Evaluation of Calcium Intakes of Young Children in the Philippines as a Result of the 2008 National Nutrition Survey

Imelda Angeles-Agdeppa, Glen Melvin P. Gironella and Ma. Adrienne S. Constantino

Food and Nutrition Research Institute
Department of Science and Technology, Taguig City, Philippines.

Calcium is considered as the most abundant mineral in the body. Milk and other milk products are the best sources of calcium. Calcium deficiency may lead to osteoporosis. This study was conducted to provide information on dietary calcium intakes of young children as basis for advocacy campaigns on keeping watch on their calcium intakes. A total of 5,691 Filipino children aged 6 months to 10 years old were the respondents in the study. The data were taken from the National Nutrition Survey conducted in 2008. Food intakes were collected by face-to-face interviews using 24-hour food recall questionnaires with mothers of children as respondents. Food intake was transformed to nutrient intakes using the Individual Dietary Evaluation System. The mean one-day calcium intake of young children is 291 mg. There was a declining trend from 6 months to 6 years old and slight increases from 7 to 10 years old. Only 14.8% have met the Estimated Average Requirement for calcium. Milk and milk products contributed to about 33.4% of the total calcium intake. The highest calcium intake of young children came from the richest quintile, compared to the groups belonging to the poorest quintile where intake was lowest. Mean and percent adequacy of calcium intake of children and the consumption of milk as rich source of calcium were both very low.

Key words: calcium intake, individual intake, milk and milk products, percent adequacy, socioeconomic status, young children

INTRODUCTION
Calcium is the most abundant mineral in the body. The adult human body contains about 1200 g of calcium, equivalent to 1–2 % of body weight (Cashman 2002). It is essential for bone growth and teeth development as it is required for the mineralization of the bone and teeth matrix. The majority (~99%) of calcium present in the body is found in bones, with a smaller amount found in teeth. The remainder (<1%) is found in soft tissues and body fluids (Theobald 2005). This was documented in a longitudinal study by Fiorito et al. (2006) that has strongly linked dietary calcium intake with high total body bone mineral content (TBBMC). Similarly, Tanaka et al. (2014) concluded that a higher calcium intake was significantly associated with lower prevalence of periodontal disease. Aside from its major role in skeletal function, calcium plays a regulatory role in a number of specialized functions in muscle (including cardiac muscle) contraction, neurotransmitter secretion, digestion, and blood coagulation (Theobald 2005; Ehrlich 2011). During growth, an adequate dietary supply of calcium is considered to be critical for the acquisition of strong and healthy bone. If children are to attain their genetic

*Corresponding author: iangelesagdeppa@yahoo.com.ph
potential peak bone mass, their diet must then meet the 
threshold of calcium needed to satisfy the needs of the 
skeleton. Accrual of peak bone mass in youth is important 
for the prevention of osteoporosis in later life (Black et 
al. 2002).

Worldwide, dietary calcium intakes remained low relative 
to the varying levels of socioeconomic status and the age 
groups in critical need of sufficient calcium. Using the 
U.S. National Health and Nutrition Examination Survey’s 
(NHANES) 2003-2006 data, Bailey et al. (2010) reported 
that for females, only 15% of 9-13 years old and ≤10% 
of females aged 14-18, 51-70, and ≥71 years old met the 
adequate intake level (AI) for calcium from diet alone. 
No better are males with 22% in 9-13 and 51-70 years old 
and 15% in ≥71 years old meeting the AI level of calcium 
from diet alone too. Additionally, another study revealed 
that adults in more economically advantaged countries 
typically drank more milk than in their poorer counterpart 
(Singh et al. 2015). This is in conformity with numerous 
studies linking poor socioeconomic status with low dietary 
calcium intake (Islam et al. 2003; Lim et al. 2015).

