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USE OF VEGETABLES AS NUTRITIONAL FOOD: ROLE IN HUMAN HEALTH

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ABSTRACT

Vegetables included in daily schedule of diet viz. Sweet Pepper, Cauliflower, Carrot, Cabbage, Lettuce, Spinach, Tomato, Potato, Reddish, and Bottle Gourd were analyzed for their proximate composition, vitamin and mineral contents to evaluate their importance in human nutrition. The results showed that almost all vegetables contain appreciable amount of essential nutrients. Moisture content was high ranging from 77% in potato to 94.5% in bottle gourd followed by carbohydrate in all selected vegetables. Crude protein, Crude fiber and ash were in range from 0.9 to 2.1%, 0.3 to 1.2% and 0.5% to 1.1% respectively. Sweet pepper was found to be highest in crude fiber content. Vegetables intake is beneficial for obese, as they furnish fat to a lesser extent. Minerals in dry weight basis were found in different concentration in all vegetables. K was the most abundant mineral followed by P and Ca. Some vegetables constitute appreciable amount of Na. Potato contained 240 mg/100gm K, but Calcium (8 mg/100gm) was deficient in it. Na was found high (63.9 mg/100gm) in reddish. P and Ca concentration was found 84mg/100gm and 76 mg/100gm respectively in Spinach, which is also an efficient source of Fe 6mg/100gm. comparatively, tomato contained less amount of P (27 mg/100g). Cabbage was found deficient in Fe (0.51 mg/100gm). All the vegetables analyzed, are poor source of Cr. Vitamin analysis confirmed that selected vitamins were found high in spinach followed by cauliflower and tomato. Carrot contains minimum amount of water soluble vitamin among various vegetables. Thiamine was relatively in higher amount than niacin and riboflavin.

Keywords: Nutrients profile, vegetables, healthy food, human health.

INTRODUCTION

Vegetables are the fresh and edible portions of herbaceous plants. They are important food and highly beneficial for the maintenance of health and prevention of diseases. They contain valuable food ingredients which can be successfully utilized to build up and repair the body. Vegetables are valuable in maintaining alkaline reserve of the body. They are valued mainly for their high carbohydrate, vitamin and mineral contents. There are different kinds of vegetables. They may be edible roots, stems, leaves, fruits or seeds. Each group contributes to diet in its own way (Robinson, 1990).

In Pakistan vegetables (excluding potatoes) are grown in the area of about 0.22 million hectares with a total production of 2.88 million tonnes in 2002-2003 (ASP, 2002-2003). Both the area and production of vegetables have been increasing for the past few years. In the North-West Frontier Province (NWFP) vegetables are mainly grown in Peshawar, Mardan, and Malakand divisions. In the year 2002-2003 vegetables occupied an area of 0.033 million hectares in the province, which produced 0.35 tonnes fresh vegetables. These estimates reflect that vegetables fit well in our multiple cropping systems. The soil and climatic conditions of Pakistan are congenial for the production of vegetables. Different kinds of vegetables are grown in the widely diversified agro climatic zones of the country (Khalil and Rehman, 1977).

Vegetables contribute minerals, vitamins, and fiber to the diet. Minerals are naturally occurring inorganic substances with a definite chemical composition and an ordered atomic arrangement (O' Donoghue, 1990). Among the plants, vegetables are the excellent sources of minerals and contribute to the RDA of these essential nutrients. Minerals are very important and essential ingredients of diet required for normal metabolic activities of body tissues. Out of 92 naturally occurring minerals 25 are present in living organisms. They are constituent of bones, teeth, blood, muscles, hair and nerve cells. Vitamins cannot be properly assimilated without the correct balance of minerals (Sonni Alvarez, 2002).

Vitamins are organic compounds occurring in natural foods especially in vegetables either as such or as utilizable "precursors". Vitamins are needed for maintenance of skin, mucous membranes, bones, teeth and hair, vision and reproduction. They help body to absorb calcium and phosphorous; needed for bone growth and maintenance. Vitamins are involved in blood clotting, normal functioning of nervous system and endocrine glands. They are also needed for metabolism of macro molecules (Chatterjea and Shinde, 1998).

Vegetables as a whole are considered as natural caches of nutrients gifted by Almighty Allah to human beings e.g. carrot is a good source of vitamin A, needed for normal vision, like wise spinach and tomato contains enough amount of vitamin C to prevent and cure scurvy. Potato is rich in starches and provide high amount of carbohydrates. Some vegetables contain high amount of dietary fibers such as sponge gourd and bottle gourd etc and help to prevent constipation. In this study, determination of selected mineral constituents, proximate composition and vitamins of different vegetables consumed daily by majority of people, was

carried out. The main purpose of this trial was to aware the peoples about the masses of the nutrients they take during ingestion of vegetables. These findings would also be useful for nutritionists to formulate balance diets in conclusion. Further investigations are required to notice the effects of cooking and storage conditions on these valuable nutrients.

