

## Inadequate Intake of Calcium and Dairy Products Among Pregnant Women in Ahwaz City, Iran

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### ABSTRACT

Inadequate calcium intake is considered a public health problem in some vulnerable groups, especially pregnant women. The aim of this study was to determine the pattern of dietary calcium intake among urban pregnant women in Ahwaz City in south west Iran. Participants comprised 339 pregnant women (26±5.5 yrs) in the 28th-32nd week of gestation, who had attended selected urban health centres in Ahwaz City in 2004. Dietary calcium intake was estimated using a 43-item food frequency questionnaire (FFQ). Calcium intakes equivalent to, or more than, 1000 mg/d were considered as "adequate". Mean (±SD) daily intakes of dietary calcium and dairy products were 644±255 mg and 1.3±0.7 servings per day, respectively. On average, dairy products provided 49% of dietary calcium. About 43% of participants were consuming =1 serving of dairy products per day; and 89% of them did not meet adequate intake of calcium. A high proportion of pregnant women in Ahwaz City did not take enough calcium and dairy products. It is suggested that the consumption of enough calcium and dairy products should be emphasised in the nutrition education component of maternal health programmes. Further research at the country level should be undertaken in order to assess the need for fortification of food with calcium and/or to provide calcium supplements to vulnerable groups.

### INTRODUCTION

Regular nutrient intake for adequate maternal reservoir is needed to meet foetal nutritional requirements, without imposing any negative health effects to the mother. Inadequate intake of calcium is a public health concern among pregnant

women in several societies (Purwar *et al.*, 1996; Agrahar-Murugkar & Pal, 2004; Belizan *et al.*, 1991; Prentice *et al.*, 1994). The importance of calcium during human pregnancy and lactation was reviewed by Prentice (2000).

In addition to the well-known physiological functions, other possible health

effects, including weight and body fat regulation and prevention of some chronic diseases have been suggested for calcium (FAO & WHO, 2002; Weaver & Heaney, 1999; Heaney, Davies & Barger-Lux, 2002; Miller & Anderson, 1999). The negative effects of inadequate calcium consumption on maternal and foetal bone health and development (Ortega *et al.*, 1998; Chang *et al.*, 2003), and the positive effects of maternal supplementation with calcium on the blood pressure of the offspring have also been proposed (Belizan *et al.*, 1997; Bergel & Belizan, 2002). Most of the calcium is transferred to the foetus during the third trimester of pregnancy (about 200 mg/d) (FAO & WHO, 2002).

The importance of adequate calcium intake has led to recommendations to include calcium-rich foods/supplements into dietary guidelines (Heaney, 2000). In addition, calcium supplementation was recommended for pregnant women who take =1 serving of calcium-rich food products daily (IOM, 1990).

While available evidence has suggested that a high proportion of Iranian population does not consume enough calcium (Salimi, Djazayeri & Nikkhuy, 2000; NNFTRI, 2004, Houshiar-rad *et al.*, 1998), data on dietary calcium intake among pregnant women in different parts of the country is lacking. Hence, the aim of this study was to determine the adequacy of calcium intake among urban pregnant women in Ahwaz, south west Iran.

## SUBJECTS AND METHODS

Participants were 339 healthy pregnant women, with gestational age between 28 and 32 weeks, 18-35 yrs of age (mean of 26 yrs), singleton pregnancy, who were not taking supplements other than iron and folate. In Ahwaz City, there were 22 "mother and child clinics". As a first step, eight clinics were selected randomly and then the calculated number of participants

was recruited sequentially among women who fulfilled the inclusion criteria. Data collection was carried out in 2004. Since the clinics were selected randomly from all districts of the City, it is very probable that the participants were from all socio-economic segments of the community. Informed written consents were obtained from all participants.

