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Recommendations for Dietary Calcium intake and Bone Health: the Role of Health Literacy

Hosking SM¹, Pasco JA²,³, Hyde NK¹, Williams LJ¹ and Brennan-Olsen SL¹,³,4,*,

¹School of Medicine, Deakin University, Geelong, 3220, VIC, Australia
²School of Medicine, the University of Melbourne, Parkville, 3000, VIC, Australia
³Australian Institute for Musculoskeletal Sciences, The University of Melbourne, Cl-Sunshine Hospital, Furlong Road, Melbourne, 3021, VIC, Australia
⁴Institute for Health and Ageing, Australian Catholic University, Melbourne, 3000, VIC, Australia

Correspondence author: Brennan-Olsen SL, Health Inequities Division of Epidemiology, Epi-Centre for Healthy Ageing, IMPACT SRC, School of Medicine, Deakin University, PO Box 281, VIC 3220, Australia, Tel: 610342153334; E-mail: sharob@barwonhealth.org.au

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Abstract

Osteoporosis is a skeletal disease that involves micro-architectural deterioration of the bone matrix and depletion of bone mineral. Inadequate dietary calcium, especially in a vitamin D deficient environment, may predispose an individual to osteoporosis. Given that recommendations for daily intake (RDI) of dietary calcium differ between countries, and according to life-stages, understanding RDIs and how to achieve them is likely to be a complex process for many individuals. Health literacy, or the ability of individuals to gain access to, understand and use health-related information, will influence the capacity of individuals to meet RDIs. Furthermore, the lowest health literacy is observed in the same groups identified as having an increased risk of osteoporosis; older individuals, and those that are socially disadvantaged. It is imperative to consider the specific health literacy needs of at-risk populations when promoting recommendations for dietary calcium intake.

Keywords: Health literacy; Dietary calcium intake; Osteoporosis; Recommended daily intake

Health Literacy

Osteoporosis, a common disease of the skeleton, involves micro-architectural deterioration of the bone matrix and depletion of bone mineral; this results in an increased susceptibility to fracture [1]. Post-fracture, there is a plethora of financial, personal and psychosocial outcomes, including reduced mobility, impairment of daily activities, inability to work and loss of confidence [2,3]. A hip fracture has the most severe implications: one in five individuals die within the first year, while 60% of individuals who survive a hip fracture still require assistance to walk one year later, and 33% are totally dependent or are admitted to a nursing home [2,4]. Bone mass is an important predictor of osteoporosis, and future fracture risk [5], and calcium plays an important role in normal growth, development and maintenance of the skeleton [6], including providing a dynamic store to maintain the intra- and extra-cellular calcium pools [7]. Calcium homeostasis is regulated by an integrated hormonal system that involves calcitonin, parathyroid hormone (PTH) and the PTH receptor, and 1,25-dihydroxyvitamin D and the vitamin D receptor [7,8], along with serum ionized calcium, and the calcium-sensing receptor [9]. When plasma concentrations of ionized calcium fall below optimal levels, bone resorption increases in order to restore the mineral equilibrium.

Clearly, adequate dietary calcium intake is an essential modifiable dietary factor for both achieving optimal peak bone mass in the second to third decade of life [10] and reducing age-related bone loss in later life [11]. However, recommendations for daily intake (RDI) of dietary calcium differ between countries; such discrepancies may likely arise from the rationale implemented by the governing bodies with responsibility for nutritional RDIs [12].

Table 1: Recommended dietary intake (RDI) of calcium in Australia and the United States of America, at different life-stages [13,14,25]. *Including pregnant and breastfeeding women.

