RESEARCH PAPER | Pharma | Volume : 3 | Issue : 5 | May 2013 | ISSN - 2249-555X

Efficacy of Supplementation of Bael (Aegle Marmelos L.) and Nutrition Intervention On Vitamins Content of the Non-Insulin Dependent Diabetics

KEYWORDS: diabetes, mineral, non-insulin, vitamin

Uttara Singh
Lecturer, (Food and Nutrition), Bindeshwari Mahavidyalay, Ambedkar Nagar, Uttar Pradesh-224122

Sadhana Singh
Assistant Prof., (Food and Nutrition), Narendra Dev University of Agriculture & Technology, Kumarganj, Faizabad-224229

ABSTRACT One hundred twenty non-insulin dependent diabetic subjects were selected from Punjab Agricultural University and Civil Hospital of Ludhiana. The selected subjects were divided into four groups viz. group I, II, III and IV having thirty subjects each. The subjects of group I was not given any treatment. The subjects of group II, III and IV were supplemented with 2 gm of bael (Aegle marmelos L.) leaf, pulp and seed powder respectively for a period of three month and supplementation was continued along with nutrition counseling for the next three months. The nutrition education was given for three months after fifteen days interval to the subjects of group II, III and IV through individual and group contact and gain in nutrition knowledge was assessed after the study. There was a significant decrease ($p \leq 0.01$) in thiamine, riboflavin, niacin and folic acid vitamins after the study by the subjects of group II, III and IV and a non- significant ($p \leq 0.01$) decrease in thiamine, riboflavin, niacin and folic acid vitamins by the subjects of group I. Whereas, a significant increase ($p \leq 0.01$) was observed in vitamin C in the subjects of group II, III and IV.

Introduction
Diabetes increases the risk of heart disease and stroke. Fifty per cent of people with diabetes die of cardiovascular disease (primarily heart disease and stroke). Diabetes with reduced blood flow, neuropathy in the feet increases the chance of foot ulcers and eventual limb amputation. Diabetic retinopathy is an important cause of blindness and occurs as a result of long-term accumulated damage to the small blood vessels in the retina. Diabetes is among the leading causes of kidney failure. Ten to twenty per cent of people with diabetes die of kidney failure. Diabetic neuropathy is damage to the nerves as a result of diabetes and affects up to 50% of people with diabetes. Although many 2 different problems can occur as a result of diabetic neuropathy, common symptoms are tingling, pain, numbness or weakness in the feet and hands. The overall risk of dying among people with diabetes is at least double the risk of their peers without diabetes (WHO 2011). Lifestyle factors, genetics and dietary composition are mainly responsible for type 2 diabetes mellitus. Higher blood sugar levels after an overnight fast are a automatic sign of diabetes. Diabetes adjusted for the subject's age, gender, body mass index, socioeconomic status and ethnicity. People with relatively higher levels of the pesticide in their blood were having high fasting blood sugar levels (Chirag et al 2010).

These days great attention is being given to management of diabetes with medicinal plants along with dietary restriction. Modern medicine is rooted in ethno botanical traditions using indigenous flora to treat symptoms of human diseases or to improve specific aspects of the body conditions. Today a great number of modern drugs are still derived from natural sources and 25 per cent of all prescriptions contain one or more active ingredients from plants (Thorfeldt 2005). WHO has estimated that 80 per cent of the population of developing countries still relies on traditional medicines mostly plant drugs for their primary health care needs and ensure patient safety by upgrading the skills and knowledge of traditional medicine providers (WHO 2008).

Aegle marmelos family rutaceae is highly reputed medicinal tree commonly known as the bael. The different parts of this plant contain number of coumarins, alkaloids, sterols and essential oils (Lmbole et al 2010). Bael (Aegle marmelos L.) is an important medicinal plant of India. Biochemical compounds of bael leaves, fruits and seeds have been used in several diseases like diabetes, cardiovascular and anti-inflammatory (Maity et al 2009). The most important ingredients present in plants are alkaloids, terpenoids, steriods, phenols glycosides and tannins (Venkatesan et al 2009). Aegle marmelos fruit extract have protective effect on pancreatic β-cells that leads to increased insulin level associated with a significant decrease in blood glucose in STZ induced diabetic rats (Kamalakkannan and Prince 2005). Aqueous seed extract of Aegle marmelos possess hypolipidemic effects in diabetic rats (Kesari et al 2006). Keeping in view the beneficial effects of Aegle marmelos leaves, fruit and seeds in the management of diabetes present study was planned with following objectives.

