Does the eating match the teaching? Food habits in people with non insulin dependent diabetes

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Three-day food records were used to assess the dietary intake of 50 patients with non insulin dependent diabetes; body mass index (BMI) exceeded 25 in 74% and exceeded 30 in 20%. Present nutrient intake was determined by the food compositional analysis package known as SODA III analysis. Two at-risk micronutrients were used as markers of food intake quality, namely calcium and thiamin. Calcium intake prior to diagnosis of diabetes by retrospective questionnaire. Serum and red cell thiamin levels were measured. All patients had received nutrition education. Results showed fat intake less than 35% in 50% of subjects and carbohydrate intake greater than 50% in 18% of subjects. Seventy-two percent of subjects had a saturated fat intake greater than 10%. Cholesterol intake exceeded 300mg in 16% of subjects. Dietary thiamin intake was adequate in 98% and did not correlate with serum or red cell thiamin levels. Only 24% of subjects had an adequate calcium intake. Previous to diagnosis of diabetes, 50% of subjects had had adequate calcium intakes. Calcium intake was related to age, increasing with increasing age ($P<0.05$) and saturated fat intake ($P<0.01$). This group had an excess intake of fat and calcium intake was largely inadequate

Key words: diabetes, education, nutrition, macronutrients, fat, saturated fat, cholesterol, carbohydrate, thiamin, calcium

Introduction

An appropriate food intake is crucial to the control of blood glucose and serum lipid levels in non-insulin dependent diabetes. The aim is a nutritionally adequate food intake, reduced in fat, with an emphasis on reduction in saturated fat[1,2]. Energy restriction with a view to decreasing insulin resistance and thus blood glucose levels is especially important in a population where it is estimated that 75% to 80% of individuals are overweight[3].

Long term lifestyle changes are difficult to maintain and changes in food intake are no exception. Although a variety of approaches are used to encourage changes in eating habits in people with non-insulin dependent diabetes there is evidence that adherence to long term changes is poor[4,5]. It has also been observed that having an illness which dictates dietary changes predisposes to an increased risk of nutritional deficiencies[6-8].

We chose to look at intake of two nutrients which may be at risk. Firstly, calcium, which in western populations is closely related to the intake of dairy products. It was hypothesised that dietary counselling emphasising a decrease in high fat diary products may lead to a reduced calcium intake as calcium-rich low fat dairy products may not be substituted. Secondly we looked at thiamin intake. Thiamin levels in blood are documented as being abnormal more frequently in people with diabetes than in the general population and there is conflicting evidence in the literature as to whether or not this is diet-related[9-12].

Aims

1. To study the food intake of a group of people with non insulin-dependent diabetes to determine intake of fat and saturated fat.
2. To determine if there is any relationship between dietary thiamin intake and serum and red cell thiamin levels.
3. To determine adequacy of present calcium intake and compare this with calcium intake prior to diagnosis.

Materials and methods

Subjects:

Subjects were selected as patients consecutively attending the Royal Perth Hospital Diabetic Clinic. Criteria for selection was treatment by diet or oral agents with adequate knowledge of English to understand instructions and complete food records.

Fifty patients agreed to participate. There were 16 male and 34 female patients, with a mean age of 59.3 ± 7.8 years (range 35 - 70). The mean age at onset of diabetes was 48.1 ± 8.0 years and the mean BMI was 28.8 ± 4.7 in females and 27.7 ± 3.2 in males. BMI was over 25 (overweight) in 37 subjects (24 female and 13 male) and over 30 (obese) in 10 subjects (9 female and 1 male). All had received extensive diabetes nutrition education.

Treatment was diet alone in 1 subject, sulphonylurea in 13, Metformin in 11 and sulphonylurea plus Metformin in 25 subjects. Six were on vitamin supplements and two were on calcium supplements. Fasting plasma glucose was 11.5 ± 3.8 mmol/L in females and 10.0 ± 2.2 mmol/L in males (to convert mmol/L to mg/dL, multiply mmol/L by 0.05551^{-1}). Glycated haemoglobin was 7.5 ± 1.4% in females and 6.8 ±

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1.6% in males (7-10%, good to fair control)[13]. Three day food records were completed by all participants. Verbal and written instruction was given by a dietitian to ensure accurate recording of food intake[14]. Food models were used to ascertain portion sizes and all food preparation methods stated, including recipe ingredients and food processing methods. Food records were specified as being three consecutive days including one weekend day.