In the Philippines, calcium intake, regardless of age 
groups is steadily declining. Based on the 6th National 
Nutrition Survey (DOST-FNRI 2003), the mean one-day 
ergy calcium intake of preschool children, pregnant 
women, and lactating mothers was 0.37 g, 0.42 g and 0.41 
g respectively. Compared with the 7th National Nutrition 
Survey (DOST-FNRI 2008), these decreased to 0.33 g, 0.39 
g, and 0.37 g, respective of the aforementioned population 
groups. Furthermore, only 11.5% of the total households 
surveyed in 2008 met 80% of the Recommended Energy 
and Nutrient Intake (DOST-FNRI 2002) for calcium and 
more than 70% of Filipinos across population groups are 
deficient in calcium in their daily diet.

Sources of calcium include milk and milk products, 
fishes, especially the small fishes eaten with bones (e.g. 
anchovies and sardines), soy bean curd or tofu, small 
shrimps, broccoli, and dark green leafy vegetables. Milk 
and other milk products offer high calcium bioavailability 
and have high calcium content relative to their nutritional 
value (Bhatia 2008). The Nutritional Guidelines for 
Filipinos recommend consuming four tablespoons of 
powdered milk or one glass of liquid milk of 240 mL, 
milk products and other calcium-rich foods for strong 
bones (Food and Nutrition Research Institute-Department 
of Science and Technology 2012). The Philippine Dietary 
Reference Intakes’ (PDRI 2015) recommended daily 
nutrient intakes (RNI) of calcium among 6 to less than 12 
month infants is 400 mg, among 1-2 year old children is 
500 mg, among 3-5 year old children is 550 mg, among 
6-9 year old children is 700 mg and among 10-12 year 
old children is 1000 mg (FNRI-DOST 2015).

Over the long term, intakes of calcium below recommended 
levels increase the risks of osteoporosis and bone fractures. 
Osteoporosis has been called the “pediatric disease with 
geriatric consequences” (National Institutes of Health 
2015). Accordingly the International Osteoporosis 
Foundation’s Asian Audit (2009) reported that the 
incidence of hip fracture has risen two- to three-fold in 
most Asian countries over the past 30 years. Children need 
sufficient calcium to support an accelerated growth spurt 
during the pre-teen and teenage years. In addition, during 
this time, their bodies are in opportune need of meeting 
adequate calcium levels to attain peak bone mass, which 
will have a tremendous impact on their bone density 
during their older years particularly between 49 to 66 
years of age (Nicklas 2003).

This evaluation study aimed to analyze calcium intake 
of Filipino children and determine the contribution of 
milk and milk products to calcium intakes of children 
by age and socioeconomic status whose parents were 
respondents in the 2008 National Nutrition Survey to 
provide comprehensive information on dietary calcium 
intakes of young children.

The results of this study will assist future intervention 
programs since this may serve as base information in 
crafting programs to increase the calcium status of young 
and older children in different socioeconomic strata.

MATERIALS AND METHODS

Study Design and Participants

The 7th National Nutrition Survey was conducted by 
the Department of Science and Technology–Food and 
Nutrition Research Institute (DOST-FNRI) in 2008 which 
utilized the Philippine Statistics Authority, formerly known 
as National Statistics Office (NSO), 2003 master sample 
in employing a stratified multi-stage sampling design. 
The first stage was the selection of primary sampling 
unit which is a barangay or contiguous barangays with at 
least 500 households. The second stage was the selection 
of enumeration areas which are contiguous areas in a 
barangay with 150-200 households, and the third stage 
was the selection of households. The 2003 master sample 
consisted of four replicates. A replicate is defined as a 
sub-sample that possesses the properties of the full master 
sample which is able to generate national level estimates 
of adequate precision.

The stratified multi-stage sampling survey that embodies 
the 7th NNS (DOST-FNRI 2008) investigated all 17 
regions of the Philippines which included 79 provinces 
and the National Capital Region. A total of 36, 634
households and 191, 316 individuals were interviewed and subjected for data collection. The dietary assessment was one of the seven major components that comprised the overall results of the 7th Philippine National Nutrition Survey which also included results on the following: anthropometry, biochemical nutrition, clinical nutrition and health survey, government program participation, and socio-economics and food insecurity survey.

