 3.41% of fat content cultivated in fresh and waste water. The obtained values of fat were a bit higher than the value (1.49%) reported by Hussain *et al.* [13] for the same species. Thence, our obtained the results indicating that these vegetable species are rich source of fat for human consumption.

In the present study, the percentage of moisture content was found to be different among the vegetable species. It was found higher in waste water cucumber (10.58%), followed by fresh water cucumber (10.18%)> waste water squash (6.6%), while found to be least in fresh water squash (5.9%).Thus,the obtained results indicating that due to climatic conditions, great variation occurred among these values.

Table 1: Analysis of macronutrients of selected vegetables from Quetta, Pakistan.

								2 samples t-test		
Samples	Moisture %	Ash %	Protein %	Fat %	Fiber %	Carbohydrate %	Energy Values Kcal/100g	95%CI	t-test	p-value
Fresh water Cucumber	10.18	9.65	11.4	2.0	6.1	66.77	330.68	(-141.3,141.3)	-0.00	1.000^{NS}
Waste water Cucumber	10.58	9.86	11.5	2.3	7.0	65.78	329.82			
Fresh water Squash	5.9	6.81	11.7	3.0	15.1	72.59	364.16	(-155.5,155.1)	-0.00	0.99^{NS}
Waste water Squash	6.6	6.98	11.8	3.41	19.0	71.21	361.89			

Note:CI=confidence interval; NS= T-test is insignificant when p>0.05.

Table 2: Analysis of micronutrients of selected vegetables from Quetta, Pakistan

					2 samples t-test		
Samples	Chromium (ppm)	Cobalt (ppm)	Manganese (ppm)	Iron (ppm)	95% CI	t-test	p-value
Fresh water Cucumber	0.02	0.05	7.76	2.38	(-7.35, 6.59)	-0.14	0.8^{NS}
Waste water Cucumber	0.04	0.08	8.57	3.04			
Fresh water Squash	0.02	0.05	6.95	0.83	(-6.55, 6.13)	-0.08	0.9^{NS}
Waste water Squash	0.02	0.07	7.56	1.03			

Note:CI=confidence interval; NS= T-test is insignificant when p>0.05.

In the present study, the fiber content of *C. maxima* was found to have high (15-19 %) as compared to the *C.sativus*, as shown in the Table 1 respectively. These obtained results showed similarity to that which was reported byHussain *et al.* [12,13]. Hence, it had been proved that *C.maxima* could be a valuable resource of dietary fiber in human nutrition.

According to the result obtained, *C.sativus* was found to have high ash content as compared to the squash. Ash contents of Cucumber grown in fresh and waste water were 9.65% and 9.86%, the values were similar to the reported value of Khattak[10]. While On the other hand, ash contents of *C. maxima* when grown in fresh water was found to be 6.81%, while those grown in waste waterwas6.98%, which were found to the lower than the reported values by Hussain *et al.* [13]. Such variations could be the result of differences in some environmental factors i.e., temperature, soil, water quality etc.

If we analyze and calculate the overall calorific values of our selected vegetable, it was found that both the species could provide significant amount of energy to the consumers. The obtained values of energy for *C.maxima* were 330.68 Kcal/100gm and 329.82 Kcal/100gm grown in fresh and waste water as shown in Table 1, respectively. *C.sativus* was found to have 364.16 Kcal/100gm and 361.89 Kcal/100gm grown in fresh and waste water, respectively. These analyze values were found to be in similar range reported by Hussain *et al.* [12,13]. The significant calorific levels provided by selected vegetables indicated that these two edible vegetables are good sources of energy for human consumption.

Furthermore, the analysis of variation between the values of macronutrients found in fresh water and waste water cultivated two vegetables samples (Cucumber and squash) revealed that no significant variations (t-test; $p>0.05$) were found between the values of all these macronutrients cultivated in two different water resources, hence both types of these vegetables are equally rich source of all these macronutrients.