Data from the food records were entered on Soda III Program (version 4.1a (1990) Curtin University W.A.) to give average daily intakes of specified nutrients and comparisons with recommended daily intakes (RDI) for Australians[15]. Body weight in kilograms, height in centimetres, fasting plasma glucose, glycated haemoglobin, serum and red cell thiamin levels were measured[16].

Calcium intake previous to diagnosis of diabetes was estimated from information on previous use of dairy products collected by questionnaire. The questionnaire was validated against 24 hours food recalls and three day food records analysed by the Soda III Program. There was a good correlation ($P<0.001$) ($R=0.98$) between calcium intake estimated by questionnaire and 24 hour food recall and 3 day food intake. A factor of 250mg of calcium was used to account for non-dairy calcium food sources[17]. Vitamin and mineral supplements and all other medications were specified.

Statistical analysis was performed using the Kwikstat (Texasoft) computer program. Soda III version 4.1a (1990) Curtin University WA.

Results

Intake of fat and carbohydrate in females and males is shown in Table 1 and Table 2, respectively. The percentage energy from fat was less than 35% in 25 (6 males) and energy from carbohydrates was greater than 50% in 9 subjects (1 male).

Table 1. Macronutrient intake in NIDDM (female).

		Mean±SD	5th - 95th %ile
Energy (Kj)		4841 ± 1182	(3016 - 7395)
Carbohydrate	% of energy	44.4 ± 8.6	(29.4 - 61.1)
Fat		33.2 ± 7.8	(20.0 - 48.3)
Protein		22.1 ± 4.2	(15.0 - 29.7)
Alcohol		0.09 ± 0.4	(0.0 - 1.4)
Simple carbohydrate (g)		41.0 ± 18.9	(15.7 - 86.4)
Complex carbohydrate (g)		89.0 ± 38.1	(35.4 - 174.6)
Dietary fibre (g)		18.0 ± 6.3	(7.7 - 29.8)
Saturated fat (g)		14.7 ± 6.1	(6.1 - 30.03)
Polyunsaturated fat (g)		8.4 ± 3.0	(2.7 - 13.5)
Monounsaturated fat (g)		15.5 ± 5.3	(7.7 - 26.7)
Cholesterol (mg)		178.2 ± 74.0	(56.1 - 307.5)

The intake of types of fats, saturated, polyunsaturated, monounsaturated are also shown in Tables 1 and 2. Thirty-six (72%) had a saturated fat intake of greater than 10% of total energy intake and 42 (84%) greater than 8%. Polyunsaturated fat provided more than 10% of total energy in 5 subjects (4 males) and monounsaturated fat provided more than 10% in 38 subjects (23 female).

Cholesterol intake was greater than 300mg/day in 8 subjects (7 male).

Table 2. Macronutrient intake in NIDDM (male)

		Mean±SD	5th - 95th %ile
Energy (Kj)		7597 ± 2528	(4773 - 14295)
Carbohydrate	% of energy	41.6 ± 6.7	(28.5 - 59.4)
Fat		36.7 ± 5.4	(25.5 - 46.1)
Protein		18.8 ± 3.5	(14.1 - 26.5)
Alcohol		2.6 ± 4.5	(0 - 15.0)
Saturated fat (g)		24.4 ± 9.3	(9.2 - 47.5)
Polyunsaturated fat (g)		17.4 ± 8.6	(6.2 - 38.2)
Monounsaturated f(g)		27.8 ± 10.8	(14.6 - 52.2)
Cholesterol (mg)		281.7 ± 187.3	(88.6 - 799.4)

Males had greater energy requirements. Percentage fat intake was also greater in males than in females but this difference was not significant.

Table 3 shows dietary thiamin intake and also serum and red cell thiamin levels. There was no significant correlation between thiamin intake and either serum thiamin or red cell thiamin. Thiamin intake was 11.7 ± 22.5mg/day in females and 17.1 ± 30.8mg/day in males. All except one had an acceptable intake greater than 66% of recommended daily intake for Australians.

Table 3. Thiamin intake, serum thiamin and red cell thiamin in NIDDM.