1. To study the vitamin intake of selected non-insulin dependent diabetes mellitus (NIDDM) patients.

Material and Methods
The patients were selected from Punjab Agricultural University Hospital and Civil hospital of Ludhiana. Newly detected, male non-insulin dependent diabetic mellitus subjects who were not taking any medicine, aged between 35-65 years, free from serious complication were selected. On the basis of the above mentioned criteria, a sample of one hundred twenty male diabetic subjects were selected and divided into four groups viz. group I, group II, group III and group IV having thirty subjects each. An open ended preliminary interview schedule was drafted to elicit information pertaining to food habits, dietary intake of the subjects. It was divided into three sections. A multiple choice questionnaire was designed to test the knowledge regarding diabetes and bael (Aegle marmelos L.). There were three parts of the questionnaire. Part I included questions related to knowledge, Part II consisted of questions related to attitude and Part III was on aspect of practices. The preliminary interview schedule was pre tested on fifteen diabetic subjects so as to test the validity and suitability of the interview schedule. Data was collected personally by interviewing the subjects and filled accordingly in the interview schedule. Information pertaining to food preferences, food avoidances was recorded. Dietary intake of subjects was recorded for three consecutive days by 24 hours recall cum weighment method, using standardized containers, both before and after the experimental period. The average daily nutrient intake of diet was calculated

Volume : 3 | Issue : 5 | May 2013 | ISSN - 2249-555X

by using MSU nutriguide computer programmer (Song et al 1992). The average raw amounts in grams of each and every item of food consumed for three consecutive days for each subjects was fed in the software and nutritive value of the diets was recorded and compared with RDA (ICMR 2010). From the day of selection each subject was followed for a period of one month without imparting nutrition intervention. The already designed and pre-tested, knowledge questionnaire was used to pre test knowledge they have regarding diet, its importance, diabetes and its management. After the pre-testing, the subjects in group II, III and IV were imparted nutrition counseling via charts, discussion and demonstration by individual and in group contact for a period of three months at 15 days interval. Lectures on diabetes, dietary treatment, and sample menu of 1280 kcal diet were given to the subjects. A booklet containing all the information regarding diabetes and diet along with food exchange lists, eating pattern, menus of different caloric value, beneficial effects of bael (Aegle marmelos L.) consumption were given to the subjects. The data on all the parameters viz. mineral and vitamin intake was analyzed statistically. The mean standard error, percentages, paired t- test and their statistical significance was ascertained using a computer programmed package (Cheema and Singh 1990).

Results and discussion

Vitamin

The mean daily intake of vitamins is given in Table 1.

Table 1: Mean daily intake of vitamins in the subjects before and after bael (Aegle marmelos L.) leaf, pulp and seed powder supplementation and nutrition intervention

Vitamins	Before 1		After	% Change		Paired t-Value	Suggested intake	
2	3		Between 1 and 2	Between 1 and 3		Between 1 and 2	Between 1 and 3	
Control			3 months			6 months		
Group I								
Thiamine (mg/day)	2.7±0.11	2.6±0.12	2.5±0.12	2.6	5.3	1.78NS	2.42*	1.2●
Riboflavin (mg/day)	1.8±0.13	1.7±0.17	1.5±0.18	7.8	18.9	1.38 NS	2.06*	1.4●
Niacin (mg/day)	18.1±0.73	18.0±0.72	17.9±0.72	0.6	0.9	1.43 NS	1.39 NS	16●
Folic acid (µg/day)	344.4±19.36	345.3±19.37	343.9±19.31	0.3	0.1	0.72NS	1.49 NS	200●
Vitamin C (mg/day)	37.7±0.63	38.3±0.69	38.9±0.85	1.6	3.3	1.74 NS	2.08*	40●
Experimental			SB			NI		
Group II								
Thiamine (mg/day)	2.8±0.12	2.6±0.11	1.7±0.10	7.1	39.3	1.89 NS	7.07**	1.2●
Riboflavin (mg/day)	1.9±0.27	1.8±0.23	1.4±0.10	6.6	28.6	1.20 NS	2.07**	1.4●
Niacin (mg/day)	20.5±0.29	20.1±0.45	18.5±0.76	2.1	9.7	2.06	3.26**	16●
Folic acid (µg/day)	336.1±0.39	335.6±0.40	326.8±5.27	0.1	2.8	1.81 NS	2.03*	200●
Vitamin C (mg/day)	40.3±0.24	42.3±0.94	44.1±1.72	4.9	9.8	2.42*	2.57*	40●
Group III								
Thiamine (mg/day)	2.8±0.11	2.6±0.14	2.1±0.15	7.3	23.9	1.74 NS	4.09**	1.2●
Riboflavin (mg/day)	1.8±0.17	1.6±0.18	1.5±0.15	9.1	13.1	1.90 NS	2.21**	1.4●
Niacin (mg/day)	19.3±0.16	19.2±0.16	17.9±0.53	0.5	7.1	1.43 NS	2.77**	16●
Folic acid (µg/day)	326.6±0.81	316.2±5.79	308.8±10.28	3.2	5.5	2.13 *	2.05*	200●
Vitamin C (mg/day)	32.2±0.25	34.2±0.98	36.3±1.92	6.0	12.5	2.29*	2.40*	40●
Group IV								
Thiamine (mg/day)	2.4±0.24	2.0±0.22	1.8±0.23	16.5	55.6	2.06*	3.26**	1.2●
Riboflavin (mg/day)	1.9±0.17	1.8±0.19	1.6±0.20	5.4	12.4	2.13 *	3.240**	1.4●
Niacin (mg/day)	18.1±0.83	17.9±0.86	16.9±0.92	0.6	6.6	1.43 NS	2.45**	16●
Folic acid (µg/day)	336.9±0.26	335.8±0.27	324.9±6.51	0.3	3.6	1.43 NS	2.13*	200●
Vitamin C (mg/day)	38.3±0.50	39.5±0.92	41.4±1.42	3.0	8.1	1.81 NS	2.72**	40●