A pre-tested questionnaire (Karandish, Djazayeri & Mahmoodi, 2003) was used to collect data. The first part of the questionnaire was allocated to general socio-demographic and health characteristics. Socio-demographic information was obtained from the "Family Health File" available at the health centers. The language used in the questionnaire was the formal national language of Iran, namely Farsi, which all the participants could understand. Trained interviewers administered the questionnaire by a face-to-face interview at the clinics.

Anthropometric measurements including weight and height were carried out according to the World Health Organization protocols (WHO, 1995). Pre-pregnancy weight was obtained from health records. Body Mass Index (BMI) value was calculated using the equation  $Wt (kg)/Ht(m)^2$ . The reported BMI was pre-pregnancy BMI.

A 43-item semi-quantitative food frequency questionnaire (FFQ) was used to estimate individual calcium intake. A complete sample of the FFQ used is shown in Table 1. The participants were asked about their consumption frequency within the last 6 months prior to the study. All common food sources of calcium were included in the FFQ. In order to estimate the amount of usual calcium intake during pregnancy, the fractional portion size of each food consumed per day was multiplied by its calcium content, obtained from the national food composition table (NNFTRI, 1979). The values were then summed up to obtain an estimate of an individual's total daily calcium intake. The

**Table 1.** Semi-quantitative food frequency questionnaire used to estimate calcium intake in pregnant women in Ahwaz City, Iran (n=339)

Food	Portion size	Never	<1/w	1-2/w	3-4/w	5-6/w	Daily	2/d	3/d	>3/d
Bread	1 slice									
Rice	½ cup									
Pasta, macaroni	½ cup									
Milk	1 cup									
Cheese	1.5 match box									
Yoghurt	¾ cup									
Ice crea	½ cup									
Kashk <sup>a</sup>	1 table spoon									
Cocoa milk	1 cup									
Dough <sup>b</sup>	1 cup									
Sardine fish	70 g									
Tuna conserve	100 g									
Other fish	2 ounces									
Sausages	2 small									
Red meat	2 ounces									
Poultry	2 ounces									
Pizza	1 medium slice									
Soya	½ cup									
Spinach	½ cup									
Green veg. (raw)	1 small dish									
Salad vegetables (cucumber,.)	1 medium portion									
Green veg. (cooked)	½ cup									
Cabbage, cauliflower (raw)	½ cup									
Cabbage, cauliflower (cooked)	½ cup									
Okra	½ cup									
Beans and legumes	½ cup									
Almond	30 g									
Sun flower seed	30 g									
Other nuts	30 g									
Egg (boiled or fried)	1 medium									
Egg in foods	1 medium									
Biscuit and cake	1 medium									
Lime	1 medium									
Fruits	1 medium serving									
Fruit juices	1 cup									
Date	4, dried									
Spices	g									
Potato	1 medium									
Chocolate	50 g									
Cocoa	g									
Cola drink	1 cup									
Coffee	1 cup									
Tea	1 cup									

<sup>a</sup>Local dairy product, which is produced from dried whey.

<sup>b</sup>Local dairy drink, which is produced from yoghurt diluted by water

latest Dietary Reference Intake (DRI) of calcium for adult pregnant women, i.e. 1000 mg/d as Adequate Intake (AI) according to the Food and Nutrition Board, Institute of Medicine, was considered as the recommended amount for pregnant women (IOM, 1997).

Based on daily consumption of dairy products, subjects were divided into 2 groups of "Low Dairy" and "High Dairy" ( $\leq 1$  and  $>1$  serving/d, respectively) (IOM, 1990).

Correlations between intake of dairy products (as number of servings) and attainment of calcium intake were determined by  $\chi^2$  test. Linear regression model was employed to analyse associations between the calcium proportion of dairy products or intake of dairy products (as number of servings) and total calcium intake. P value less than 0.05 was considered as statistically significant. All statisti-

cal analyses were carried out using the Statistical Package for Social Science (SPSS, version 9.0).

The study protocol was approved by the "University Research Council" as well as "The Ethics Committee", Ahwaz Jondi-Shapour University of Medical Sciences and Health Services, Iran.