<table>
<thead>
<tr>
<th>Life-stage</th>
<th>RDI (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Babies 0-6 months</td>
<td>~210 (if breastfed)</td>
</tr>
<tr>
<td>Babies 7-12 months</td>
<td>~350 (if formula fed)</td>
</tr>
<tr>
<td>Children 1-3 years</td>
<td>270</td>
</tr>
<tr>
<td>Children 4-8 years</td>
<td>500</td>
</tr>
<tr>
<td>Children 9-11 years</td>
<td>700</td>
</tr>
<tr>
<td>Adolescents 12-18 years*</td>
<td>1,000</td>
</tr>
<tr>
<td>Women 19-50 years*</td>
<td>1,300</td>
</tr>
<tr>
<td>Women 51-70 years</td>
<td>~1,300</td>
</tr>
<tr>
<td>Men 19-70 years</td>
<td>1,000</td>
</tr>
<tr>
<td>Adults over 70 years</td>
<td>~1,300</td>
</tr>
</tbody>
</table>

For instance, whilst RDI guidelines from the United Kingdom (UK) were formulated to address nutritional needs of the population as a whole, countries such as the United States of America (USA) and Australia targeted guidelines to address fluctuations in needs related to growth and development of bone health across the life-course [13,14].
messages for at-risk individuals. As an example, data collected using a
Literacy in Medicine (REALM) tools, showed that older populations
health information. By taking into account the health literacy strengths
ability to decipher nutrition labels and understand how to source
skills
advantaged [16]; in English speaking countries, this may also
multi-dimensional health literacy measurement tool suggests that
variability and short falls in these older unidimensional
have lower health literacy compared to younger populations [21];
underpin the high variability in prevalence of sub-optimal health
literacy, and the application of
health literacy is defined by the World Health Organisation as the
“...cognitive and social skills, which determine the motivation and
ability of individuals to gain access to, understand and use information
in ways which promote and maintain good health” [18]. Health literacy
skills influence the uptake of health promotion messages. The
measurement of health literacy is complex, and, to date, most research
in this field has been undertaken using measurement tools that focus on
a narrow definition of health literacy, for instance focusing on
language or numeracy skills [19]. These narrow definitions of health
literacy, and the application of different measurement tools, may
underpin the high variability in prevalence of sub-optimal health
literacy reported within the literature [20]. For instance, studies that
applied the Newest Vital Sign (NVS), and the Rapid Estimate of Adult
Literacy in Medicine (REALM) tools, showed that older populations
have lower health literacy compared to younger populations [21];
however, the opposite was observed when the Test of Functional
Health Literacy in Adults (TOFHLA) was employed [21]. To address
the variability and short falls in these older unidimensional
measurement tools, recently developed tools encompass a broader
range of health literacy skills and abilities; these include the Health
Literacy Management Scale (HeLMS) [22], Health Literacy
Questionnaire (HLQ) [23], and the European Health Literacy Survey
Questionnaire (HLS-EU-Q) [19]. Despite the limitations of older
unidimensional health literacy tools, there was relative consistency in
the suggestion that certain populations have different health literacy
needs. Those with lower health literacy skills are the same groups at
increased risk for osteoporosis, and subsequent fracture.

Taken in context, it is clear that health literacy plays an important
role in health promotion. In order to increase the proportion of
individuals that meet RDI for dietary calcium, we need an improved
understanding of how older individuals, those that are socially
disadvantaged, and those from NESB, obtain, understand and use
health information. By taking into account the health literacy strengths
and weaknesses of these subgroups, it will enable us to inform the
development of more appropriately targeted interventions, and
therefore will improve the accessibility and comprehension of RDI
messages for at-risk individuals. As an example, data collected using a
multi-dimensional health literacy measurement tool suggests that
older individuals are more likely to have a higher than average level of
social support [24], thus health messages channelled through (non-
electronic) social networks may be efficacious. Similarly, individuals
with lower educational attainment (a parameter of social disadvantage)
are more likely to have difficulties finding, understanding and
appraising health information [24], thus messages aimed at this group
need to be presented in simple, user friendly formats. Finally,
individuals of NESB have a reduced capacity to understand health
information presented via mass media [24]; thus, resources in a variety
of languages are necessary. However, data also suggested that the
distribution of these resources within healthcare settings for
individuals of NESB may not influence behaviour change, as this group
also had a reduced capacity to navigate healthcare systems [24].

In conclusion, the majority of public health campaigns aimed at
promoting adequate dietary calcium intake are likely to have limited
impact on those at greatest risk, if the important role played by health
literacy in the likelihood of individuals meeting RDIs is ignored.

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Conflict of Interest

None declared.

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