A Meta-Analysis Study: Vitamin D Deficiency in Saudi Arabia between 2009 and 2013

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ABSTRACT

Objective: Our aim was to review the prevalence of vitamin D deficiency in Kingdom of Saudi Arabia in different areas done by many researches.

Methods: By systematic review with meta-analysis we collected the research performed in different areas of Saudi Arabia over the period of 2009-2013. This included both published papers (peer reviewed) and papers presented at documented scientific conferences.

Results: Fourteen papers were found, thirteen of which were peer reviewed and published and one had been presented in a conference. They covered five main areas in KSA, and pooling the numbers yielded 6478 total healthy participants. 4694 (72%) were in the least healthy range with deficiency levels < 20 ng/ml, and a total of 5355 (82.7%) were at levels below recommendations (< 30 ng/ml). The central region in Riyadh and Qassim cities represented the most investigated area including 2755 participants with 6 articles; followed by the western region, at Jeddah and Makkah cities, with 2239 participants.

The eastern region (2 articles in Dammam and Al Khobar cities with 339 participants) showed the lowest frequency of vitamin D deficiency at 29.2%, followed by the central region at 74%.

Conclusions: Despite adequate sunlight and adequate intake of dairy products, vitamin D deficiency appears to be a major health problem in the Saudi community. There are some geographic areas in the country that may be at high risk. Control strategies should take these differences into account.

Keywords
Vitamin D deficiency; KSA; Meta-analysis; Prevalence.
INTRODUCTION

Studies have observed relationships between low vitamin D levels and multiple disease states including hypertension, cardiovascular disease, impaired immune function, and malignancies. Sufficient concentrations of vitamin D may be important in reducing the occurrence of autoimmune diseases, such as multiple sclerosis, rheumatoid arthritis, diabetes and some cancers[1-4].

In contrast to 1,25(OH)₂D, which has a short half-life of ~4–15 hours, the serum concentration of 25 hydroxyvitamin D (25(OH)D) has a fairly long circulating half-life of ~15 days, and is considered the best indicator of vitamin D status that can be measured. Serum 25(OH)D reflects vitamin D produced cutaneously and also that obtained from food and supplements[3]. Plasma 25(OH)D at concentrations 10 ng/mL is a useful marker of the risk of clinical deficiency, despite limitations caused by the lack of methodological standardization[6,7]. There is no absolute consensus on the cut-off value between a normal and low level of vitamin D, but most experts now recommend the normal level of 25(OH)D to be 30 ng/ml or more. They have also agreed to define vitamin D insufficiency as a level between 20–29 ng/ml and deficiency when the level is less than 20 ng/ml[5,8-9].

Up until recently, vitamin D deficiency was considered rare in those parts of the world that had plenty of sunshine all year round but the World Health Organization (WHO) now estimates that globally one billion people have vitamin D deficiency or insufficiency[7,8].

Studies revealed that vitamin D deficiency was prevalent across all age-groups, geographic regions, and seasons. As early as 1982 Woodhouse and Norton[9] and Sedrani and colleagues[10] 1983, reported low vitamin D levels in the ethnic Saudi Arabian population. The human body manufactures vitamin D through exposure to sunlight, but some of the sunniest parts of the world have the highest rates of vitamin D deficiency. Several factors have contributed to dangerously low vitamin D blood levels among people in the Kingdom of Saudi Arabia (KSA)[11].

There are several studies on vitamin D status among KSA population, but these studies were in small scope and lacked diversity of age and gender and the majority used a hospital based sampling. Many researchers tried to do a global estimation and to generalize their results for all regions and for all people in KSA.

A systematic review is a thorough, comprehensive, and explicit way of interrogating the medical literature. It typically involves several steps including: (1) Asking an answerable question (2) Identifying one or more databases to search, (3) Developing an explicit search strategy, (4) Selecting titles, abstracts, and manuscripts based on explicit inclusion and exclusion criteria, and (5) Abstracting data in a standardized format. A “meta-analysis” is a statistical approach to combine the data derived from a systematic-review.

Our aim was to collect the accumulating evidence for the frequency of vitamin D deficiency in KSA in different geographic areas done by many researchers and to make an overall view.

METHODS

By systematic review we collected the research performed in different areas of KSA over the period of 2009-2013. This included both the published papers (peer reviewed) and papers presented at documented scientific conferences. A computer-based search was performed for online papers. Inclusion criteria was any peer reviewed and published, or conference presented paper that considered vitamin D screening in any population, or governorate, in KSA. Exclusion criteria including any research published before 2009 or after 2013 or non-peer reviewed.

Meta-analysis of the pooling means and separation of the groups were performed. 25(OH)D concentration was accepted as ng/ml for all (2.496 nmol/L being equivalent to 1 ng/ml).

Statistical analysis was performed using analysis of variance. All analyses were tested as 2-sided, for individual groups unrelated one-way ANOVA and in-between groups Dunnett T3 Post Hoc test for the statistical significance within the groups, and a value of p < 0.05 was considered significant.

RESULTS

Fourteen papers were found, thirteen were peer reviewed published journals and one was presented in a documented conference. These covered five main regional areas in KSA.