Micronutrients Analysis: In this research project, few of the trace minerals such as chromium, cobalt, iron and manganese were analyzed by atomic absorption spectroscopy. This technique was reported by Farooq *et al.* [9]. These traces minerals were expressed in the units of ppm (see Table 2 and Figures 3-4).

According to the different studies, it has been reported that the range of chromium at 5 mg/L is found to be toxic for human health. Chromium contamination of soil and ground water has become a source of concern for human beings. Its toxicity in plants greatly effects their yield and growth. In the present study, waste water cucumber was found to contain higher concentration of chromium that is 0.04 ppm, followed by fresh water cucumber (0.02 ppm), waste water squash (0.02 ppm) and fresh water squash (0.02 ppm). These results were found to be almost similar to that which was reported by Hussain *et al.* [12].

As studies have been carried out on cobalt in different food, it was found that the cobalt variation in vegetables is about 0.006-009 mg/kg [14]. The RDA value of cobalt in human diet is 0.005 mg/day [15].In the present study, waste water *C. maxima* and *C. sativus* revealed the high cobalt content ranged from 0.07-0.08 ppm than that those cultivated in fresh water that is 0.05 ppm as shown in the Table 2. These results are comparable to those values which were reported by Hussain *et al.* [12]. if there is deficiency of chromium, it can play role in producing anoxia and injure the cardiac muscles [16]. While it's over intake can cause skin and digestive problems in humans.

The daily intake limits of iron are 8-11 mg/day. The concentration of iron below this range a major problem in Asian countries and about 60% of the world population suffers from iron deficiency [17]. The obtained results showed that iron concentration in fresh and waste water *C. sativus* was 2.38 ppm and 3.04 ppm respectively. While iron concentration in fresh water and waste water of *C. maxima* was 0.83 ppm and 1.03 ppm, respectively. These results were lower than the reported results of Hussain *et al.* [13]. Such variation probably is due to the low percentage of iron in water or also due to lower consistency of iron in soil of the area from where these species were collected. Iron deficiency can cause anemia, reduced attentiveness and loss of concentration.

Another trace element is called manganese (Mn), which is an essential element and required mainly in carbohydrate metabolism. The limit of manganese intake is 2-5 mg/day. The obtained results of manganese were 7.76, 8.57, 6.94 and 7.55 ppm in fresh water and wastewater*C. sativus*andfresh and waste water squash, respectively. These results were almost similar to the results obtained by Hussain *et al.* [13]. When there is excessive manganese, it will lead to poor growth and anemia because those individuals who are deficient in iron can have elevated manganese absorption [18]. Skin contact with it may cause manganic pneumonia [19].

Analysis of variations between the amounts of micronutrients in two vegetables cultivated in two different water resources revealed that no significant variations (t-test; $p>0.05$) are found in the concentrations of four micronutrients such as, chromium, cobalt, manganese and iron, so both types of vegetables cultivated in different water resources contain almost equal concentrations of these four micronutrients (Table 2).

CONCLUSIONS

Both cucumber (*C. sativus*) and squash (*C. maxima*) can provide sufficient amount of micro and macronutrients, which are required for the human body for its normal functioning. The quality of water plays a vital role by providing a potential source of important nutrients to those vegetables that are grown in it. The comparative nutritional analysis of these two selected species also proved that those vegetable species that grown with sewage water contain higher values of macro and micronutrients as compared to that grown with tube well (fresh) water. Sewage water can also provide high level of heavy metals as it is composed of different types of domestic effluents. These effluents in return contain various chemicals compounds composed of different metals. Though vegetables irrigated with waste water provides nutrients and good yields, but it also contains organocholorinated pesticides such as DDT, eggs of helminthes, high concentration of *E.coli*bacteria and viruses that are hazardous for human health. High concentration of heavy metals in sewage water vegetables can also lead to several crucial health problems. In the present study, the selected vegetables contain appropriate concentration of such nutrients so they are compatible for our daily requirement.