MATERIALS AND METHODS

Vegetable samples were collected through stratified random sampling method. For this purpose Peshawar valley was divided into three strata i.e. Tarnab, Malakander and Pishtakhara village. One kg of each of the vegetable samples including carrot, cabbage, lettuce, spinach, sweet pepper, potato, cauliflower, reddish, tomato, and bottle gourd from each stratum was collected. Three replications of each of these samples were analysed for their proximate composition and mineral contents to evaluate their nutritive value in human food. These vegetables excluding sweet pepper and reddish were also checked for Ascorbic acid, Niacin, Riboflavin and Thiamin contents.

Proximate Composition

Proximate composition includes moisture, Crude protein, ether extract, Crude fiber, Ash, and Nitrogen free extract. The composite samples were prepared for proximate analysis. Moisture was determined by oven dehydration method at 105˚C up to the constant weight. Crude protein was determined by estimating the nitrogen content of the food materials, using Kjeldhal method. Crude fat was determined by ether extraction method using sohxtech. Crude fiber was determined by Acid digestion and Alkali digestion and by using fibertech. Ash content was determined in muffle furnace at 550˚c for 6 hours. For all these determinations powdered and oven dried sample were used in triplicate, accordance with AOAC (2000). NFE is calculated by difference, Food energy calculation is derived by multiplying the percentage of crude protein and carbohydrate by 4.1 and crude fat by 9.3 (Khalil and Saleemullah, 2004).

Mineral Assay

For minerals analysis viz P, K, Ca, and Na the samples were digested by using $HClO_4$/ HNO_3 method (Steekel and Flannery. 1965). And for the determination of micro minerals i.e. Cr and Fe the samples were digested by dry ash method (Isaac and Johnson. 1975). The digested samples were used for selected minerals analysis, using sophisticated instrument, U.V. Spectrophotometer (Optima, SP 3000+), Atomic Absorption Spectrometer (Perkin Elmer model 2380) and Flame Photometer (Jenway PFP7).

Vitamins Assay

Vitamin C was determined in fresh vegetable samples by dichlorophenol Indophenol dye reduction method (Smirnoff. 2000). Niacin was determined by colorimetric method (Nudelman and Nudelman, 1976) whereas thiamine and riboflavin were determined by flourometric method. (Hodson and Norris, 1939)

RESULTS AND DICUSSION

Proximate Composition

Proximate composition and energy value of each vegetable is shown in Table-1. The moisture content in all vegetables was very high ranging 77% to 94.5%. After moisture the second major chemical constituent found was carbohydrate. Potato was having high amount of carbohydrates (19.0%) as compare to other vegetables, therefore its energy value is found highest. Tomato was deficient in carbohydrates its concentration was noted to be 3.9%. Crude protein content was estimated 0.9% to 2.1% in all the selected vegetables. The crude fat analysis showed that vegetables are deficient in fats this makes them good for health. The result shows that Ash contents were 0.5% to 1.1%, high amount was found in the spinach. The crude fiber content in sweet pepper was 1.2% amount is high as compare to other vegetables, minimum amount was found 0.3% in potato. The energy calculated in Calories for all the selected vegetables showed that reddish and tomato provide 23 Cal each, sweet pepper and cauliflower both provide 25 Cal, cabbage 24 Cal, spinach 27 Cal, lettuce 17 Cal, bottle gourd 15 Cal and potato provides high energy 81 Cal per 100 gm food.

Vegetables are good sources of fiber, which lowers the body cholesterol level, consequently decrease the risk of cardiovascular diseases. It is required that vegetables should be used frequently as they are good for heath and provides all the essential nutrients for normal body functions when consumed in appropriate combination.

Mineral Composition

The Macro elemental compositions of different vegetables are given in Table-2, showing that the mineral concentration in all the selected vegetables is comparatively varied. Potassium (K) content was high as compare to other minerals. Potato provided maximum 240 mg/100g K while its concentration was found minimum 10 mg/100gm in reddish. Second abundant mineral found in most vegetables was P. Na was also found in appreciable amount, maximum amount was found in the radish 63.9 mg/100gm while minimum amount was found in bottle gourd 1.7 mg/100. Ca was found high in spinach (76 mg/100gm) while low in potato (8mg/100gm). Iron is a micro nutrient required for erythropiosis and found high as compare to Chromium in all selected vegetables. All the results are in range with the results given be Haward *et al* (1962). Same results were given by the Bors and Jasper (1992).