The dietary assessment component utilized 50% of one replicate permitting national estimates. All members of the sampled households were included in the survey requiring individual data. A total of 5,691 children aged 6 months to 10 years old served as the sample subjects for this study. Dietary data was collected by trained nutritionist-dietitians using the 24-hour food recall method and was conducted through the Multiple Pass Method (MPM), a five-stage guided interview that improves the precision of the 24-hour food recall method (Moshfegh et al. 2008). The stages consist of (1) quick list of foods; (2) forgotten food list by eliciting additional recall of foods by focusing respondent’s attention on 9 categories of foods that are often forgotten; (3) recalling the time and occasion the respondent ate each food and the name of the eating occasion; (4) collection of detailed description of food including amount, cooking methods, brand names, additional ingredients, and location where it was eaten; and (5) final review probe. Research assistants were trained according to the 2008 National Nutrition Survey implementation protocols.

Individual 24-hour food recall data for two non-consecutive days were obtained through face-to-face interviews using structured questionnaires for mothers or caregivers of 6 month - 5 year old children. On the other hand, 6-10 year old children were interviewed in the presence of their parent or guardian to confirm their answers. Food intake was recalled starting from the time the child woke up in the morning until the time he/she slept at night including in-between meals and midnight snacks. In most cases, most food items recalled were cooked state except for some foods that are conventionally eaten fresh and raw. Amounts are in household measures such as cups and tablespoons or by size and number of pieces.

Food models or pictures were used as aides in estimation, description, and proper identification of food items or serving portions. Rulers were also used to estimate sizes given through mere gestures. A structured questionnaire was used as guide for the interview.

In translating the recalled amounts of consumed food into weights, the Standard Weights and Measures and List of Substitutes and List of Fishes developed by FNRI-DOST were used. In addition, sample weighing and market surveys (part of the 7th National Nutrition Survey), were conducted. Calcium intake in this study covered all dietary food sources of calcium including cow’s milk but not breastmilk. Breastmilk was not included in the calculation of calcium intake due to the difficulty in interviewing mothers on the frequency and duration the infant is put to the breast during the previous 24 hours.

After translating food consumption data into weights, individual 24-hour food recall data were converted to As Purchased/Edible Portion (AP/EP) values using the Individual Dietary Evaluation System (IDES) developed by DOST-FNRI with reference to Philippine Food Composition Library as its nutrient database (DOST-FNRI 2008). The Individual Dietary Evaluation System (IDES) is a computer software that was used to generate individual nutrient intakes based on the weight of consumed foods. The same software was also used to determine and compute the amount and kinds of nutrients in dietary intakes. A manual test run was done for a few households to compare the results of the IDES before the actual run on the computer system. After the nutrients of each food were identified and quantified by the IDES, the nutritional value and adequacy of the dietary intakes were then evaluated by comparing these with the PDRI’s Recommended Nutrient Intakes (RNI) and Estimated Average Requirement (EAR) (DOST-FNRI 2015). The Recommended Nutrient Intakes refer to the levels of intakes of nutrients which, on the basis of current scientific knowledge, are considered adequate for the maintenance of good health and well-being of nearly all healthy Filipinos. Estimated Average Requirement (EA) refers to the daily nutrient intake level that meets the median or average requirement of healthy individuals in a particular life stage and sex group, corrected for incomplete utilization or dietary nutrient bioavailability (DOST-FNRI 2015). Analysis of the data was made using the SPSS Statistics software version 15 while tables were produced using the Stata software version 7.

Statistical Analyses

Descriptive statistics, specifically means and percentages, were calculated for assessing the dietary calcium intake and percent contribution of milk and milk products to calcium intake of young children aged 6 months to 10 years old. The percent adequacy of calcium intake per age group and the number of children meeting the RNI and EAR for calcium were calculated by comparing the actual intake and the calcium requirement per age group based on PDRI (DOST-FNRI 2015).

