

## **DAIRY CONSUMPTION AND CALCIUM INTAKE OF EGYPTIAN WOMEN**

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### **ABSTRACT**

Dairy products are nutrient-dense foods necessary to promote bone health, to help reduce risk for chronic diseases. This study was conducted to evaluate the daily calcium intake by using 24 hour dietary intake method, the sources of calcium and the percent intake of different dairy products. A stratified, multistage, random sampling design was used to select approximately 3854 households in Giza, Sharkia, Domiat, Behira and Bany-Sueif governorates distributed between urban and rural area. The survey data indicate that the mean intakes of calcium, are higher for urban Beheira mothers (814.14mg/day, 67.85% of RDA) than that of governorates and the lowest was for urban Bany-Sueif mothers (658.96 mg/day, 54.91% of RDA), with significant differences in intakes between governorates at  $P < 0.05$ . Dairy foods contributed about 42.42% of the dietary calcium for the total population, the highest consumption of milk were in urban Behira (52.8%) and the lowest, were in rural Bany-Suief (4.7%). As for cheese, the highest consumption was in rural Bany-Suief (84.2%) and the lowest was in urban Giza (40.3%). But the consumption of yogurt was higher in urban Domiat (18.8%) but the lowest was in rural Bany-Suief (0.7%). These results reinforce the importance of nutritional educational efforts to promote milk consumption, which has declined over the past several decades. Also fortification of some products must be considered to increase the intake of calcium

### **INTRODUCTION**

Milk and other milk products make important contributions to the diet quality by providing abundant amounts of protein, vitamins, and minerals. Dairy products are major sources of calcium and vitamin D and also an abundant food source of minerals as phosphorus, potassium, magnesium; vitamins as riboflavin, niacin, vitamin B12 and vitamin A, and protein in the diet (Gerrior and Bente, 2001). Inadequate total dairy consumption is associated with insufficient intake of essential minerals, such as calcium, magnesium, and potassium (Weinberg *et al.*, 2004). Although nondairy sources of calcium may also contribute to intake of this nutrient, there are concerns about bioavailability of calcium from many nondairy sources (Heaney, 2005). Increased dietary calcium intake is associated with increased bone mass. Calcium intake is one of a number of factors that affect peak bone mass which, in turn, is inversely related to bone fragility and osteoporosis (Heaney, 1991). High bone mass at skeletal maturity is considered to be the best protection against these fractures (Chapuy *et al.*, 1992). Current recommendations for calcium intake for individuals 25 y and older is 1200 mg Ca/d according to RDA (RDA, 2002) for non pregnant or lactating women.

#### **Sources of calcium in the diet**

Calcium is widely distributed in both plant and animal foods. However, except for tissues such as bone and milk; animal foods, in general, contain less calcium than do vegetable foods (USDA, 1986 a,b,c) but the presence of

oxalic acid (present in vegetables) and phytic acid (in legumes) decrease the absorption of calcium from these sources (Starck *et al.*, 1993). In the distant past, the calcium content of the human diet may have been two or three times what it is today, most of the calcium being contributed by plant foods, which were eaten in abundance, together with animal foods and insects.

Specific objectives of this work is to: (a) examine governorate related differences in mean calcium intake; (b) examine governorate related differences in mean intakes of milk, cheese, yogurt, and total dairy in a sample of Egyptian women.

## **MATERIALS AND METHODS**

A stratified, multistage, random sampling design was used to select approximately 3854 households in Giza, Sharkia, Domiat, Behira and Bany-Sueif governorates. The present study was carried out as a part of the food consumption pattern in Egypt during 2006-2007.

### **Dietary Intake**

Well-trained interviewers who visited each participating household and solicited one 24-hour recall form mothers in the study. Food intake data were converted to nutrient intake variables using FIAS, 1998. Food Intake Analysis System (FIAS) is a food analysis program developed by the University of Texas and has been used for the developing of an Egyptian food data base since 1992. The program produces nutritional analysis of the recipes through entering the ingredients and cooking methods.

### **Statistical analysis**

Statistical analyses were conducted using SPSS program(ver. 16).

