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Evaluation and analysis of the vitamin levels in the self-selected diets of senile diabetics

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Abstract: This study was aimed at evaluating the daily vitamin intakes of senile diabetics whose diets were self-selected in order to apply the data obtained to prevent and treat senile Type 2 diabetics effectively. The daily vitamin intakes of 43 Type 2 diabetics (group A) and 43 healthy non-diabetics (group B) as revealed by their answer to a questionnaire were evaluated by computer analysis and compared with the Recommended Dietary Allowance (RDA). The data obtained in this study showed that the daily vitamin B_1 and B_2 intakes in both groups were obviously low, less the 50% of RDA; and that in group A was lower than that in group B. The daily intakes of vitamin E and A were significantly different between group A and group B ($P<0.01$ for vitamin E and $P<0.05$ for vitamin A). So the vitamin intakes of the senile diabetics with their self-selected diets were inadequate. The author suggests that it is necessary to give a scientific guide for the diets of senile diabetics. If the vitamin intake from foods is inadequate, vitamin supplements should be given to prevent complications.

Key words: Vitamin, Diabetes mellitus, Intakes, Recommended Dietary Allowance (RDA)
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INTRODUCTION

Vitamins are indispensable nutrients for maintaining life. They exist in foods. Most of them cannot be synthesized in our bodies. Every vitamin has a special function. New findings on their functions showed that vitamins are not only essential nutrients but also have a health care function to prevent many chronic degenerative diseases (China Nutrition Committee, 2001). Diabetes is a chronic metabolic disease. Diabetes patients should control their diets for life to prevent deterioration of the disease. In the USA, a semi-quantitative food frequency questionnaire was used for nutritional education of diabetes patients. A rapid food screener was also used to assess fat, fruit and vegetable intake (Yamoka et al., 2000; Block et al., 2000). In China, a food survey is often used to assess different levels of nutrition and to evaluate the daily intake of calories and main nutrients for comparison with the RDA (Li et al., 1999). So the questionnaire is a valid and advisable method for assessing nutrients intakes. At present, research on vitamins in diabetic diets is rare. This study was aimed at evaluating the vitamin intake in self-selected diets of diabetes patients and to provide a basis for remedial diet therapy.

METHODS

Patients

Group A consisted of 43 Type 2 diabetics who came to a nutrition clinic and endocrinology ward. All patients met the WHO criteria for Type 2 diabetes in 1980. Twenty six were men, seventeen were women. The mean age was 68.60 years (range 60 to 88 years). The diabetes duration was 5 to 18 years. They all consulted the nutritionist regarding their diets. Group B consisted of 43 senile persons. Twenty two were men, twenty one were women. The mean age was 65.74 years (range 60 to 81).

Information collection and analysis

The contents of all meals of the patients were recorded for three days, and patients' heights and weights were measured. These data were analyzed by the YL-2 Medical Nutrition Computer made by the Suzhou Infor-

mation Technique Research Institute. The exact daily vitamin intakes of patients in their self-selected diets were printed and compared with the RDA (China Nutrition Committee, 1990).

Statistical methods

Statistical analysis was performed by Sigar Star Software. Mann-Whitney Rank Sun Test and T-test were used.

RESULTS

1. The mean daily vitamin intake of group A and group B was compared to the RDA(Table 1).

1) In group A, the percentage of cases whose daily vitamin intake was higher than or equal to the RDA was low, especially in vitamin B_1, vitamin B_2, vitamin E and vitamin A.

2) The daily intake of vitamin A, vitamin B_1, vitamin B_2 and vitamin E of group A was 70.23%, 62.31%, 55.38% and 68.58%, respectively, of the RDA.

3) For group B, the percentage of cases whose daily vitamin intake was higher than or equal to the RDA was also low, especially in vitamin B_1, vitamin B_2 and vitamin A.

4) The daily intake of vitamin B_1, vitamin B_2 and vitamin A of group A was 66.15%, 56.92% and 87.62%, respectively, of the RDA.

Table 1 Comparison of the mean daily vitamin intake to the RDA

Vitamin	A(μg)	B_1(mg)	B_2(mg)	E(mg)	C(mg)
RDA	800	1.3	1.3	12	60
Group A					
Mean intake($\bar{x}$)	561.87	0.81	0.72	8.23	155.55
Cases of $X \geqslant$ RDA	9	7	2	4	30
Percentage of cases	20.93	16.28	4.65	9.30	69.77
Percentage of $\bar{x}$ to RDA	70.23	62.31	55.38	68.58	259.25
Group B					
Mean intake($\bar{x}$)	700.95	0.86	0.74	26.60	144.30
Cases of $X \geqslant$ RDA	5	1	4	38	38
Percentage of cases	11.63	2.33	9.30	88.37	88.37
Percentage of $\bar{x}$ to RDA	87.62	66.15	56.92	221.67	240.5

2. Comparison of the mean daily vitamin intake between the two groups ($\bar{x} \pm S$) (Table 2).

1) There was significant difference of mean daily vitamin E intake between group A and group B ($P < 0.01$); there was also significant difference of mean daily vitamin A intake between group A and group B ($P < 0.05$).

2) There was no significant difference of mean daily vitamin B_1, vitamin B_2 and vitamin C intake between group A and group B ($P > 0.05$).

