Calcium Intakes in the Diet of Eastern Morocco's Population

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Abstract: *Purpose*: Osteoporosis is the most common bone disease in the world. Most epidemiological studies show that calcium and vitamin deficiencies are very frequent not only in the elderly population but also in the general adult population. The aim of our work was to evaluate the calcium intake in population of eastern Morocco by the translated version in Moroccan Arabic dialect of Fardellone questionnaire.

Methods: The version translated into Arabic dialect Fardellone questionnaire was tested on a sample of 1000 subjects. The age distribution was calculated on the distribution of the general Moroccan population according to the most recent population and housing census of September 2014. Therefore, subjects younger than 15 years represented the first age group, the subjects aged 16 to 59 years represented the second age group and the subjects older than 60 years represented by the third age group.

Results: The study population included 56% women (n = 560), 44% of men (n = 440). The subjects aged less than 15 years accounted for 11% (n = 110), those aged 15 to 59 73.1% (n = 731) and those aged over 60 years 15.9% (n = 159). The mean calcium intake was respectively 4907 mg by week (that means 701 mg/day). The assessment of calcium intake by age group showed a deficiency in all three groups. The average consumption of calcium per day was significantly lower than the recommended daily amount for the three age groups. Patients aged over 60 years is the age group most under nourished calcium. The comparison of both gender found a deficit higher among women than among men.

Conclusion: Evaluation of the calcium intake is an essential tool for better management of metabolic bone diseases.

Keywords: Calcium, Calcium intake, Fardellone, Morocco.

1. INTRODUCTION

The evaluation of the ration as the calcium intake influences the occurrence of an osteoporosis, And is associated with several diseases such as obesity [1-4], cardiovascular illnesses [5, 6], high blood pressure [6, 7], Type 2 diabetes [8], colorectal cancer [9], And endometrial cancer [10]. Calcium is necessary for the growth and maintenance of teeth and the skeleton, which contains 99% of the body's calcium [11]. Sufficient calcium intakes should allow a growing individual to optimize his peak osseous mass according to the possibilities of his inheritance [12-14]. A sufficient calcium intake is proportionally associated with increased osseous mass and decreased fracture risk in adulthood regardless of ethnic origin [15-19]. Calcium needs vary in function with age, sex and individuals. However, many countries have set recommended daily allowance levels (RDA) in calcium, which are supposed to cover the needs of 95% of the population (recommended daily allowance). The RDAs are distinguished from the estimated needs that represent significantly lower average mandatory losses (Requirement: approximately 600 mg by day). These needs evaluated by the study of the calcium balance, which determines a threshold beyond which there is no retention of calcium. Needs are increased in adolescents, during pregnancy and in the elderly and are sometimes difficult to cover [12]. We performed this work in order to evaluate the calcium ration in the eastern Morocco's population and any age group confused of its region.

2. METHODS

This is a cross-sectional study to describe the calcium ration in the population of eastern Morocco. The target population consisted of healthy individuals residing in eastern Morocco. Sampling was non-random by quotas, proportional to age. The size of our sample has been arbitrarily fixed to a thousand subjects. The age distribution was calculated on the distribution of the general Moroccan population according to the most recent population and housing

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census of September 2014 [20]. Therefore, subjects younger than 15 years represented the first age group, the subjects aged 16 to 59 years represented the second age group and the subjects older than 60 years represented by the third age group. The calcium ration was evaluated using the translated version in dialectal Arabic of the Fardellone questionnaire [21, 22]. The questionnaire consists of 22 items whose calcium content was evaluated by the Fardellone equivalence tables [21]. These foods have been grouped into one of the following five classes: Calcium in the form of milk (Pure milk, Milk drinks, etc.); Calcium in the form of dairy and cheese (Yoghurt, petit Suisse, white cheese, baked cheese, soft cheese, etc.); Calcium in the form of vegetables, fruits, meats and mineral waters (VFMW) (Note that Moroccan mineral waters are not very rich in calcium [23]; Calcium in the form of breads, meal or pasta (BMP) And calcium in the form of chocolate. The calcium intake in drug form Were not included in the calculation of calcium intake. The time required to complete the questionnaire was 15 to 20 minutes. The investigation lasted three months (March, April, and May 2017). Statistical analysis used Uni- and bivariate analysis. The univariate analysis consisted of a percentage calculation for the qualitative variables, of mean and standard deviation for the quantitative variables. Bivariate analysis used hypothesis testing. The Student test and the analysis of variance were used for comparison of means. The chi-square test and Fisher's exact test have been used to compare percentages. Nonparametric tests have been used when the conditions of use of the previously described tests were not verified. The statistical analysis was carried out using the software Epi-info in version 7.2. The threshold of significance was set at $\alpha = 5\%$. The questionnaire was completed after having the informed consent of the participants, informed in advance about the purpose of our work and the conditions of the proceedings and strictly anonymous.