Wealth quintiles based on the socio-economic status were divided into five data sets to stratify the distribution of calcium intake of young children (Rutstein and Johnson 2004). Twenty-fifth (25th), 50th, and 75th percentiles of calcium intakes were presented to further describe the
RESULTS AND DISCUSSION

Calcium intake of young children
The mean one-day calcium intake of young children aged 6 to 11 months old by single age group was 446 mg. It can be observed that children under the age group 6 to 11 months had the highest mean calcium intake (446 mg) although this was not statistically significant when compared with 6 to 9 years old children who had the lowest (248 mg) intake. About 44.6% of the children aged 6 to 11 months old met the Estimated Average Requirement. The percentage of children meeting the EAR decreased as age increased. The lowest percentage (7.6%) was observed among children aged 6-9 years old. For children meeting at least 80% of the Recommended Nutrient Intake (RNI), on the other hand, the highest percentage was observed among children aged 6 to 11 months. This was significantly different from that of children aged 10 years old and onwards which had the lowest percentage (Table 1).

The recommended calcium intake for 6-11 months old is 400 mg. In this study, only 39.5% and 45.2% met 100% and 80% of the Recommended Nutrient Intake (RNI) respectively. On the other hand, only 44.6% met the Estimated Average Requirement (EAR). Moreover, the 6 months to 1 year old only met about 30% of the requirement or a third of the recommended RNI, which is statistically different from the other age groups. The percentage mean adequacy levels in the different age groups decreased as the age of the children increased. For children aged 6 years to 10 years, the mean percentage adequacy when compared with both the EAR and RNI was below 10% (Table 1).

Contribution of milk and milk products
Milk and milk products have contributed to about 86.7% (387.0 mg) and 80.2% (343.6 mg) of the calcium intake of children aged 6 to 11 month old and 1 year old, respectively. The contribution of milk and milk products to the calcium intake of children decreased as children grew older. The percentage contribution of milk and milk products to the calcium intake of children was lowest when the child reached 9 to 10 years old. The type of milk that was commonly cited and had contributed the highest source of calcium intake of children in all age groups was powdered milk. It contributed to about 1/3 or 33.4% of the total calcium intake (Table 2).

Calcium intake based on socio-economic status
Tables 3 - 5 show the distribution of calcium intake of children from infancy and toddlers to school age divided according to years and months. The 1st quintile represents the poorest group of children while the 5th quintile belongs to the most affluent group. In all tables, across wealth quintiles, children under the 25th percentile in all age groups have the lowest calcium intake. Intake increased as children reached school age. This observation, however, does not apply to children under the 25th percentile of the 5th
Table 2. Percentage contribution of milk and milk products to calcium intake of 6 months – 10 years old and by single age group: Philippines, 2008.

<table>
<thead>
<tr>
<th>Food Group/ Subgroup</th>
<th>6 to 11 mo</th>
<th>1 year old</th>
<th>2 years old</th>
<th>3 years old</th>
<th>4 years old</th>
<th>5 years old</th>
<th>6 years old</th>
<th>7 years old</th>
<th>8 years old</th>
<th>9 years old</th>
<th>10 years old</th>
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<tbody>
<tr>
<td></td>
<td>Intake %</td>
<td>Intake %</td>
<td>Intake %</td>
<td>Intake %</td>
<td>Intake %</td>
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<td>Intake %</td>
<td>Intake %</td>
<td>Intake %</td>
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<tr>
<td>Milk &amp; Milk Products</td>
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<tr>
<td>Fresh whole milk</td>
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<td>0</td>
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<td>0.1</td>
<td>0</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
<td>1.1</td>
<td>0.5</td>
<td>2.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Evap milk, filled, recomb</td>
<td>0.2</td>
<td>0.03</td>
<td>0.5</td>
<td>0.1</td>
<td>1</td>
<td>0.3</td>
<td>1.5</td>
<td>0.5</td>
<td>1.5</td>
<td>0.6</td>
<td>2.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Powdered milk</td>
<td>386.7</td>
<td>86.6</td>
<td>338.9</td>
<td>79.1</td>
<td>207.6</td>
<td>59.8</td>
<td>127.2</td>
<td>41.7</td>
<td>75.5</td>
<td>28.5</td>
<td>403.9</td>
<td>19.9</td>
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<tr>
<td>Infant Formula</td>
<td>283.4</td>
<td>63.5</td>
<td>63</td>
<td>147</td>
<td>313</td>
<td>9</td>
<td>28</td>
<td>0.9</td>
<td>4.5</td>
<td>1.7</td>
<td>3.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Whole/Full cream</td>
<td>22.6</td>
<td>5.1</td>
<td>152.7</td>
<td>35.6</td>
<td>93.1</td>
<td>268</td>
<td>429</td>
<td>14.1</td>
<td>33.2</td>
<td>12.5</td>
<td>11.8</td>
<td>4.8</td>
</tr>
<tr>
<td>Filled milk</td>
<td>80.6</td>
<td>18.1</td>
<td>122</td>
<td>28.5</td>
<td>82.2</td>
<td>23.7</td>
<td>80.3</td>
<td>26.4</td>
<td>36.7</td>
<td>13.8</td>
<td>33.6</td>
<td>15.5</td>
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<tr>
<td>Skimmed milk</td>
<td>0.1</td>
<td>0.02</td>
<td>1.3</td>
<td>0.3</td>
<td>1</td>
<td>0.3</td>
<td>1.2</td>
<td>0.4</td>
<td>1.1</td>
<td>0.4</td>
<td>0.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Condensed milk</td>
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<td>0</td>
<td>0.6</td>
<td>0.1</td>
<td>0.7</td>
<td>0.2</td>
<td>0.2</td>
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<td>0.1</td>
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</tr>
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<td>Milk products</td>
<td>38</td>
<td>1.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheese</td>
<td>0</td>
<td>0</td>
<td>0.1</td>
<td>0.02</td>
<td>0.2</td>
<td>0.04</td>
<td>0.9</td>
<td>0.3</td>
<td>0.6</td>
<td>0.2</td>
<td>1.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Other milk products</td>
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<td>0.02</td>
<td>2.9</td>
<td>0.7</td>
<td>1.8</td>
<td>0.5</td>
<td>3.4</td>
<td>1.1</td>
<td>4.2</td>
<td>1.6</td>
<td>2.6</td>
<td>1.1</td>
</tr>
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</table>