Table 2 Comparison of mean daily vitamin intake between the two groups ($\bar{x} \pm S$)

Vitamin	Group A($n = 43$)	Group B($n = 43$)	P
Vitamin A(ug)	561.87 ± 97.34	700.95 ± 110.77	< 0.05
Vitamin B_1(mg)	0.81 ± 0.34	0.86 ± 0.31	> 0.05
Vitamin B_2(mg)	0.72 ± 0.34	0.74 ± 0.29	> 0.05
Vitamin E(mg)	8.23 ± 0.93	26.60 ± 1.82	< 0.01
Vitamin C(mg)	155.55 ± 8.60	144.30 ± 8.08	> 0.05

DISCUSSION

Vitamins play an important role in promoting and regulating metabolism, and maintaining normal cells function (Zhang, 1998). Diabetes patients have the same vitamin and mineral needs as the general population. But diabetes patients often have secondary conditions that need special consideration and that may influence the demands of vitamins and minerals, as well as diuretics or other drug use (Wen et al., 1998). In this study the daily vitamin intakes of both groups were low compared with the RDA, especially in vitamin B_1, vitamin B_2 and vitamin A. For group A, the intake of vitamin E was also low. It indicates there is a common condition that vitamin intake is inadequate in the diets of the senile. So when diabetes patients control their daily calorie intakes, they should pay more attention to choose vitamin-rich foods to meet the demands of physical functions and to improve their health condition with good nutrition.

Vitamin E is a strong antioxidant. It protects the unsaturated fatty acids of cell membranes, the cell skeleton, sulfydryl of some proteins and intracellular nucleic acids from being oxidated by free radicals. Deficiency of vitamin E prevents antioxidation and cause cell injury. This function complements the normal function of the immune, nervous, vascular and reproductive systems (China Nutrition Committee, 2001). In this study, the percentage of cases whose daily vitamin E intake was more than or equal to the RDA was 9.3% for group A and 88.3% for group B. The mean daily intake was 8.23 mg for group A and 26.60 mg for group B, which was 68.58% and 221.67% of the RDA, respectively. The result of the Third National Nutrition Investigation in 1992 showed the mean daily vitamin E intake was 336.7% of the RDA (Ge et al., 1999). So the diabetes patients with fat-restricted diets had vitamin E deficiency. There was a significant difference ($P < 0.01$) between people with diabetes and healthy people. One study showed vitamin E also improved glucose tolerance in elderly non-diabetics. Three months or more of supplementation may be required for the benefits to become apparent (Paolisso et al., 1994a; 1994b). Another study indicated glycosylation was an important index of diabetes indicating to how much sugar attaches abnormally to protein, vitamin E reduced this problem in some (Ceriello et al., 1991; Duntas et al., 1996).

Vitamin B_1 is a water-soluble compound containing substituted pyrimidine. It serves as a coenzyme in glucose and amino acid metabolism. Inadequate vitamin B_1 results in abnormal carbohydrate metabolism and amino acid and fatty acid synthesis. Vitamin B_1 is also related to heart function. Its deficiency may lead to disorders of cardiac function. The mechanism may be the increasing of blood volume into tissue so as to make heart output heavier. Vitamin B_1 may have an additional role in neuronal conduction (He, 2000). So the relationship of a vitamin B_1-deficency diet and diabetic neuropathy may need further study. In our patients the percentage of those with a daily vitamin B_1 intake more than the RDA was only 62.31% of group A and 66.15% of group B. So when diabetics select their foods, the amount of vitamin B_1 should not be ignored. One study showed a trial using 10 mg of vitamin B_1 per day for four weeks reported reduced blood sugar levels in six of eleven diabetics (Vorhaus et al., 1935). Recently, supplementation with both vitamin B_1 (25 mg per day) and B_6 (50 mg per day) to a group of people with diabetic neuropathy led to significant improvement in only four weeks (Abbas, 1997).

Vitamin B_2 consists of isoalloxazin and ribose. It is an important component of coenzyme for many oxidases. It is a catalyst in many oxidation-reduction reactions. Vitamin B_2 deficiency can influence protein and lipid metabolism, such as the damage of vitamin B_6 transformation to its coenzyme derivant (Wen, 1998). It also produces disorders of substance and energy metabolism. It was reported that vitamin B_2 deficiency increases lipid peroxidation; and that vitamin B_2 can inhibit this process (Dutta et al., 1995). In this study, there were only two cases of daily intake of more than the RDA in group A and

four in group B. The mean daily intake of diabetics was only 55.38% of the RDA. So diabetes patients should pay attention to their intake of vitamins essential to their wellbeing.

Vitamin A is a non-enzyme antioxidase. It plays an important role in visual function, proliferation and differentiation of cells, reproduction, and immune function. Vitamin A and caroteine can prevent cancer (China Nutrition Committee, 2001). This study showed the cases of daily intake of more than the RDA were low in both groups. The percentage of daily intake was 70.23% of the RDA for group A and 86.62% for group B. There was significant difference between the two groups ($P < 0.05$).

Vitamin C is also an antioxidant because of its strong reducing property, which is related to its being the coenzyme of the substrate and enzyme in hydroxylation. Antioxidation is the main function of vitamin C. Like other antioxidants, it can eliminate free radicals (China Nutrition Committee, 2001) and may prevent oxidation of LDL out of cells. A study showed that vitamin C may improve glucose tolerance in Type 2 diabetes patients. Many doctors suggested that diabetics supplement their diets with one to three grams of vitamin C per day (Eriksson et al., 1995; Will et al., 1996). In this study, the patients' intakes of vitamin C were not inadequate. Vitamin C intake levels should be monitored.

With advancing age, the body's physical functions gradually decline. The amount of vitamin stored in body tissue and organs significantly decrease. Vitamins are essential for regulating metabolism and maintaining health. Being the contents of most coenzymes, they are absolutely important in the regulation of metabolism and delaying degeneration (Gu Jingfan, 1991). In our study, the difference between patients' vitamin intake and the recommended intake was significant. Along with diabetic patients controlling their diets, it is important to select vitamin-enriched foods. If necessary, vitamin supplementation is also permissible.

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