ORIGINAL ARTICLE

Frequency of Low Calcium Intake, a Risk Factor for Development of Metabolic Syndrome and Type 2 Diabetes Mellitus in Pakistani Women

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ABSTRACT

Objective: To determine the frequency of low calcium intake as a risk factor for development of metabolic syndrome and type 2 diabetes in Pakistani women.
Study design: Cross sectional survey.
Place and duration of study: King Edward Medical University and Allied hospitals Lahore, from April 2010 till October 2010.
Methodology: 450 type 2 diabetic women were enrolled and interviewed for daily calcium intake according to a predesigned questionnaire. Average daily calcium intake of the subjects was calculated using daily calcium calculator table.
Results: Mean daily calcium intake of the patients was 787 mg/day. 167 (37%) patients had daily calcium intake less the 500mg , 173(38%) patients in the range of 500-999mg/day, 40(9%)patients in the rang of 1000-1499mg/day,59(13%) patients in the range of 1500-1999 mg/day, 9(2%) patients in the range of 2000-2499 mg/day and 2 patients in the rang of 2500-2999 mg/day. 366 (81%) patients had low calcium intake according to RDA (Recommended Daily Allowance) and 84 (18%) patients had normal calcium intake according to RDA.
Conclusions: Average daily intake of calcium is low among type 2 diabetic females, in comparison to RDA and acts as a risk factor for development of metabolic syndrome and type 2 diabetes mellitus.
Key words: Type 2 diabetes; RDA; calcium intake.

INTRODUCTION

Diabetes mellitus is a serious public health concern all over the world. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. The prevalence of diabetes is higher in men than women, but there are more women with diabetes than men[1].

In 1997, an estimated 124 million people worldwide had diabetes, 97% of these having NIDDM. The regions with the greatest potential increases are Asia and Africa, where diabetes rates could rise to 2 or 3 times those experienced today[2].

In Pakistan, 6.9 million people are affected by diabetes with the International Diabetes Federation estimating that this number will grow to 11.5 million by 2025. Diabetes mellitus is the fourth leading cause of death in the world according to IDF estimates[3].

Diabetes is a chronic disease, which occurs when the pancreas does not produce enough insulin, termed Type 1 diabetes or when the body cannot effectively use the insulin it produces as in Type 2 diabetes. This leads to an increased concentration of glucose in the blood. Gestational diabetes is hyperglycemia that is first recognized during pregnancy[4].

Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use can prevent or delay the onset of diabetes[5]. Family history of diabetes, excessive use of refined carbohydrates. obesity, increasing age and smoking all predispose to diabetes[6]. Other causes of diabetes include genetic defects in insulin processing or insulin action, exocrine pancreatic defects, endocrinopathies some viruses and drugs[7].

Major complications of diabetes mellitus include neuropathy, retinopathy, skin Complications, high blood Pressure, stroke, hyperosmolar hyperglycemic nonketotic syndrome, diabetic ketoacidosis, gastroparesis, nephropathy, mental health problems, stress, and peripheral arterial disease[8].

Diabetes can be especially hard on women. Women with diabetes are also more likely to have a heart attack and at a younger age than women without diabetes. Depression is also twice as common among diabetic women as compared to men. The disease can affect both mothers and their unborn children. Gestational diabetes develops in 2–

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5% of all pregnancies. Who have had gestational diabetes are at an increased risk for developing type 2 diabetes later in life[9]. 55% of diabetes deaths are in women.

Calcium is an essential and most plentiful mineral in the body. It plays a key role in the development and maintenance of bones and teeth, enables the contraction of muscles, including heart muscles. It is also an essential micronutrient for normal blood clotting, proper nerve impulse transmission, appropriate support of connective tissue, assistance in the production of lymphatic fluids[10]. 68% of the adult population is deficient in Calcium[11,12].

Studies have shown that both calcium and vitamin D intake**s** are inversely associated with development of type 2 diabetes. Abnormal regulation of intracellular calcium affecting both insulin sensitivity and insulin release has been suggested as a potential mechanism to explain the putative association between calcium insufficiency and risk of diabetes[13,14]. According to a study only 24% diabetic woman had adequate calcium intake. Women with the highest calcium (>1,200 mg/day) had 33%lower risk of developing diabetes after multivariate adjustment[15].

A series of recent metabolic and epidemiologic studies have suggested that dairy consumption may have beneficial effects on body weight, blood pressure, insulin resistance syndrome (IRS), and cardiovascular health [16].There is a significantly lower prevalence of the metabolic syndrome among those with higher calcium intake (both food and supplements)[17]. Diet rich in dairy calcium intake enhances weight reduction in type 2 diabetic patients. Such a diet could be tried in diabetic patients, especially those with difficulty adhering to other weight reduction diets[18].

Calcium deficiency is widely prevalent especially in our region and significantly contributes towards morbidity and mortality due to fractures as well as asthenia due to muscle weakness leading to gait instability and falls[19].

Therefore the aim of this study was to assess the daily intake of calcium in women with type 2 diabetes. In women with type 2 diabetes this issues gains more importance because dietary calcium deficiency is more common among elderly, pregnant, lactating and post menopausal women, Mortality due to diabetes is higher in women as compared to men and there are more women with diabetes as compared to men. This assessment can have important public health implications because high dietary intake of calcium can be implemented easily and inexpensively as a tool in the prevention of diabetes, metabolic syndrome and for enhancing weight loss among overweight type 2 diabetics.