## **RESULTS AND DISCUSSION**

The sample consists of 3854 mothers, distributed between 5 governorates, as shown in Table 1. The sample was distributed between urban and rural, 1947 and 1907 respectively.

**Table 1: Characteristics of Study Sample**

<b>Characteristics</b>	<b><i>n</i></b>	<b>%</b>
<b>Governorate</b>		
Giza	1002	26
Sharkia	769	19.9
Domiat	559	14.5
Behira	1042	27
Bany-Sueif	482	12.5
<b>District</b>		
Rural	1947	50.52
Urban	1907	49.48
<b>Total</b>	<b>3854</b>	<b>100</b>

The survey data indicated that the mean intakes of calcium were 745.44mg/day, which represents 62.12% of RDA and were higher for urban areas (770.33mg/day, 64.19% of RDA) than rural areas (713.08 mg/day, 53.43% of RDA). But according to governorates, Behira had the highest intake (774.87 mg/day, 64.57% of RDA), followed by Domiat (772.82 mg/day, 64.40% of RDA) and Giza (743.21 mg/day, 61.93% of RDA) but Bany-Sueif had the lowest intake (662.41 mg/day, 55.20% of RDA). And when comparing rural and urban areas, we find that urban Behira mothers have the higher intake (814.14mg/day, 67.85% of RDA) and the lowest was for rural Bany-Sueif mothers (658.96mg/day, 54.91% of RDA). There were significant differences in intakes between governorates at  $P<0.05$ .

**Table 2: Calcium Intake and Percent of RDA for Egyptian Mothers**

Governorate	Mean intake (mg/day) ±Standard Error	% RDA
<b>Giza</b> (n=1002)	<b>743.21 ± 8.40</b>	<b>61.93</b>
Urban	787.43 ± 14.25	65.62
Rural	705.36 ± 9.09	58.78
<b>Sharkia</b> (n=769)	<b>695.06 ± 16.86</b>	<b>57.92</b>
Urban	715.16 ± 23.61	59.92
Rural	665.18 ± 22.45	55.43
<b>Domiat</b> (n=559)	<b>772.82 ± 9.31</b>	<b>64.40</b>
Urban	780.14 ± 9.67	65.01
Rural	726.88 ± 29.61	60.57
<b>Behira</b> (n=1042)	<b>774.87 ± 9.93</b>	<b>64.57</b>
Urban	814.14 ± 16.01	67.85
Rural	753.05 ± 12.37	62.75
<b>Bany-Sueif</b> (n=482)	<b>662.41 ± 10.69</b>	<b>55.20</b>
Urban	665.81 ± 15.33	55.48
Rural	658.96 ± 14.99	54.91
<b>Sample Mean Intake</b> (n=3854)	<b>745.44 ± 4.75</b>	<b>62.12</b>
Urban	770.33 ± 6.61	64.19
Rural	713.08 ± 6.50	53.43

The results obtained are *higher* than those obtained in a study by Shabayek and Saleh (2000), in which the mean intake of calcium was 431.9mg/day in some squatter areas of Alexandria.

Foods consumed by individuals were categorized using nine major food groups (dairy products; grains; legumes; vegetables; fruits; sweets and beverages; meat, fish and poultry; eggs and others) and the percent consumed of each group were calculated. Table 3 presents the percent of consumption of major food groups in the five governorates.

From Table 3, sweets and beverages have the highest consumption of all food groups (225.47gm/d), and the highest was in Behira governorate (232.39gm/d) and the lowest was Domiat governorate (211.87gm/d). The mean dairy products consumption was (115.15mg/d), the highest consumption was in Behira (150.66gm/d) and the lowest was in Bany-Suief (80.76gm/d).