Table 3. Distributions of calcium intake of young children aged 6 months – 10 years old by single age group by wealth quintile: Philippines, 2008.

<table>
<thead>
<tr>
<th>Age</th>
<th>Sample size (n)</th>
<th>1st wealth quintile</th>
<th>2nd wealth quintile</th>
<th>3rd wealth quintile</th>
<th>4th wealth quintile</th>
<th>5th wealth quintile</th>
<th>Total Calcium Intake by Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-11 months</td>
<td>261</td>
<td>12.7</td>
<td>30.1</td>
<td>184.7</td>
<td>19.4</td>
<td>80.6</td>
<td>671.0</td>
</tr>
<tr>
<td>1 – 1.99 years</td>
<td>501</td>
<td>53.9</td>
<td>97.0</td>
<td>178.7</td>
<td>97.5</td>
<td>193.3</td>
<td>492.8</td>
</tr>
<tr>
<td>2 – 2.99 years</td>
<td>487</td>
<td>88.4</td>
<td>141.0</td>
<td>188.3</td>
<td>125.5</td>
<td>203.8</td>
<td>352.3</td>
</tr>
<tr>
<td>3 – 3.99 years</td>
<td>486</td>
<td>87.0</td>
<td>128.4</td>
<td>206.2</td>
<td>141.1</td>
<td>215.6</td>
<td>318.5</td>
</tr>
<tr>
<td>4 – 4.99 years</td>
<td>549</td>
<td>104.1</td>
<td>143.9</td>
<td>187.6</td>
<td>128.2</td>
<td>181.1</td>
<td>267.0</td>
</tr>
<tr>
<td>5 – 5.99 years</td>
<td>531</td>
<td>106.2</td>
<td>145.2</td>
<td>214.8</td>
<td>135.6</td>
<td>202.9</td>
<td>255.4</td>
</tr>
<tr>
<td>6 – 6.99 years</td>
<td>521</td>
<td>132.1</td>
<td>174.5</td>
<td>248.1</td>
<td>134.8</td>
<td>197.1</td>
<td>259.0</td>
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<tr>
<td>7 – 7.99 years</td>
<td>578</td>
<td>121.4</td>
<td>176.4</td>
<td>244.9</td>
<td>144.7</td>
<td>191.7</td>
<td>266.4</td>
</tr>
<tr>
<td>8 – 8.99 years</td>
<td>638</td>
<td>138.2</td>
<td>183.4</td>
<td>264.4</td>
<td>154.5</td>
<td>216.2</td>
<td>295.0</td>
</tr>
<tr>
<td>9 – 9.99 years</td>
<td>538</td>
<td>140.4</td>
<td>191.9</td>
<td>259.5</td>
<td>160.1</td>
<td>227.3</td>
<td>302.9</td>
</tr>
<tr>
<td>10 – 10.99 years</td>
<td>601</td>
<td>152.4</td>
<td>221.5</td>
<td>293.1</td>
<td>167.3</td>
<td>220.8</td>
<td>287.0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>5,691</strong></td>
<td><strong>110.7</strong></td>
<td><strong>162.3</strong></td>
<td><strong>237.6</strong></td>
<td><strong>136.2</strong></td>
<td><strong>204.7</strong></td>
<td><strong>299.6</strong></td>
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</tbody>
</table>
Table 4. Distribution of calcium intake of young children aged 6 months – 10 years old by wealth quintile: Philippines, 2008.