## RESULTS

Anthropometric and socio-demographic characteristics of the subjects are shown in Table 2. Most participants were literate, as more than half had attended at least high school education. Only 18% of them had an academic degree. The majority of subjects were housewives. More than 70% of them were experiencing their 1st or 2nd pregnancy.

Dietary calcium intakes are shown in

**Table 2.** Anthropometric and socio-demographic characteristics of subjects (n=339)

<i>Variable</i>	<i>Number</i>
Age (y) <sup>a</sup>	26±5.5
Pre-pregnancy weight (kg) <sup>a</sup>	61±10.6
Height (cm) <sup>a</sup>	162±6
Pre-pregnancy BMI (kg/m <sup>2</sup> ) <sup>a</sup>	23.2±4
Education level <sup>b</sup>	
Illiterate or elementary	116 (34.3)
High school	163 (48.1)
University/ college level	60 (17.7)
Occupation <sup>b</sup>	
Housewife	314 (92.6)
Working	25 (7.4)
Previous pregnancy <sup>b</sup>	
0	124 (36.6)
1	118 (34.8)
2	64 (18.9)
≥3	33 (9.7)

<sup>a</sup> Mean±SD

<sup>b</sup> Number (%)

Table 3. Mean of daily dietary calcium intake (644 mg/d) was lower than the AI value of 1000 mg/d. Dietary calcium intake in 89% of the pregnant women was lower than the AI level. Two hundred and seven (61 %) of the participants had calcium intake below 2/3 of the AI. About half of the dietary calcium was derived from dairy products. Only 19.1% (37 out of 194) women in the "High Dairy" group met the AI level for calcium intake, while all in the "Low Dairy" group, had daily calcium intake below the recommended level (Table 4). Milk and yoghurt were the main dairy products consumed, followed by cheese. Bread and other cereals were the most important non-dairy food sources of calcium.

The relationship between calcium share of dairy products or number of servings of dairy products and total dietary calcium intake are shown in Figures 1 and 2. Both correlation coefficients were statis-

tically significant ( $r= 0.64$ ,  $r= 0.86$ , respectively;  $P<0.0001$ ).

## DISCUSSION

Findings of this cross-sectional study indicate that (1) a high proportion of pregnant women in Ahwaz City do not consume enough calcium as well as calcium-rich food products; and (2) meeting adequate intake of this nutrient is not possible through the current dietary patterns in the majority of the studied population.

Compared to other nutrients, usual intakes of calcium can be estimated better by the FFQ method (Weaver & Heaney, 1999). Validation studies in some countries including Italy (Montomoli *et al.*, 2002), United States (Cummings *et al.*, 1987), New Zealand (Wilson & Horwath, 1996), Malaysia (Chee *et al.*, 2002), Denmark