	Female (n=28)	Male (n=14)	Reference range
Thiamin intake (mg)	11.7 ± 22.5	17.1 ± 30.8	0.7-1.1
Serum thiamin (μg/l)	4.8 ± 2.6	5.8 ± 2.4	3-9.3
Red cell thiamin (μg/l)	50.3 ± 17.0	47.4 ± 20.6	50-106

All except 4 males were taking less than the recommended daily intake of calcium and only 7 males and 5 females were taking more than 66% of the recommended daily intake of calcium (Table 4). Calcium intake was 482.6 ± 161.1mg/day in females and 618.0 ± 206.1mg/day in males.

Table 4. Calcium intake in NIDDM

	Female (A=32)	Male (N=16)	Recommended intake
Calcium intake (mg)	482.6 ± 161.1	618.0 ± 20.6.1	800 - 1000
Calcium intake previous to diagnosis of diabetes (mg)	564.5 ± 204.0	763.9 ± 27.5	

Calcium intake previous to diagnosis of diabetes as assessed by questionnaire was higher than present calcium intake. Previous to diagnosis, 13 males and 12 females were above 66% of the recommended calcium intake and the mean intakes were 564.5 ± 204.2mg/day in females and 765.9 ± 271.5mg/day in males. (People on calcium supplements were excluded from this analysis).

The calcium intake in female patients was shown to be related to age, increasing in older women ($P<0.05$). It was also related to fat intake ($P<0.05$) particularly saturated fat intake ($P<0.01$), calcium intake increasing with increasing fat intake.

Too few males participated in the study to do this analysis for males.

Discussion

There have been relatively few studies on actual dietary intake of patients with diabetes. This group of patients had received diabetes nutrition education over a long period of time. However, many were still overweight and few achieved substantial reduction in fat and saturated fat intake. Other studies show similar results[18-21]. Calcium intake was inadequate in the majority of individuals and was substantially lower than calcium intake prior to the diagnosis of non insulin dependent diabetes. Dietary calcium intake was closely related to intake of fats, especially saturated fats. This suggests that patients were reducing intakes of full cream dairy products in an attempt to reduce fat intake, without substituting low fat equivalents to maintain calcium intake.

Thiamin intake was at an acceptable level consistent with an adequate intake of high fibre foods and was not related to reduced blood levels of thiamin. This is consistent with some similar studies but conflicts with others[9-12]. The results do not indicate any dietary deficiency of thiamin.

Nutrition education is a complex area with many factors influencing eating patterns. Knowledge, motivation and support are all crucial issues in maintaining new healthy eating patterns. Increased knowledge does not always mean long term changes in food intake[22]. The results of this study highlighted the problem of increased knowledge failing to result in permanent healthy lifestyle changes. People with diabetes appear to understand most of the information given, but find incorporating other alternatives into their diet and maintaining these changes difficult in the long term.

People with non insulin dependent diabetes are an older group with a well established eating pattern. Our expectation of change in this group may be over optimistic. One solution may be to target solely the most important dietary changes (such as fat reduction) with other changes to be introduced when the initial change is well established. Greater resources to allow more intensive nutrition follow-up also seem indicated.

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非胰島素依賴性糖尿病人的飲食習慣是否與指導一致

摘要

作者用三天食物記錄去評估 50 位非胰島素依賴性糖尿病人的膳食攝取. 病人體重指數超過 25 的占 74%, 超過 30 的占 20%. 目前營養素攝取用 Soda III 分析鑒定, 而鈣攝取則用問卷追憶至糖尿病診斷之前. 測定了血清和紅細胞硫胺素水平, 所有病人均接受營養教育. 結果顯示 50% 病人脂肪酸攝取少于總能量 35%, 而 18% 病人的碳水化合攝取大于 50%, 72% 病人的飽和脂肪酸攝取量大于 10%, 16% 病人每日膽固醇的攝取量大于 300 毫克. 98% 病人膳食硫胺素的攝入是足夠的. 但與血清或紅細胞硫胺素水平無關, 僅24% 病人鈣的攝入是足夠的. 在診斷糖尿病前, 有 50% 病人鈣的攝取是足夠的, 鈣的攝入與年齡有關, 隨年齡增加而增加 (P<0.05), 飽和脂肪酸也是如此(P<0.01). 作者得出的結論是該組病人的脂肪攝入過多, 但鈣的攝入則遠遠不足。

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