VALIDATION OF A NEWLY DEVELOPED FOOD FREQUENCY QUESTIONNAIRE TO ASSESS MAGNESIUM INTAKES

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Introduction

Magnesium (Mg) is the second most abundant intracellular cation in the body and is a cofactor in more than 300 enzymatic reactions involved in energy metabolism and protein and nucleic acid synthesis. Mg is found in a large array of foods and beverages and is easily attained through a healthy, well-balanced diet. However, the National Health and Nutrition Examination Survey (NHANES) from 2005 to 2006 reported that 60% of adults do not meet the dietary requirements for magnesium. Low intakes of magnesium have been implicated in several disease states, such as obesity, cardiovascular disease and diabetes mellitus.1

Assessment of dietary consumption is traditionally conducted using a dietary recall, although this method is time consuming for both researchers and participants. A Food Frequency Questionnaire (FFQ) is a tool designed to track the eating patterns of a large population through the use of questions relevant to serving size and incidence of consumption.2 The underlying principle of the FFQ approach is that average long-term diet is a more relevant determinant of nutrient intake than intake on a few specific days.3

For mineral validation of a FFQ, a nutrient estimate consisting of a 14-day recording has been proposed as a validation standard.4 By designing and validating a Mg FFQ that reflects habitual intake of Mg-rich foods, it is our hope to create a reliable tool to estimate Mg intakes in those at risk for micronutrient deficiency in the general population.

Participants and Methods

Participant Characteristics

- The Drexel University Institutional Review Board approved all study procedures
- Adults between the ages of 20 to 75 years who completed both the 14-day food diary and the Mg FFQ were included

Instructions for Completion of 14-Day Food Diary

- Participants noted meal, food, amount, method of preparation, brand name of food and package size, and who prepared the meal

Development of a Mg Food Frequency Questionnaire

- 33 commonly consumed foods were identified using the United States Department of Agriculture (USDA) National Nutrient Database that contained at least 10% Daily Value (DV) of Mg
- Foods ranged from 6 mg to 178 mg of Mg per serving and represented all 5 food groups
- Participants required to complete the Mg FFQ to determine usual eating patterns and identify consumption
- Participants ranked serving size (1/2, 1, or 2X serving size) and frequency (# times eaten/day, #eaten/week, or #eaten/month)

Administration of 14-day Food Diary and Mg Food Frequency Questionnaire

- Participants gave written consent prior to completing the 14-day food diary and Mg FFQ
- Mg FFQ information was collected by the researchers for each participant
- A blank 14-day food diary was given to each participant for completion at home
- Mg intake was calculated from Mg FFQ and compared to 14-day food diary average
- Average Mg consumption from the 14-day food diary was calculated using the USDA’s SuperTracker tool

Statistical Analyses

- Means, standard deviations, and ranges were calculated
- Pearson’s correlations were calculated to estimate correlation coefficients
- The agreement between the 14-day food diary and the Mg FFQ was assessed by calculating the coefficient of variation (CV)
- P-value <0.05 was considered significant

Are you eating enough Magnesium?

Results

• 23 participants completed the 14-day food diary and Mg FFQ; 18 were used in this study after 5 participants showed greater than 50% CV between the two methods
• Demographics for the 18 participants are listed in Table 1
• The average daily Mg intake from participants’ 14-day diet was 345 mg compared to 366 mg from the Mg FFQ (Figure 1)
• A significant correlation was observed (r = 0.77, p < 0.01) between the 14-day food diary and Mg FFQ (Figure 2)
• Female participants had a lower coefficient of variation between the two methods (18.3 ±13.8%) than male participants (20.97 ±14.74%) (Figure 3)

Table 1: Demographic Characteristics of Participants (N=18)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>31.6 ± 13.2</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>24.1 ± 3.7</td>
</tr>
<tr>
<td>Male/Female</td>
<td>5 M / 13 F</td>
</tr>
<tr>
<td>Multivitamin use (Yes/No)</td>
<td>9 Y / 9 N</td>
</tr>
</tbody>
</table>

Figure 1: Magnesium intakes calculated from 14-day food diary and Mg FFQ (N=18)

Figure 2: Relationship between Mg intakes from 14-day food diary and Mg FFQ

$r = 0.772$  
$P < 0.01$

Figure 3: Coefficient of variation between the 14-day food diary and Mg FFQ

Conclusions

• Our preliminary data from 18 participants showed a significant positive correlation between the 14-day food diary and the newly developed Mg FFQ
• Limitations of this study include the small sample size, lack of racial diversity, and recall bias
• Goals for continuing this research are to recruit 200 participants to improve reliability and validity
• These data suggest that the newly developed Mg FFQ is a promising tool that could be used by clinicians and researchers to quickly and accurately assess Mg intake and predict disease risk

References