<table>
<thead>
<tr>
<th>Age</th>
<th>Sample size (n)</th>
<th>1st wealth quintile</th>
<th>2nd wealth quintile</th>
<th>3rd wealth quintile</th>
<th>4th wealth quintile</th>
<th>5th wealth quintile</th>
<th>Total Calcium Intake by Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>25th</td>
<td>50th</td>
<td>75th</td>
<td>25th</td>
<td>50th</td>
<td>75th</td>
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<tr>
<td>6-23 months</td>
<td>1,678</td>
<td>27.4</td>
<td>84.9</td>
<td>184.7</td>
<td>65.9</td>
<td>177.6</td>
<td>522.0</td>
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<td>24-47 months</td>
<td>1,567</td>
<td>87.0</td>
<td>129.8</td>
<td>190.0</td>
<td>128.5</td>
<td>213.3</td>
<td>328.1</td>
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<tr>
<td>48-71 months</td>
<td>1,105</td>
<td>105.6</td>
<td>144.9</td>
<td>201.3</td>
<td>132.6</td>
<td>186.6</td>
<td>267.0</td>
</tr>
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<td>72-95 months</td>
<td>911</td>
<td>130.3</td>
<td>174.5</td>
<td>245.4</td>
<td>140.0</td>
<td>193.4</td>
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<td>96-131 months</td>
<td>430</td>
<td>144.2</td>
<td>199.7</td>
<td>274.6</td>
<td>162.3</td>
<td>223.3</td>
<td>296.0</td>
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<tr>
<td>TOTAL</td>
<td>5,691</td>
<td>110.7</td>
<td>162.3</td>
<td>237.6</td>
<td>136.2</td>
<td>204.7</td>
<td>299.6</td>
</tr>
</tbody>
</table>

Table 5. Distribution of calcium intake of young children aged 6 months – 10 years old by wealth quintile: Philippines, 2008.

<table>
<thead>
<tr>
<th>Age</th>
<th>Sample size (n)</th>
<th>1st wealth quintile</th>
<th>2nd wealth quintile</th>
<th>3rd wealth quintile</th>
<th>4th wealth quintile</th>
<th>5th wealth quintile</th>
<th>Total Calcium Intake by Percentile</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>25th</td>
<td>50th</td>
<td>75th</td>
<td>25th</td>
<td>50th</td>
<td>75th</td>
</tr>
<tr>
<td>Infants &amp; Toddlers</td>
<td>1,678</td>
<td>27.4</td>
<td>84.9</td>
<td>184.7</td>
<td>65.9</td>
<td>177.6</td>
<td>522.0</td>
</tr>
<tr>
<td>6-23 months</td>
<td>2,672</td>
<td>97.9</td>
<td>139.0</td>
<td>196.9</td>
<td>130.5</td>
<td>198.3</td>
<td>297.4</td>
</tr>
<tr>
<td>Pre-school children</td>
<td>1,341</td>
<td>138.0</td>
<td>186.8</td>
<td>261.7</td>
<td>151.8</td>
<td>212.3</td>
<td>284.6</td>
</tr>
<tr>
<td>2-5.99 years</td>
<td>2,672</td>
<td>97.9</td>
<td>139.0</td>
<td>196.9</td>
<td>130.5</td>
<td>198.3</td>
<td>297.4</td>
</tr>
<tr>
<td>School-age</td>
<td>1,341</td>
<td>138.0</td>
<td>186.8</td>
<td>261.7</td>
<td>151.8</td>
<td>212.3</td>
<td>284.6</td>
</tr>
<tr>
<td>6-10.99 years</td>
<td>1,678</td>
<td>27.4</td>
<td>84.9</td>
<td>184.7</td>
<td>65.9</td>
<td>177.6</td>
<td>522.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5,691</td>
<td>110.7</td>
<td>162.3</td>
<td>237.6</td>
<td>136.2</td>
<td>204.7</td>
<td>299.6</td>
</tr>
</tbody>
</table>