**Table 3.** Dietary intake of calcium and dairy products in pregnant women in Ahwaz City, Iran (n=339)

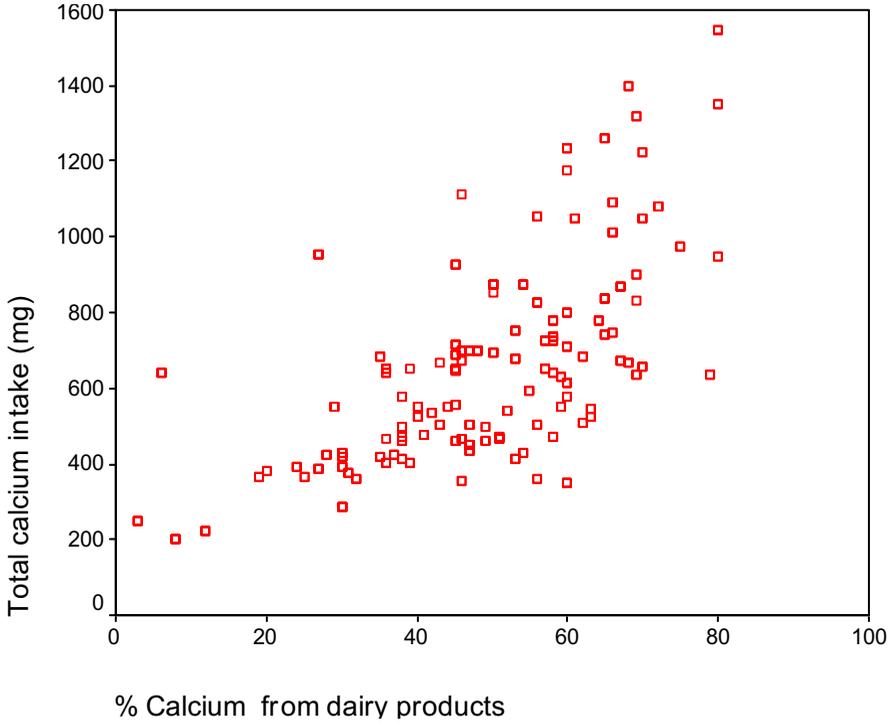
Dietary intake	Mean±SD	Minimum	Maximum
Dietary calcium intake (mg/d)	644 ± 255	202	1548
Intake of dairy products (No. of servings/d) <sup>a</sup>	1.3 ± 0.7	0.01	3.5
Calcium share of dairy products (%)	49 ± 16	3	80

<sup>a</sup> One cup of milk; ¾ cup of yoghurt; 45 g cheese

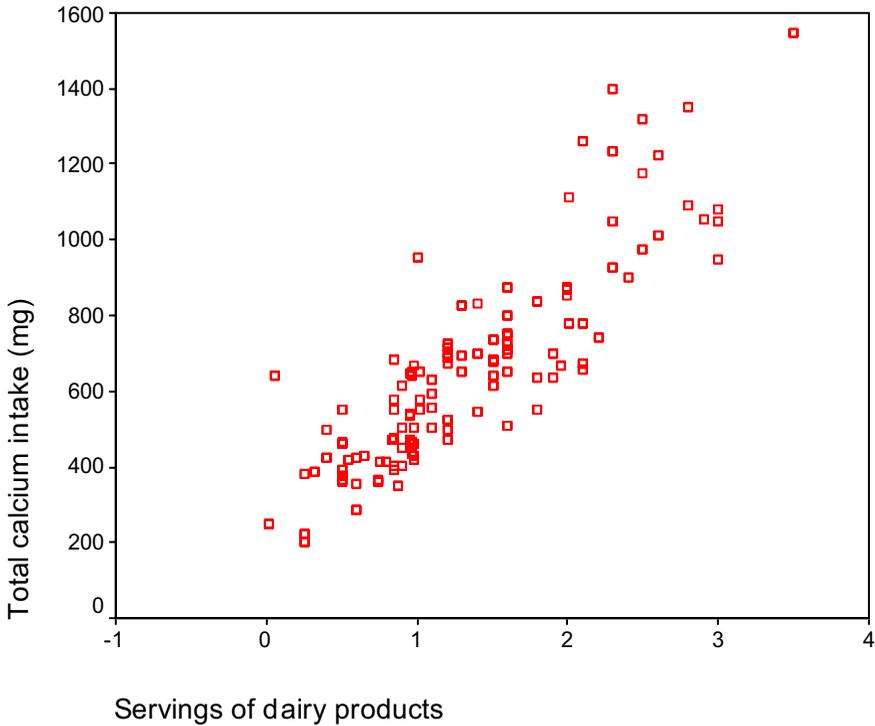
**Table 4.** Meeting "Adequate Intake" of calcium according to consumption of dairy products in pregnant women in Ahwaz City, Iran (n=339)

Daily servings of dairy products	Adequate Intake	
	<1000 mg/d	≥1000 mg/d
≤1	145	0
>1	157	37

$P < 0.0001$ , tested by  $\chi^2$



**Figure 1.** Linear regression between Calcium share of dairy products and total dietary calcium intake (mg/d) in urban pregnant women in Ahwaz City, Iran (n= 339)