Minerals are important for vital body functions such as acid base and water balance. Calcium and

Phosphorus are the minerals present in the largest quantity in the structure of the body and in the bones. Na and K are used as an electron carrier in the body. Fe is an important constituent of Hb while Cr is involved in various metabolic reactions. Vegetables contribute these minerals and enhance their availability in daily life.

Vitamins Analysis

Results of some of the water soluble vitamins namely thiamine, riboflavin, niacin and ascorbic acid are shown in Table-3. Results show that spinach is overall a good source of water soluble vitamins containing 0.13 mg/100g of thiamine, 0.15 mg/100g of riboflavin, 0.9 mg/100g of niacin and 76 mg/100g of ascorbic acid. The 2nd good source of these vitamins is cauliflower containing 0.09 mg/100g, 0.08 mg/100g, 0.9 mg/100g and 45 mg/100g of thiamine, riboflavin, niacin and ascorbic acid. It is observed that carrot is a poor source of water soluble vitamins.

Vitamin C (Ascorbic acid) is water-soluble vitamin required in high amount, as its loss is frequent from body. It participates in reversible Oxidation-reduction system. Vitamin C prevents Scurvy disease and also aids in the formation of folic acid derivatives, which are essential for DNA synthesis (Chatterjea and Shinde, 1998).

Thiamine, riboflavin, and niacin are members of Vit B complex series. These 3 vitamins act as coenzyme in various oxidative reactions. Thiamine is necessary for the normal metabolism of carbohydrates. It also functions in the utilization of pentoses and in the synthesis of certain amino acid. Its deficiency causes anorexia, fatigue, constipation and retarded growth. Riboflavin acts as a coenzyme in two different mononucleotides (FMN). These riboflavin coenzyme acts as receptors for the transfer of protons between NAD^+ and $NADP^+$ and cytochromes, which transport electrons in the mitochondria. Similarly, niacin is an essential constituent of NAD^+ and $NADP^+$. The important coenzyme involved in biological oxidation and reduction. Niacin deficiency results in pellagra (rough skin). The disease is characterized by dermatitis and diarrhea. The deficiency of riboflavin in humans produces lesions in the corners of mouth (cheilitis), inflammation of tongue (glossitis), and lesions on the lips, and around the eyes and nose (Khalil and Saleemullah, 2004).

Table-1. Proximate composition of selected vegetables (on dry weight basis gm/100gm).

S. #	Name of vegetables		Moisture (g)	Protein (g)	Fats (g)	Carbohydrates (g)	Fiber (g)	Ash (g)	Energy (Cal)
	English	Scientific							
1.	Bottle Gourd	*Legenaria vulgaris*	94.5 ±0.06	1.2 ±0.06	0.2 ±0.02	3.75 ±0.03	0.7 ±0.01	0.5 ±0.01	15 ±0.12
2.	Cabbage	*Brassica oleracea_capitata*	92.0 ±0.12	1.6 ±0.20	0.2 ±0.01	4.8 ±0.01	0.9 ±0.30	0.6 ±0.01	24 ±0.12
3.	Cauliflower	*Brassica oleracea*	92.0 ±0.26	1.8 ±0.06	0.2 ±0.02	4.8 ±0.01	0.8 ±0.06	0.6 ±0.01	25 ±1.0
4.	Carrot	*Daucus carota*	79 ±0.76	1.5 ±0.01	0.2 ±0.00	10.4 ±0.21	0.6 ±0.01	0.8 ±0.01	40 ±0.50
5.	Lettuce	*Lacluca sativum*	93.8 ±0.20	1.2 ±0.00	0.25 ±0.03	3.0 ±0.10	0.7 ±0.20	0.8 ±0.01	17 ±0.10
6.	Potato	*Solenum tuberosum*	77.0 ±0.10	1.9 ±0.10	0.2 ±0.01	19.0 ±0.15	0.4 ±0.05	0.9 ±0.00	81 ±0.29
7.	Reddish	*Raphanus sativus*	92.8 ±0.10	1.3 ±0.04	0.1 ±0.06	4.56 ±0.04	0.9 ±0.01	0.8 ±0.01	23 ±0.12
8.	Spinach	*Spinacia oleracea*	91.0 ±0.06	2.1 ±0.15	0.38 ±0.01	4.0 ±0.12	0.6 ±0.01	1.1 ±0.15	27 ±0.29
9.	Sweet Pepper	*Capsicum anum*	91.5 ±0.10	1.3 ±0.02	0.2 ±0.01	4.8 ±0.21	1.2 ±0.01	0.6 ±0.02	25 ±0.58
10.	Tomato	*Lycopersicum esculentum*	93.5 ±0.21	0.9 ±0.06	0.2 ±0.01	3.9 ±0.10	0.3 ±0.01	0.9 ±0.05	23 ±0.00

(Mean Value ± SD Value)

Table-2. Macro and micro mineral content (mg/100g) of selected vegetables.