Wealth quintile where infants and toddlers have the highest calcium intake which decreased as children reached school age. Generally, calcium intake was higher among children in the higher socio-economic strata across quintiles and age groups (Table 3-5).

DISCUSSION

The 7th NNS (2008) data were analyzed to determine the dietary calcium intake among young children and how this correlates with wealth quintiles to facilitate clearer targeting and planning of future interventions. Calcium is a major component of the skeleton and its importance to human health extends beyond its contribution to healthy and strong bones but the quality of life too. Since milk is a good source of calcium, this study also focused on the consumption of milk as a form of calcium intake.

From children aged 6 months to 10 years old, only 14.8% of the children met the estimated average requirement for calcium (Table 1). The age groups that have met at least 30% or 1/3 of the RNI were the 6-11 months and 1 year old attributable to their high consumption of milk and milk products amounting to 86.7% and 80.2% respectively (Table 2). It was also noted that parallel to the reduction of calcium intake with increasing age is the declining contribution of milk and milk products to calcium intake as the child grows older. A similar study showed that calcium intake from fluid milk decreased with an increase in age (Alexy and Kersting 2003). Calcium intake followed similar patterns to milk intake since ruminant milks are among the richest sources of dietary calcium when expressed as a percentage of weight consumed. For instance, cow’s milk contains approximately 120 mg Ca/100 g (Holick 2002). The declining trend observed between calcium and milk intake and increasing age can be explained by two factors: the gradual onset of lactose intolerance and an increased preference for coffee and tea (28.24 – 28.74%), chocolate-based beverages (25.31% – 26.38%), and softdrinks (16.20 – 16.73%) by 6-12 years old Filipino children (Golloso-Gubat et al. 2015). Lactose intolerance (LI) is a clinical syndrome caused by lactase deficiency that affects 50-100% of Asians, approximately 20% of whom are children (Sahi 1994; Heyman 2006). Although threshold values for LI are highly individualized.

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Asian Audit (2009), the incidence of hip fracture has risen two- to three-fold in most Asian countries over the past 30 years. Filipino women are more likely to develop osteoporosis because their bones are thinner than those of their Caucasian counterparts (Mithal et al. 2009). The belief that osteoporosis is prevalent in Western countries and rare in Asia, including the Philippines is conceptually inappropriate. This was validated by the Fracture Projections by the World Health Organization (WHO) which indicated that by 2050, more than 50% of all osteoporotic hip fractures will occur in Asia.

A previous study has identified that the risk factors for osteopenia during childhood were low intake of milk, fresh fish, and green leafy vegetables (Villadolid et al. 2002). One study found that milk intake in childhood (≤ 12 yr) was independently related to spine and hip BMD in women aged 45–49 yr (Kalkwarf et al. 2003). Conversely, in an efficacy study among Filipino schoolchildren aged 6 to 8 years old, drinking milk resulted in increased total bone mineral content and total bone mineral density among children over a 12-month period (Villadolid et al. 2002). Conflicting results could be due to differences in methodological approaches and sample characteristics.