Values represent Mean±SE ** Significant 1% *Significant 5% ●ICMR (2010) NS-Non significant SB-Supplementation of bael (Aegle marmelos L.) leaf, pulp and seed powder NI-Supplementation of bael (Aegle marmelos L.) leaf, pulp and seed powder + Nutrition counseling

Thiamine It was observed that the mean initial daily intake of thiamine were 2.7±0.11, 2.8±0.12, 2.8±0.11 and 2.4±0.24 mg/day by the subjects of group I, II, III and IV respectively and the corresponding figures after nutrition intervention were 1.7±0.10, 2.1±0.15 and 1.8±0.23 mg/day by the subjects of group II, III and IV respectively. The intakes of thiamine in all the four groups were more as compared to the RDA of 1.2 mg/day by ICMR (2010). However there was a significant decrease ($p \leq 0.01$) in thiamine intake by the subjects of group II, III and IV respectively and non-significant ($p \leq 0.01$) decrease in thiamine intake by the subjects of group I after study. The thiamine intakes were higher possibly due to the higher intake of cereals. After nutrition education the thiamine intake was decreased due to decreased intake of cereals in the diet. Choudhary (2010) also reported more than adequate intake of thiamine by the diabetic subjects.

Riboflavin The mean daily riboflavin intake before study were 1.8±0.13, 1.9±0.27, 1.8±0.17 and 1.9±0.17 mg/day by the subjects of group I, II, III and IV respectively and after nutrition intervention the corresponding riboflavin intake were 1.4±0.10, 1.5±0.15 and 1.6±0.20 mg/day by the subjects of group II, III and IV respectively. After the study the riboflavin intake was 1.5±0.18 mg/day by the subjects of group I. However, there was a significant decrease ($p \leq 0.01$) in the riboflavin intake by the subjects of group II, III and IV respectively and non-significant ($p \leq 0.01$) decrease in riboflavin intake by the subjects of group I after the study. The reduction in riboflavin could be due to nutrition education given to diabetics. The recommended riboflavin intake by ICMR (2010) is 1.4 mg/day. Similar study, also done by Choudhary (2010) reported significant decrease in riboflavin of diabetic subjects after nutrition intervention.

Niacin The mean daily niacin intakes before the study were 18.1±0.73, 20.5±0.29, 19.3±0.16 and 18.1±0.83 mg/day by the subjects of group I, II, III and IV respectively. After nutrition intervention the corresponding figures observed were 18.5±0.76, 17.9±0.53 and 16.9±0.92 mg/day by the subjects of group II, III and IV respectively. The reduction in niacin could be due to nutrition education given to diabetics. The recommended intake of niacin by ICMR (2010) is 16 mg/day. It was observed that there was a significant decrease ($p \leq 0.01$) in the mean daily intake of niacin by the subjects of group II, III and IV after the study and non-significant decrease ($p \leq 0.01$) in the mean daily intake of niacin by the subjects of

Volume : 3 | Issue : 5 | May 2013 | ISSN - 2249-555X

group I. Similarly, Choudhary (2010) who also reported decreased niacin intake by the diabetic subjects after nutrition intervention.

Folic Acid The daily folic acid intakes before the study were 344.4±19.36, 336.1±0.39, 326.6±0.81 and 336.9±0.26 µg/day by the subjects of group I, II, III and IV respectively. After nutrition intervention the corresponding figures observed were 326.8±5.27, 308.8±10.28 and 324.9±6.51 µg/day by the subjects of group II, III and IV respectively. There was a significant reduction ($p \leq 0.05$) in folic acid intake by the subjects of group II, III and IV non-significant decrease ($p \leq 0.05$) in folic acid intake by subjects of group I. The intake of folic acid more than the RDA of 200 µg/day given by ICMR (2010). The reduction in folic acid could be due to nutrition education given to diabetics as high amount of cereals in diet increased the folic acid. The present study inline with Choudhary (2010) reported significant reduction in folic acid intake after nutrition education.