**Table 3: Percent Calcium Intake by Food Source for Mothers.**

Governorate	Dairy Products	Grains	Legumes	Vegetable	Fruit	Sweets & Beverages	Meat, Fish & Poultry	Eggs	Other
<b>Giza (n=1002)</b>	<b>40.33</b>	<b>6.78</b>	<b>8.81</b>	<b>9.06</b>	<b>8.21</b>	<b>3.04</b>	<b>12.76</b>	<b>7.38</b>	<b>3.62</b>
Urban	44.36	6.77	7.84	7.22	8.46	3.48	12.27	7.31	2.05
Rural	43.05	6.97	10.03	11.98	7.64	1.93	10.01	7.57	0.76
<b>Sharkia (n=769)</b>	<b>43.05</b>	<b>6.50</b>	<b>7.52</b>	<b>11.06</b>	<b>7.81</b>	<b>1.69</b>	<b>11.57</b>	<b>7.32</b>	<b>3.47</b>
Urban	40.49	5.24	7.84	11.35	5.08	2.03	16.65	8.63	2.69
Rural	35.42	8.02	8.82	12.92	10.04	1.90	10.82	7.51	4.55
<b>Domiat (n=559)</b>	<b>42.93</b>	<b>6.46</b>	<b>6.30</b>	<b>6.26</b>	<b>7.91</b>	<b>1.69</b>	<b>19.14</b>	<b>6.63</b>	<b>3.55</b>
Urban	42.24	5.19	6.66	7.81	6.62	1.49	20.5	7.27	3.27
Rural	40.54	6.85	6.25	6.06	7.75	1.77	21.78	5.62	3.35
<b>Behira (n=1042)</b>	<b>48.55</b>	<b>7.79</b>	<b>7.49</b>	<b>4.32</b>	<b>8.27</b>	<b>2.03</b>	<b>14.24</b>	<b>6.45</b>	<b>0.86</b>
Urban	52.08	5.28	9.17	5.82	6.74	2.81	12.55	6.70	0.00
Rural	47.22	8.94	6.99	4.41	8.90	1.82	21.25	6.55	0.96
<b>Bany-Sueif (n=482)</b>	<b>37.22</b>	<b>8.81</b>	<b>8.62</b>	<b>8.76</b>	<b>9.90</b>	<b>9.90</b>	<b>12.71</b>	<b>7.85</b>	<b>3.48</b>
Urban	39.04	7.96	8.45	7.31	10.67	2.22	14.52	8.11	1.72
Rural	33.22	9.78	8.87	10.02	9.44	9.44	14.20	7.79	3.61
<b>Sample Mean (n=3854)</b>	<b>42.42</b>	<b>7.27</b>	<b>7.75</b>	<b>7.89</b>	<b>8.42</b>	<b>3.67</b>	<b>14.08</b>	<b>7.13</b>	<b>3.00</b>
Urban	43.64	6.09	7.99	7.90	7.51	2.41	15.30	7.60	1.95
Rural	39.89	8.11	8.19	9.08	8.75	3.38	15.61	7.01	2.65

When comparing rural and urban areas it can be noticed that urban had higher intake than rural, except for grains, urban Behira had the highest consumption for dairy products (172.72gm/d) and urban Bany-Suief had the lowest (68.90gm/d).

The amount of calcium contributed to the diet of individuals from each of these food groups was calculated. Table 4 summarizes the mean proportion of dietary calcium, derived from different food sources.

Dairy foods contributed about (42.42%) of the dietary calcium for the total population. Grains and bakery products, including all kinds of bread, and legumes supplied (7.27%) and (7.75%) of calcium. While vegetables and fruits contributed (7.89%) and (8.42%) respectively. 14.08% was supplied by meat, poultry and fish, (7.13 %) was from eggs. The remaining was from sweets and beverages and others. It can be noticed that urban mothers have higher calcium intake from dairy products than those in rural areas.

As for comparing urban and rural areas, the highest contribution of dairy products were in urban Behira (52.08%) and the lowest, were in rural Bany-Suief (33.22%) and for grains the highest were in rural Bany-Suief (9.78%) and the lowest were in urban Domiat (5.19%). As for legumes the highest contribution was in rural Giza (10.03%) and the lowest were in rural Domiat (6.25%). But for meat, poultry and fish, the highest were in rural Domiat (21.78%) and the lowest were in rural Giza (10.01%). Other food groups contributed the rest of the calcium intake of mothers.