METHODOLOGY

Four hundred and fifty (450) type 2 diabetic women coming to indoor and outdoor departments of King Edward Medical University and Allied Hospitals Lahore were reviewed from April 2010 to October 2010. Women with known Crohns disease or chronic kidney disease were excluded. All the data including people identity was kept confidential. After getting informed consent, all the people who fulfill the inclusion criteria were interviewed by the researcher for assessment of calcium intake...Average daily intake of calcium of a subject was calculated using calcium intake calculator table. The normal calcium intake was assessed in comparison to the RDA. Statistical analysis was performed using SPSS ver. 10. Frequency of low calcium intake among type 2 diabetic women was calculated. Mean and standard deviation for quantitative variables like age duration of diabetes, fasting blood sugar level, random blood sugar level and daily calcium intake was calculated. Low calcium intake was presented as frequency and percentage. As this was a descriptive study, no test of significance was applied.

RESULTS

Four hundred and fifty patients who fulfilled the inclusion criteria were included in the study and were interviewed for daily calcium intake. The mean age of the patients was 52±9 years. 337(75%) patients were postmenopausal and 113(25%) patients were not postmenopausal none of the postmenopausal patients was receiving estrogen therapy. Mean duration of diabetes was 8±6 years. Majority of the patients 241(54%) had duration of diabetes in the range of 5-10 years In the distribution of hypoglycemic therapy 432(96%) patients were receiving hypoglycemic therapy and 18(4%) patients were not receiving hypoglycemic therapy. Mean fasting blood sugar level was 149±23mg/dL and Mean random blood sugar level was 218±68mg/dL. 316(70%) patients were not receiving calcium supplements and 134 (30%) patients were receiving calcium supplements Mean daily calcium intake of the patients was 787.22±515.62mg/day. 366(81%) patients had low calcium intake according to RDA and 84(19%) patients had normal calcium intake according to RDA (Table 1).

In the comparison of age with calcium intake according to RDA majority of the patients with normal calcium intake 45 were in the age rang of 40-49 year. In the comparison of menopausal status with calcium intake according to RDA 53 and 31 patients had

normal calcium intake, 284 and 53 patients had low calcium intake among postmenopausal and not postmenopausal patients respectively (Table 2).

In the comparison of calcium supplements with calcium intake according to RDA 80 patients had normal and 54 patients had low calcium intake among those who were receiving calcium supplements. 04 patients had normal 312 had low calcium intake among those who were not receiving calcium supplements (Table 3).

Table 1: Frequency of low calcium intake according to RDA (n=450)

Calcium Intake according to RDA	Frequency	%age
Low	366	81
Normal	84	19

Table 2: Comparison of menopausal status with calcium intake according to RDA (n=450)

Menopausal status	Calcium Intake according to RDA		
	Low	Normal	
Not Postmenopausal	82	31	113
Postmenopausal	284	53	337

Table 3: Comparison of calcium supplements with calcium intake according to RDA (n=450)

Calcium Supplements	Calcium Intake according to RDA		
	Low	Normal	
No	312	4	316
Yes	54	80	134
Total	366	84	450

DISCUSSION

Diabetes mellitus is a serious public health concern all over the world. In Pakistan diabetes is on rise and we are in the middle of a global epidemic of this disease. In 1997, an estimated 124 million people worldwide had diabetes, 97% of these having NIDDM. Diabetes mellitus is the fourth leading cause of death in the world according to IDF estimates[3].

In Pakistan, 6.9 million people are affected by diabetes with the International Diabetes Federation estimating that this number will grow to 11.5 million by 2025 unless measures are taken to control the disease. Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use can prevent or delay the onset of diabetes[5].

Calcium is an essential and most plentiful mineral in the body. It plays a key role in the development and maintenance of bones and teeth, enables the contraction of muscles, including heart muscles. It is also an essential micronutrient for normal blood clotting, proper nerve impulse transmission, appropriate support of connective tissue, assistance in the production of lymphatic fluids 10. 68% of the adult population is deficient in Calcium[11,12].

It has been observed that the relative risk of developing type II diabetes is reduced by as much as 33% in men and women who increase their intake of vitamin D above 800 IU/day along with 1,000 milligrams of calcium[13,14].

Liu S, and et al showed in a study of 10,066 women aged 45 or above, higher intakes of total, dietary, and supplemental calcium were significantly and inversely associated with the prevalence of metabolic syndrome[17].

Pitas G et al showed in their study that only 24% diabetic woman had adequate calcium intake (i.e. 76% have low calcium intake). Women with the highest calcium (>1,200mg/day) had 33%lower risk of developing diabetes after multivariate adjustment 14. In another study Pittas G et al showed that the median reported intake of calcium in the U.S. diabetic population declines with age (ages 51–70 yr, 708mg/d for men and 571mg/d for women; older than 70 yr, 702 mg/d for men and 517mg/d for women[15]**.** In our study frequency of low calcium intake was 75.6% comparable with the study done by pitas G et al[14].

This is the first study of its kind in Pakistan. This study highlights the high frequency of low calcium intake acting as a risk factor for metabolic syndrome and type 2 diabetic females Clinicians must be made aware of the potential relationship between dietary calcium and diabetes. Clinicians should also be advised to assess daily calcium intake of diabetics and subjects should be advised to increase their dietary intake of calcium in order to delay and prevent the development of diabetes, better glycemic control with diabetes and prevention of metabolic syndrome.

We suggest further confirmation of calcium intake assessment on larger groups of population, before public health measures to increase calcium consumption can be recommended.

CONCLUSION

This study showed that average daily intake of calcium is low in females with type 2 diabetes as compared to RDA and so acts as a risk factor for development of metabolic syndrome and type 2 diabetes mellitus. This assessment can have important public health implications because high dietary intake of calcium can be implemented easily and inexpensively as a tool in the prevention of diabetes, metabolic syndrome and for enhancing weight loss among overweight type 2 diabetics.

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