S. #	Name of vegetables			Ca	P	Na	K	Cr	Fe
	English	Local	Botanical						
1.	Bottle Gourd	Kaddu	*Legenaria vulgaris*	12 ±0.03	37 ±0.01	1.7 ±0.01	87 ±0.02	0.05 ±0.06	0.8 ±0.01
2.	Cabbage	Band Ghobi	*Brassica oleracea_capitata*	52 ±0.03	44 ±0.50	8 ±0.09	12 ±0.04	0.004 ±0.04	0.51 ±0.00
3.	Carrot	Gajor	*Daucus carota*	39 ±0.06	26 ±0.05	32 ±0.01	102 ±0.12	0.017 ±0.08	1.4 ±0.06
4.	Cauliflower	Phool Ghobi	*Brassica oleracea*	23 ±0.12	44 ±0.01	53.0 ±0.03	135 ±0.18	0.003 ±0.01	0.82 ±0.02
5	Lettuce	Salad	*Lacluca sativum*	45 ±0.01	34 ±0.10	4.5 ±0.10	58.5 ±0.19	0.005 ±0.09	1.1 ±0.01
6.	Potato	Alu	*Solenum tuberosum*	8 ±0.02	46 ±0.01	11.3 ±0.06	240 ±0.09	0.007 ±0.07	0.75 ±0.09
7.	Reddish	Mooli	*Raphanus sativus*	33 ±0.03	28 ±0.02	63.9 ±0.06	10 ±0.07	0.008 ±0.02	0.7 ±0.08
8.	Spinach	Palak	*Spinacia oleracea*	76 ±0.06	84 ±0.15	58.5 ±0.03	202 ±0.19	0.005 ±0.06	6 ±0.07
9.	Sweet Pepper	Shimla Mirch	*Capsicum anum*	12 ±0.2	30 ±0.12	5 ±0.00	12 ±0.03	0.007 ±0.02	1 ±0.01
10.	Tomato	Tamatar	*Lycopersicum esculentum*	13 ±0.05	27 ±0.07	44 ±0.16	114 ±0.23	0.005 ±0.18	0.7 ±0.01

(Mean Value ± SD Value)

Table-3. Vitamins content in mg/100g of selected vegetables.

S. #	Name of vegetables			Vitamin B_1 Thiamine	Vitamin B_2 Riboflavin	Vitamin B_5 Niacin	Vitamin C Ascorbic Acid
	English	Local	Scientific				
1.	Bottle Gourd	Kaddu	*Legenaria vulgaris*	0.03 ±0.01	0.05 ±0.08	0.3 ±0.01	12 ±0.07
2.	Cabbage	Band Gobhi	*Brassica oleracea_capitata*	0.06 ±0.01	0.05 ±0.025	0.4 ±0.01	55 ±0.06
3.	Carrot	Gajor	*Daucus carota*	0.05 ±0.02	0.05 ±0.01	0.5 ±0.07	15 ±0.08
4.	Cauliflower	Phool Ghobi	*Brassica oleracea*	0.09 ±0.04	0.08 ±0.02	0.9 ±0.05	45 ±0.09
5.	Lettuce	Salad	*Lacluca sativum*	0.06 ±0.01	0.1 ±0.04	0.5 ±0.08	10 ±0.09
6.	Potato	Alu	*Solenum tuberosum*	0.1 ±0.06	0.05 ±0.04	1.2 ±0.05	12 ±0.05
7.	Spinach	Palak	*Spinacia oleracea*	0.13 ±0.01	0.15 ±0.03	0.9 ±0.04	76 ±0.08
8.	Tomato	Tamatar	*Lycopersicum esculentum*	0.10 ±0.02	0.03 ±0.05	0.5 ±0.04	26 ±0.09

(Mean Value ± SD Value

CONCLUSION

From this research it is concluded that vegetables are nutritious foods that provide sufficient amount of nutrients needed for normal body function, maintenance and reproduction. It was found that nutrients composition in all the selected vegetables was different. Some vegetables contained high amount of starches while other contained maximum amount of protein. Some vegetables were rich in some minerals such as P, Na, K etc. but their concentration in other vegetables were poor. Vitamins concentration was also different in all the vegetables. Moisture content was found maximum in all the selected vegetables. Vegetables are poor sources of fat that make them good food for obese people. They are good source of fiber and can decrease the concentration of high cholesterol level in body. From this trial we found that vegetables intake in different combination is essential for the maintenance of healthy life and normal body functioning. However, further investigations are required to notice the effect of cooking and storage conditions on these valuable nutrients.

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