3. RESULTS

Our series included a thousand healthy subjects, 44% of whom were male (n = 440) and 56% female (n = 560). Sex was not mentioned on a single card. The subjects aged less than 15 years accounted for 11% (n = 110), those aged 15 to 59 73.1% (n = 731) and those aged over 60 years 15.9% (n = 159). The average age was 37.33 ± 11.42. The mean total calcium consumption of the subjects recruited was 4907 mg per week, a daily consumption of 701 mg per day. The assessment of calcium intake by age group showed a deficiency in all three groups. This deficiency was important in subjects older than 60 years. The results are detailed in Table **1**. The distribution of calcium intake by food groups showed that deficiency in subjects younger than 15 years was due to reduced intake of chocolate (8.6% of the total calcium intake) Followed by the BPS group (14,1% of total calcium intake) and VFMW (15,4% of total calcium intake) (Table **2**). The same finding have been made in subjects aged 16 to 59 years, the calcium intake of chocolate represented 4,7% of calcium intake Followed by the BPS group, which represented 12% of the overall calcium intake. For the third group consisting of subjects over the age of 60 years, calcium deficiency was explained by a decreased contribution of chocolate (2.2% of the total calcium intake) followed by the BPS group (16% of the total calcium intake) and cheese dairy (18,5% of the total calcium intake) (Table **2**). We also evaluated calcium intake in women over 50 years of age who were presumed to be menopausal. This group is represented by 174 subjects out of a thousand, whose average weekly intake was estimated at 4165 mg (595 mg per day). The distribution according to the different groups of foods targets a net deficiency at the expense of chocolate (3% of the total calcium intake) Followed by the BPS group (15% of the total calcium intake); the calcium intake of milk and dairy represented 62% of the total calcium intake (Table **3**). Analysis of mean calcium intake by sex in subjects younger than 15 years and in adults over 16 years (group 2 and 3 confounded) did not find any significant difference between the two sexes (Table **4**).

4. DISCUSSION

The objective of our study was to quantify the calcium intake of a population representing the different

Table 1: The Mean Calcium Intake According to Age Groups

Age range	Average (mg / wk)	Average (mg / day)	Number
15 and less	6026 ± 2324	860	110
16 to 59	4440 ± 2113	634	731
60 and more	3078 ± 1353	440	159
Total	4907 ± 2010	701	1000

Table 2: Weekly Calcium Intake Distributed According to Food Groups

Age range	Food Groups	Average calcium intake in mg / week	Average calcium intake in mg / day
15 and less	Milk	1986 (33 %)	284
	Dairy + cheese	1740 (28.9 %)	248
	Vegetables + fruits + meat + water	930 (15,4 %)	132
	Bread + pasta + semolina	850 (14,1 %)	121
	Chocolate	520 (8,6 %)	74
	Total	Total 6026	
16 to 59	Milk	1380 (31 %)	283
	Dairy + cheese	1470 (33,1 %)	210
	Vegetables + fruits + meat + water	850 (19,1 %)	121
	Bread + pasta + semolina	530 (12 %)	76
	Chocolate	210 (4,7 %)	30
	Total	Total 4440	
60 and more	Milk	1220 (39,6 %)	174
	Dairy + cheese	570 (18,5 %)	81
	Vegetables + fruits + meat + water	730 (23,7 %)	104
	Bread + pasta + semolina	488 (16 %)	70
	Chocolate	70 (2,2 %)	10
	Total	Total 3078	

Table 3: Weekly Calcium Intake Distributed According to Food Groups in Supposed Menopausal Women

	Milk	Dairy products	Vegetables, fruits, meat, water	Breads, semolina	Chocolate
Average (%)	1478 (35%)	1160 (27.8%)	780 (18.7%)	620 (14.8%)	127 (3%)
Standard deviation	1245	688	275	268	122
Minimum	0	0	210	40	0
Maximum	5250	3260	1490	1578	1990

Table 4: Weekly Calcium Intake According to Sex in Patients Aged less than 15 Years and Adults Aged Over 16 Years.

Age group (years)	Sex	Number	Average calcium intake (Mg / week)	Degree-Type	Degrees of Significance
15 and less	Male	42	6130	2520	0.088
	Female	68	5920	2780	
More than 16	Male	440	4570	2340	0.015
	Female	450	4830	2458	

age groups and to compare these results with the recommended intakes. This type of survey of calcium ration is easy to carry out, especially with the current choice of frequency questionnaires. The Fardellone questionnaire used for our study has the advantage of being adapted to the Moroccan food culture. Evaluating a weekly frequency, it takes into account intra-individual food variations and consumption throughout the week without excluding weekend meals. Our survey has the advantage of including a large number of subjects and assessing the intake of calcium in different age groups. We have shown a lack of calcium intake affecting the different age groups; Children, adults and elderly. For subjects less than 15 years of age, we found an average calcium intake of 860 mg per day with a slightly higher consumption in boys than girls but not significant (6130 mg per week and 5920 mg per week) ($p = 0.088$). Calcium intake in this age