The results are higher than those obtained by Mahmoud *et al.* (2001), who reported that only 26.87% and 46.33% of calcium in mother's diet were supplied by dairy products in urban and rural areas of Behira respectively.

**Table 4: Percent Consumption of Different Dairy Products by Mothers.**

Governorate	Sub			
	Milk	Cheese	Yogurt	Other
<b>Giza</b> (n=1002)	<b>11.6%</b>	<b>50.8%</b>	<b>8.0%</b>	<b>29.6%</b>
Urban	10.4%	40.3%	10.5%	38.8%
Rural	14.4%	75.4%	2.1%	8.1%
<b>Sharkia</b> (n=769)	<b>5.1%</b>	<b>81.3%</b>	<b>7.8%</b>	<b>5.8%</b>
Urban	5.5%	78.9%	8.8%	6.8%
Rural	4.8%	83.8%	6.6%	4.7%
<b>Domiat</b> (n=559)	<b>10.6%</b>	<b>62.6%</b>	<b>14.7%</b>	<b>12.1%</b>
Urban	6.9%	66.7%	18.8%	7.6%
Rural	11.6%	61.5%	13.5%	13.4%
<b>Behira</b> (n=1042)	<b>20.9%</b>	<b>55.0%</b>	<b>4.0%</b>	<b>20.1%</b>
Urban	7.5%	78.7%	12.2%	1.7%
Rural	25.8%	48.0%	1.6%	24.6%
<b>Bany-Sueif</b> (n=482)	<b>8.6%</b>	<b>84.6%</b>	<b>5.0%</b>	<b>4.8%</b>
Urban	25.4%	53.7%	17.0%	4.0%
Rural	4.7%	84.2%	0.7%	5.6%
<b>Sample</b> (n=3854)	<b>13.0%</b>	<b>61.3%</b>	<b>8.4%</b>	<b>17.3%</b>
Urban	9.1%	59.2%	12.5%	19.3%
Rural	15.4%	62.6%	5.9%	16.1%

From table 5, it can be observed that cheese is considered the most frequently used dairy product by Egyptian mothers; it represents (61.3%) of dairy consumption compared with milk which presents only (13.0%). The highest milk consumption was in Behira (20.9%) and the lowest were in Sharkia (5.1%). Also for cheese, the highest consumption was in Sharkia (81.3%) and the lowest was in Giza (50.8%). But the consumption of yogurt was higher in Domiat (14.7%) but the lowest was in Behira (4.0%), as for other sources, which include cream, ice cream and milk containing drinks, the highest was in Giza (29.6%) and the lowest was in Sharkia (5.8%).

As for comparing urban and rural areas, rural areas had higher consumption of milk and cheese, (15.4% and 62.6%) respectively. The highest consumption of milk was in rural Behira (25.8%) and the lowest, were in rural Bany-Suief (4.7%). As for cheese, the highest consumption was in rural Bany-Suief (84.2%) and the lowest was in urban Giza (40.3%). But the consumption of yogurt was higher in urban Domiat (18.8%) but the lowest was in rural Bany-Suief (0.7%). The results obtained are similar with those obtained in the study by FTRI (1998), in which 75% of the households in Cairo, Ismailia, Dakahlia, Aswan and New valley consumed dairy products twice s week. Also, Gaabr *et al.* (2000) reported that 26% and 34% of women in Behira consumes milk and cheese, respectively, less than 3 times weekly. The results obtained in these studies may be explained by the total production of milk in different governorates, as Behira has the highest production in all governorates, 940467 tons, as reported by Animal Wealth development sector (2007).



## CONCLUSION

The data support efforts to promote milk consumption, which has declined over the past several decades. This suggests that dietitians must carefully examine the impact of one recommended food change on overall nutrient intakes. Also the results highlight the importance of considering the overall diet of the person. Because food choices, eating patterns, and nutrient profiles of foods change, these analyses should be updated in the future. Increasing availability of fortified foods is particularly important to consider.