Ascorbic Acid (Vitamin C) The mean daily vitamin C intakes of the subjects before the study were 37.7±0.63, 40.3±0.24, 32.2±0.25 and 38.3±0.50 mg/day in group I, II, III and IV respectively. After nutrition intervention the corresponding figures recorded were 44.1±1.72, 36.3±1.92 and 41.4±1.42 mg/day by the subjects of group II, III and IV respectively and. However, there were 9.8, 12.5 and 8.1 per cent increase in vitamin C intake by the subjects of group II, III and IV respectively after the study. Subjects in group II, III and IV were told the importance of vitamin C and its role in iron absorption and also the important sources of vitamin C like amla, ber, citrus fruits and green leafy vegetables. The vitamin C intake was recommended 40 mg/day given by ICMR (2010). It was found that there was a significant increase ($p \leq 0.01$) in the mean daily intake of vitamin C in the subjects of group II, III and IV respectively after study. Vitamin C supplementation improved glycemic control among NIDDM subjects (Eriksson and Kohvakka 2000). Similar results were also reported by Choudhary (2010).

Conclusion

It was seen that there was a significant decrease ($p \leq 0.01$) in thiamine, riboflavin, niacin and folic acid vitamins after the study by the subjects of group II, III and IV and a non- significant ($p \leq 0.01$) decrease in thiamine, riboflavin, niacin and folic acid vitamins by the subjects of group I. Whereas, a significant increase ($p \leq 0.01$) was observed in vitamin C in the subjects of group II, III and IV. The decrease in the vitamins could be due to reduced intake of cereals by the subjects of group II, III and IV and increase in vitamin C intake was due to counseling to include more amla, citrus fruits, sprouted pulses, lemon water and green leafy vegetables for the increased resistance in the body. Hence it can be inferred from the results that supplementation of bael (Aegle marmelos L.) leaf, pulp and seed powder along with nutrition counseling significantly improved the vitamin content of the diabetic patients.

REFERENCE Choudhary, M. (2010). Hypoglycemic and hypolipidemic effect of Aloe vera L. in non-insulin dependent diabetics. M.Sc. Thesis, Punjab Agricultural University, Ludhiana, India. | Cheema, H. S. and Singh, B. (1990). CPCSI- A computer program package for the analysis of commonly used experimental designs. Punjab Agricultural University, Ludhiana. | Chirag, J. P., Bhattacharya, J. and Butte, A. J. (2010). An Environment-Wide Association Study (EWAS) on Type 2 Diabetes Mellitus. PLoS ONE 5(5): 575-582. | Eriksson, J. and Kohvakka, (2000). Magnesium and Ascorbic acid supplementation in diabetes mellitus. Annal Nutr Metab 39: 213-217. | ICMR., (2010). Dietary guidelines for Indians. A Manual of National Institute of Nutrition. Hyderabad. | Kamalakkannan, N. and Prince, P. S. (2005). The effect of Aegle marmelos fruit extract in streptozotocin diabetes: A histopathological study. J Herb Pharmacotherapy 5(3): 87-98. | Kesari, A. N., Gupta, R. K., Singh, S. K., Diwakar, S. and Watal, G. (2006). Hypoglycemic and antihyperglycemic activity of Aegle marmelos seed extract in normal and diabetic rats. J Ethnopharmacol 107(3): 374-79. | Lmbole, V. B., Murti, K., Kumar, U., Bhatt, S. P. and Gajera, V. (2010). Phytopharmacological Properties of Aegle Marmelos as a Potential Medicinal Tree: An Overview. Int J Pharmaceutical Sci Revw and Res 5(2): Article-014. | Maity, P., Hansda, D., Bandyopadhyay, and Mishra, D. K. (2009). Biological Activity of crude extracts and chemical constituents of bael, Aegle marmelos (L.) Corr.#. Ind J Experimental Biology 47: 849-861. | Song, W. O., Hoerr, S. B., Pande, U., Singh, I., Mehta, U., Mann, S. K., Sehgal, S. D. R. P. and Kakrala. M. (1992). Nutriguide, Asian Indian Foods, Nutritional Analysis Computer Programme. Michigan State University,USA pp.7-38. | Thorfeldt, S. (2005). Herbs in diabetes mellitus. Alt Med Rev 9: 13-18. | Venkatesan, D., Karrunakarn, C. M., Selva, S. K. and Palani, P. T. S. (2009). Identification of Phytochemical Constituents of Aegle marmelos Responsible for Antimicrobial Activity against Selected Pathogenic Organisms. Ethnobotanical Leaflets 13: 1362-72. | WHO. (2008). World health Statistics (http://www.who.int/whosis /whostat /2008 /en/) | WHO. (2011). Diabetes. (http://www.who.int/mediacentre/factsheets/fs312/en/) |