**Figure 2.** Linear regression between daily consumption of dairy products (as no. of servings/d) and total dietary calcium intake (mg/d) in urban pregnant women in Ahwaz City, Iran (n= 339)

(Mølgaard, Sandstrom & Michaelsen, 1998), and Finland (Erkkola *et al.*, 2001) have shown acceptable correlations between estimations of calcium intake obtained from FFQ and more accurate dietary estimation methods. Some investigators emphasised that the accuracy of a semi-quantitative FFQ is equivalent to two to three repeat 24-h recalls (Sempose, Liu & Ernst, 1999); while others believe that the FFQs overestimate food consumption and intake of nutrients (Erkkola *et al.*, 2001). Uses and limitations of FFQs to assess the food and nutrition consumption of individuals have been summarised recently by Gibson (2005). No validation study on the use of FFQ for estimation of calcium intake is available in Iran, and it is an important limitation of our study. All major food sources of calcium, which have been recognised in the previous national household food consumption surveys, were included in the FFQ.

Calcium intake widely differs between different societies and communities. Mean dietary calcium intake among our study subjects was a little higher than half of the AI level set for the US. The calcium intake level is clearly lower than intakes reported in many developed countries (Villar & Repke, 1990; Levine *et al.*, 1997), which were above 1000 mg/d, but is close to the figures shown by investigators in some developing countries (Belizan *et al.*, 1991; Lopez-Jaramillo *et al.*, 1997). Findings of calcium intake among Tehrani pregnant women (Houshiar-rad *et al.*, 1998; Azizi, 2001), and in the subjects of a small research project in Ahwaz City (Karandish, Djazayeri & Razi-Jalali, 2004) were 600 mg/d. Though the mean calcium intake in our subjects was higher than the figures reported from pregnant women in India (Purwar *et al.*, 1996; Agrahar-Murugkar & Pal, 2004), and Gambia (Prentice *et al.*, 1994), (. 300-400 mg/d), the level consumed by the study subjects was still considerably lower than the values recommended in the AI.

Considering the rather high percentage of "low dairy" intake among the pregnant women, inadequate calcium intake among pregnant women in Ahwaz should be regarded as a serious public health problem.

Analysis of the dietary sources of calcium in the subjects' habitual diet showed unsatisfactory amounts of milk and dairy products. This finding is consistent with the findings in India (Agrahar-Murugkar & Pal, 2004) with average intake of dairy products below 12 g/d in pregnant women; and lower than in Spain (Irlles Rocamora *et al.*, 2003) with  $1.9 \pm 1.1$  (mean  $\pm$  SD) servings of dairy products per day. Although the ranking of dietary sources of calcium in our study was similar to that reported in a cohort of pregnant women in USA (Harville, Schramm & Watt-Morse, 2004), the mean intake of calcium in that study at 1671 mg/d was much higher than that provided by dairy products in our study.

We found that dairy intakes  $\leq 1$  serving/d can be regarded as a criterion for the potential inadequacy of dietary calcium. We observed that none of the subjects with such a dairy intake met the AI for calcium. In addition, the significant correlation observed between consumption of dairy products and total dietary calcium may justify the importance of increasing calcium share of dairy products among urban pregnant women in Ahwaz.

It can be concluded that a high proportion of pregnant women in Ahwaz do not consume enough dairy products, and this contributed to their low intake of calcium. It is recommended that consumption of enough calcium and dairy products should be included and emphasised in the nutrition education component of maternal health programmes. Further research at the national level should be undertaken to assess the need for foods to be fortified with calcium or to provide calcium supplements to pregnant women.

## ACKNOWLEDGEMENTS

We appreciate the financial support for the project provided by Ahwaz Jondishapour University of Medical Sciences and Health Services, and the statistical assistance of M.H. Haghizadeh. Cooperation of the staff in the selected health centres is highly acknowledged. Sincere thanks to all the participants who made this study possible.

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