The Nutritional Guidelines for Filipinos recommend the consumption of one glass of milk, milk products, or other calcium-rich foods to help meet the requirements for calcium (DOST-FNRI 2012). Calcium absorption from plant sources is considered to be low compared to animal sources because of the chelation properties of phytates and oxalates present in a plant-based diet (Holick 2002). Based on the 2008 National Nutrition Survey, the mean one-day calcium intake of young children is 291 mg which is only 12.6% adequate when compared with the 80% requirement of the same age group. According to a study of among women ≥50 years of age, those with low milk intake during childhood had a two-fold greater risk of fracture than did women with high milk intake during childhood, and this greater risk could account for 11% of osteoporotic fractures in this population. A study also indicated that women who reported drinking milk with every meal during childhood and adolescence had significantly higher bone densities than women who reported drinking milk less frequently (Cooper 2003).

It should be considered, however, that increased calcium intake is not the only panacea for osteoporosis prevention. Bone-related variables are influenced by exercise and diet and the combination of these two factors. Julian-Almarchegui et al. (2015) stated that the effect of exercise plus increased calcium intake on increasing bone mass was greater than the effect of either exercise or calcium intake alone. Furthermore the same study also noted, though results were inconsistent due to methodological discrepancies, that a minimum calcium intake is necessary...
in order to observe a positive effect of physical activity on bone mass.

**Effect of socio-economic status on calcium intake**

An increase in wealth quintile status per age group is directly proportional to an increase in total calcium intakes (Tables 3 – 5). In the 25th percentile or the lowest quintile of the 6-11 months old group, calcium intake was 12.7 mg per day. In the next four quintiles of the same age group and percentile, the intakes were 19.4 mg, 90.7 mg, 90.7 mg and 294.9 mg, respectively (Table 3). This is consistent with a recent study in Korea where calcium intakes and dietary quality of calcium were lowest in the low household income group and was significantly lower in regions with lower socioeconomic status (Lim et al. 2015). It is logical to think that part of the social inequalities in health could be associated with lower intake of calcium among low income families. Impoverished families are incapable of meeting adequate nutrient intakes, regardless of the age group concerned, through independent or synergistic mechanisms of financial limitations, nutritional education deficit, and food insecurity. Though milk and milk products provide greater amounts of readily-absorbed dietary calcium, these products are generally beyond the reach of the poor (Islam et al. 2003). In a study between two socioeconomic groups in Bangladesh, it was revealed that the main sources of calcium in the low-income group were cereals, vegetables, and fish whereas the sources in the high-income group were fish, milk products, and cereals (Islam et al. 2003).

The promotion of high-cost foods to low-income people without taking food costs into account is not likely to be successful. Milk and milk products are costly, therefore promotion and consumption of other rich sources of calcium that are cheaper and accessible to low income groups such as soy bean curd, small shrimps, green leafy vegetables like horseradish and mustard leaves, and fishes eaten with bones like dilis (anchovies) and sardines should be sought and taught nationwide, reaching all segments of the population. Since offsetting the limiting influence and crippling effect of low socioeconomic status, specifically household income, on health and nutrition status requires strong poverty reduction programs, key reforms on national economic and social development policies, and time, immediate interventions focusing on enhancing nutrition education among low-income and vulnerable groups, planned dietary interventions, and bolstering the efficacy and reach of complimentary health and nutrition services should be given attention to help increase calcium intake in population groups consuming it the least but needing it the most.

**CONCLUSIONS AND RECOMMENDATIONS**

The analysis of the dietary assessment component of the 2008 National Nutrition Survey revealed that the mean and percentage adequacy of calcium intake of children was very low. Calcium and milk and milk product intake was lowest among the lowest segment of socio-economic stratum. Furthermore, milk and milk product intake declines with increasing age. This study warrants future researches on the assessment of main sources of dietary calcium per socioeconomic group and the relationship between diet quality, nutrient intake, and other demographic characteristics of various population groups. Findings of this study may be used to effectively target population groups with inadequate calcium and milk and milk product intake; to create, tailor and deliver appropriate and timely nutrition intervention programs through strong national government support and sustainable collaborations between the public and private sector; to develop localized integration of nutrition programs through the involvement of parents, local health units, stakeholders, program managers, and policymakers; and, to address cost reduction of milk and milk products by industries.

**ACKNOWLEDGEMENTS**

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