Table 5: Comparison of Calcium Intake for Different Series

	Publications	Calcium intake In mg / day
Subjects age 15 and under	Ait Ouazar *et al*. [24]	839
	Lisa *et al*. [25]	752-856
	Teresa *et al*. [26]	733-915
	Keith Jensen *et al*. [27]	1200-1479
	Siew Sun Wong *et al*. [28]	1045-1210
	Our series	860
Postmenopausal women	Ait Ouazar *et al*. [24]	603
	Bennouna *et al*. [32]	448.38
	Laatar *et al*. [33]	427 ± 160
	Goodau *et al*. [34]	652
	Hercberg *et al*. [35]	800
	Chapuy *et al*. [36]	659
	Scaccini *et al*. [37]	600
	Angus *et al*. [38]	809
	Zvonimir *et al*. [39]	901.8
	Our Series	610

group remains below recommended intakes which range from 800 to 1500 mg per day [11]. In Morocco, a similar study carried out in 2010 for evaluating the calcium ration in population of Marrakesh and its region [24], which shows results similar to the results of our study, which can be explained by the similarity of food habits between the east and the south of Morocco. Comparison of our results and results of the American series [25-27] shows that our results remain on average lower than the figures found by these authors (Table **5**). In our survey, the assessment of calcium ration in adults over 16 years of age showed a lower intake than recommended. No significant differences were found between the sexes (p = 0.015 (Table **4**). Nancy *et al*., Have evaluated calcium in adults at 869 ± 380 mg per day [28]. Based on the idea that the diet, and in particular the calcium intake, is modified by the rural or urban origin of the population studied, Jane *et al*. Evaluated calcium in 81 adults of rural origin. They found that the average calcium intake assessed by the questionnaire (1287 mg per day) differs from that measured by the reference method (1141 mg per day) with p = 0.01. Thus, they concluded that this is not a good way to evaluate the calcium in the rural population and that instead it is necessary to use appropriate questionnaires for this population [29], Hence the interest of developing questionnaires adapted to the specificities of the diet of each region, which was the case for example in the United Arab Emirates and Kuwait. The evaluation of calcium ration in postmenopausal women is interesting due to the involvement of calcium deficiency in the defect of bone mineralization predisposing to osteoporosis. We then evaluated the calcium ration in 174 women aged over 50 years who were thought to be menopausal. The mean calcium intake is 595 mg per day, which is well below the recommended intakes for this age group. The distribution according to the different food groups shows that the calcium intake of milk and milk products represents 62% of the total calcium intake (Table **3**). Another Moroccan study carried out in Casablanca, including 130 postmenopausal women, estimated the average calcium intake by the Fardellone questionnaire at 448.38 mg per day [31]. In the same survey, considering food groups, the distribution of calcium consumption shows that nearly 58% of the calcium in food is supplied by non-dairy foods (vegetables, breads, meats, water, etc.) compared to 4, 7% for milk and 37.4% for dairy and cheese. Eighty-five point thirty-eight percent of subjects have a "low" calcium intake (less than 500 mg per day); 11.53% of subjects had a "poor" calcium intake (between 500 and 999 mg per day) and 3.09% had a "sufficient" calcium intake (between 1000 and 1499 mg per day) [31]. Evaluation of the calcium ration of Tunisian women by the Fardellone questionnaire found a low average calcium intake estimated at 427 ± 160 mg per day. The calcium intake was greater than 800 mg per day in only 4% of postmenopausal women and 1,200 mg per day in 0.2% of menopausal women. Dairy products provided only 34.5% of this diet [32]. Thus, it can be seen that the calcium consumption of women in eastern Morocco is close to consumption in the north of the country as well as in Tunisia, suggesting the implication of the

Maghrebian diet based mainly on bread and Meal in this deficiency. This consumption is still lower than that reported by some surveys carried out in Europe and Australia [33-38] (Table **5**). The deficiency of calcium intake is often associated with vitamin D deficiency. This situation is frequent in the Maghreb countries despite the sunshine [39-41], which suggests a high incidence of bone metabolic pathology.

5. CONCLUSION

Our survey shows the frequency of calcium deficiency affecting all age groups by means of an easy-to-use Fardellone questionnaire. The frequency of calcium deficiency requires the implementation of a strategy of management including calcium supplementation not only for postmenopausal women but also for other age groups. Prevention involves raising public awareness of the implications of this deficiency and the risk factors. Finally, we emphasize the usefulness of the Fardellone questionnaire adapted to our context to estimate the calcium consumption in order to prescribe a more systematic supplementation.

CONFLICT OF INTEREST

On behalf of all authors, the corresponding author states that there is no conflict of interest.

ETHICAL STANDARDS STATEMENT

Our study has been approved by the appropriate ethics committee and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

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