It is thus clear that one or more of three things must occur if Egyptian women are to achieve sufficient intakes of calcium. The first possibility is for substantial changes to take place in eating patterns. Because milk, both in milk products and as an ingredient in other foods, is the source of about 42% of the calcium intake of Egyptian woman. The precipitous decline in consumption of milk products from childhood through adulthood is notable. A second possibility is for the calcium content of foods to be increased, either through increased use of milk as an ingredient or through direct fortification. A final approach is to go beyond the diet and rely on supplementation.

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### المستهلك من الألبان والمأخوذ من الكالسيوم للأمهات في جمهورية مصر العربية حنان عبد الحميد حسين و إبراهيم أحمد يوسف معهد بحوث تكنولوجيا الأغذية – مركز البحوث الزراعية

تعتبر منتجات الألبان احد المغذيات الضرورية لتحسين صحة العظام وتقليل مخاطر الإصابة بالأمراض المزمنة، وقد تناولت هذه الدراسة مصادر الكالسيوم في منتجات الألبان المختلفة والمتنوعة خلال ٢٤ ساعة و كانت العينة المختارة عينة عشوائية متعددة المراحل وحجمها ٣٨٥٤ سيدة موزعة بين مناطق الريف والحضر في محافظات الجيزة، الشرقية، دمياط، البحيرة وبنى سويف. وقد أظهرت النتائج أن أعلى متوسط متناول من الكالسيوم كان للأمهات في منطقة الحضر بمحافظة البحيرة حيث بلغ ٨١٤.١٤ ملجم/يوم (مقارنة بالمحافظات الأخرى) وهذا يغطي حوالي ٦٧.٨٥% من الاحتياجات الغذائية الموصى بها. بينما كان أقل متوسط من المتناول من الكالسيوم للأمهات في الحضر بمحافظة بنى سويف حيث بلغ ٦٥٨.٩٦ ملجم/يوم وهذا يغطي حوالي ٥٤.٩١% من الاحتياجات الغذائية الموصى بها مع وجود فروق معنوية للمتناول من الكالسيوم بين المحافظات عند مستوى معنوية ٠.٠٥%.

كما أظهرت الدراسة أن منتجات الألبان تساهم بحوالي ٤٢.٤٢% من إجمالي المتناول من الكالسيوم وكانت الأمهات في حضر البحيرة أكثر استهلاكاً للألبان (٥٢.٨%) بينما الأمهات في ريف بنى سويف فكن الأقل استهلاكاً للألبان (4.7%). كما وجد أن أعلى استهلاك للبن للأمهات في ريف البحيرة بنسبة ٥٢.٨% وأقل استهلاك للأمهات في ريف بنى سويف بنسبة ٤.٧%. بينما كان أعلى استهلاك للجبين للأمهات في ريف بنى سويف بنسبة ٨٤.٢% وأقل استهلاك للجبين للأمهات في حضر الجيزة بنسبة ٤٠.٣% بينما أقل استهلاك للزبادى للأمهات في ريف بنى سويف بنسبة ٠.٠٧% وأعلى استهلاك للزبادى للأمهات في حضر دمياط ١٨.٨%. والنتائج المتحصل عليها من هذه الدراسة تعزز أهمية التنقيف الغذائى لزيادة استهلاك الألبان الذى تراجع فى العقود الماضية وكذلك ضرورة تدعيم بعض المنتجات بالكالسيوم لزيادة نسبة المتناول منه.

#### قام بتحكيم البحث

كلية الزراعة – جامعة المنصورة  
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أ. د/ محمد يونس رياض مهنى  
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**Table 5: Mean Consumption of Different Foods (gm/d/mother)**