REFERENCES

1. Hanif, R., Z. Iqbal, M. Iqbal, S. Hanif and M. Rasheed, 2006. Use of vegetables as nutritional food: Role in human health. Journal of Agriculture and Biological sciences, 1(1): 18-22.
2. Caunii, A., R. Cuciureanu, A.M. Zakar, E. Tonea and C. Giuchici, 2010. Chemical composition of common leafy vegetables. Studia Universitatis "Vasile Goldiş", SeriaŞtiinţeleVieţii, 20(2): 45-48.
3. Hussain, J., K. Al-Rehman, M. Humayun, T. Shah, M. Nisar, T. Bano, Z.K. Shinwari and I. Lee, 2009. Proximate and nutrient analysis of selected vegetable species: A case study of Karakregion, Pakistan. Afri. J. of Biotech., 8(12): 2725-2729.
4. Ather, M. and T.Z. Bakharim, 2006. Ethnobotany and production constraints of traditional and commonly used vegetables of Pakistan. J. Vegetable Sci., 12(2): 27-38.
5. Pandey, M., A.B. Abidi, S. Singh and R.P. Singh, 2006. Nutritional Evaluation of leafy Vegetable. Paratha J. Hum.Ecol., 19(2): 155-156.
6. Schwarz, K., 1977. Clinical Chemistry and Chemical Toxicology of Metals.(Eds. S.S. Browred), Elsevier, Amsterdam, pp: 135.
7. Ghafoor, A., A. Rauf, M. Arif and W. Muzzafar, 1995. Chemical composition of effluent from different industries from Faisalabad city. Pak. J. Agri. Sci., 31(4): 37-69.
8. Ensink, J.H.J., T. Mahmood, W. Van der Hoek, L. Raschid-Sally and F.P. Amerasinghe, 2004. A notation wide assessment of water use in Pakistan: an abscure activity or a vitally important one? Water policy, 6: 197-206.
9. Farooq, M., F. Anwar and U. Rashid, 2008. Appraisal of heavy metal contents in different vegetables grown in the vicinity of an industrial area. Pak. J. Bot., 40(5): 2099-2106.
10. Khattak, K.F., 2011. Nutrient composition, phenolic content and free radical scavenging activity of some uncommon vegetable of Pakistan. Pak. J. Pharm. Sci., 24(3): 277-83.
11. Agbaire, P.O. and O.O. Emoyan, 2012. Nutritional and anti-nutritional levels of some local vegetables from Delta state, Nigeria. Afri. J. of Food Sci., 6(1): 8-11.
12. Hussain, J., N. Rehman, A.L. Khan, M. Hamayun, S.M. Hussain and Z.K. Shinwari, 2010. Proximate and essential nutrients evaluation of selected vegetables species from Kohat region. Pakistan. Pak. J. Bot., 42(4): 2847-55.
13. Hussain, J., N. Rehman, A. Al-Harrasi, U. Riaz, F. Mabood, H. Hussain and M. Ismail, 2011. Nutritional prospects and mineral compositions of selected vegetables from Dhoda Sharif-Kohat. J. Med. Plants Res., 5(27): 6509-6514.
14. Leblanc, J.C., P. Verger, T. Guerin and J.L. Volatier, 2004. Etude de la'alimentation total francaise Mycotoxines, minerauxetelement traces. In: INRADGAL (Eds.), pp: 68.

15. Agency for Toxic substances and disease Registry, US Department of Health and Human Services. Public Health Service contact No.205-93-0606.
16. Carsan, B.L., H.V. Ellis and J.L. Mccann, 1986. Toxicology and biological monitoring of metals in Human. Lewis Publishers Inc., Michigan, USA.
17. Brown, P.H., 2004. Principles of micronutrient use. IFA International Symposium on Micronutrients, 23-25, New Dehli, India, pp: 12.
18. Mena, I., K. Horiuchi and G. Lopez, 1974. Factors enhancing entrance of manganese in to the brain; Iron deficiency and age. J. Nuel. Med., 15: 516.
19. Underwood, E.J., 1997. Trace elements in human and animal nutrition. 4thed., Academic Press Inc., NewYork, pp: 545.