Governorate	Dairy Products	Grains	Legumes	Vegetable	Fruit	Sweets & Beverages	Meat, Fish & Poultry	Eggs	Others
<b>Giza (n=1002)</b>	<b>101.15±2.73</b>	<b>188.69±2.62</b>	<b>134.99±5.57</b>	<b>110.90±3.35</b>	<b>209.35±7.80</b>	<b>231.32±1.86</b>	<b>198.27±6.44</b>	<b>58.34±1.76</b>	<b>259.62±8.34</b>
Urban	87.10±4.73	171.40±4.14	134.28±9.51	107.02±6.77	171.76±18.72	234.88±2.93	246.49±13.79	71.06±4.11	277.63±5.62
Rural	105.16±3.24	192.44±3.06	135.45±6.82	111.54±3.73	216.89±8.53	228.51±2.40	185.93±7.17	54.52±1.86	233.31±16.59
<b>Sharkia (n=769)</b>	<b>88.41±3.18</b>	<b>177.71±1.51</b>	<b>100.93±4.21</b>	<b>142.77±3.56</b>	<b>143.35±6.94</b>	<b>228.85±3.67</b>	<b>160.76±10.62</b>	<b>58.57±3.43</b>	<b>197.00±34.77</b>
Urban	110.69±6.42	155.64±1.93	175.95±18.11	125.71±3.51	126.16±15.83	217.21±5.42	140.02±12.90	76.00±5.79	170.00±30.00
Rural	81.49±3.59	169.50±6.77	82.29±2.43	164.78±6.71	147.75±7.71	230.92±4.21	168.50±13.74	50.27±3.85	215.00±57.66
<b>Domiat (n=559)</b>	<b>123.58±2.90</b>	<b>150.17±3.29</b>	<b>80.01±4.30</b>	<b>117.60±1.94</b>	<b>207.04±5.86</b>	<b>211.87±3.66</b>	<b>215.38±6.99</b>	<b>60.16±3.31</b>	<b>285.00±0.00</b>
Urban	95.86±7.82	131.17±2.95	88.69±9.49	112.24±2.71	227.86±14.29	198.48±12.26	221.24±22.80	70.10±9.82	-
Rural	131.81±2.92	155.31±4.09	78.77±4.72	121.82±2.73	199.51±6.04	213.61±3.82	213.61±5.97	55.87±2.08	285.00±0.00
<b>Behira (n=1042)</b>	<b>150.66±4.38</b>	<b>179.77±2.23</b>	<b>99.21±2.95</b>	<b>97.98±1.89</b>	<b>209.97±5.08</b>	<b>232.39±3.88</b>	<b>175.28±5.99</b>	<b>75.43±3.78</b>	<b>199.00±11.85</b>
Urban	172.72±5.40	181.28±3.36	120.94±8.09	146.00±11.83	235.91±6.43	237.70±6.84	199.40±8.22	80.39±3.39	201.66±15.84
Rural	99.31±6.85	177.97±2.80	94.35±3.10	92.86±1.64	164.55±7.27	227.81±4.17	136.30±7.87	69.96±7.00	194.19±17.50
<b>Bany-Sueif (n=482)</b>	<b>80.76±2.21</b>	<b>190.54±2.62</b>	<b>92.69±2.33</b>	<b>111.50±3.52</b>	<b>169.27±3.37</b>	<b>220.96±4.67</b>	<b>189.52±4.46</b>	<b>55.37±1.26</b>	<b>177.17±22.40</b>
Urban	68.90±3.20	197.34±2.68	87.47±3.36	111.89±5.12	178.97±5.89	268.52±23.05	201.62±6.63	55.73±1.50	90.00±0.00
Rural	94.09±2.91	198.17±2.13	96.27±3.18	111.43±4.09	160.31±3.46	209.98±2.10	176.11±5.77	55.00±2.03	185.09±22.95
<b>Sample Mean (n=3854)</b>	<b>115.15±1.57</b>	<b>179.45±1.11</b>	<b>103.36±1.88</b>	<b>115.16±1.26</b>	<b>194.17±2.69</b>	<b>225.47±1.86</b>	<b>191.86±3.06</b>	<b>61.98±1.28</b>	<b>217.46±7.74</b>
Urban	121.94±2.98	167.82±1.90	125.02±5.07	121.78±2.32	208.45±4.60	239.65±5.45	204.79±5.67	69.05±2.11	226.53±11.01
Rural	111.01±1.75	185.91±1.36	95.64±1.78	112.56±1.50	185.56±3.27	219.80±1.42	183.52±3.46	57.43±1.58	206.95±10.72

\* Data based on food consumption

\* Mean± Standard Error