Characteristics of the articles[11-21] were summarized in Table 1. There was a difference in laboratory techniques used but all were immunoassays. Sample types were varied including people in malls (one article[14]), primary health center patients (four articles[13,15,16,21]) but most of the articles from hospitals (nine articles).

The values for considering the deficiency of vitamin D were also different, from the lowest of < 5 ng/ml (three articles[11,12,20] and considered as severe deficiency in two articles), to < 10 (one article[21]). Most articles considered deficiency as < 20 (seven articles); while insufficiency between 20 to < 30 ng/ml (seven articles). However all articles considered > 30 ng/ml as a sufficient level except one, where the value for sufficiency level was > 39 ng/ml[9]. Most divided the participants to deficiency and insufficiency but three articles divided them to severe < 5 ng/ml, moderate <10 or 15, and mild deficiency < 12.5 or < 29[13,14,16] as in Table 1.

There were five types of participants: Healthy, blood donors, kidney diseases, males and females, young, mid-aged and elderly.

Distribution of vitamin D deficiency in regions of KSA was shown in Table 2.

They covered five main areas in KSA, and pooling the numbers yielded 6478 total healthy participants. 4694 (72%) were in the least healthy range with deficiency levels < 20 ng/ml, and a total of 5355 (82.7%) were at levels below
### TABLE 1.
Baseline characteristics of the articles found.

<table>
<thead>
<tr>
<th>Region or Province</th>
<th>Source</th>
<th>Sample Type</th>
<th>Lab Techniques</th>
<th>Values for Low Vit D ng/ml</th>
<th>% of Low Vitamin D</th>
<th>Compared Groups (by means)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Al-Othman et al. [13]</td>
<td>BMC Pediar 2012</td>
<td>Elisa†</td>
<td>Relative D. &lt; 30</td>
<td>11.44%</td>
<td>7.61%</td>
</tr>
<tr>
<td></td>
<td>Elshafie et al. [14]</td>
<td>Euro J Clin Nutr 2012</td>
<td>ECLA ‡</td>
<td>Deficiency &lt; 5</td>
<td>58.6%</td>
<td>10.5%</td>
</tr>
<tr>
<td></td>
<td>Kenan et al. [15]</td>
<td>Public Health Nutr 2013</td>
<td>HPLC§</td>
<td>Deficiency &lt; 20</td>
<td>79.02%</td>
<td>63.81%</td>
</tr>
<tr>
<td></td>
<td>Bin-Abbas et al. [16]</td>
<td>Saudi Med J 2011</td>
<td>Maried couples, PHC</td>
<td>Deficiency &lt; 10</td>
<td>55.11%</td>
<td>52.04%</td>
</tr>
<tr>
<td></td>
<td>Zahid et al. [17]</td>
<td>IJHS, 2011</td>
<td>EIA (Enzymo Immunoassay)</td>
<td>Deficiency &lt; 20</td>
<td>28.30%</td>
<td>21.9%</td>
</tr>
<tr>
<td></td>
<td>Adrawi et al. [18]</td>
<td>Osteoporos Int 2012</td>
<td>CLIA¶,</td>
<td>Deficiency &lt; 5</td>
<td>80.12%</td>
<td>67.81%</td>
</tr>
<tr>
<td></td>
<td>Al Masoudi et al. [22]</td>
<td>-</td>
<td>CLIA*</td>
<td>Deficiency &lt; 5</td>
<td>92.62%</td>
<td>31.32%</td>
</tr>
<tr>
<td></td>
<td>Alhumidi et al. [23]</td>
<td>-</td>
<td>CLIA*</td>
<td>Deficiency &lt; 5</td>
<td>92.62%</td>
<td>31.32%</td>
</tr>
</tbody>
</table>

*ECLIA: Electrochemiluminescence immunoassay; †Elisa: Enzyme linked immunosorbent assay; ‡ECLA: Electrochemical luminescence assay; §HPLC: High performance liquid chromatography; RIA: Radioimmuno assay; ¶CLIA: Chemiluminoescence immunoassay; CKD: Chronic kidney disease; SEEK: Screening and early evaluation of kidney diseases; PHC: Primary Health Centers; M: Males; F: Females; T1DM: Type 1 diabetes mellitus; T2DM: Type 2 diabetes mellitus; CKD: Chronic kidney disease.

**Central, Riyadh**
- **Elisa**†: 2.5% of boys 153, girls 178.
- **Pre-menopausal**: 588.
- **Post-menopausal**: 4 PHC.
- **Healthy Women**: Deficiency < 5, Insufficiency < 39-5.

**Qassim**
- **Elshafie et al. [14]**: 55.11%.
- **Deficiency**: 55.11%.
- **Insufficiency**: 50.24%.

**Western, Jeddah**
- **Bin-Abbas et al. [16]**: 52.04%.
- **Healthy Men**: Deficiency < 5, Insufficiency < 29-15.

**Eastern, Dammam**
- **Zahid et al. [17]**: 28.30%.
- **Deficiency**: 28.30%.
- **Insufficiency**: 20.18%.

**Northern, Tabuk**
- **Elsammak et al. [20]**: 11.01%.
- **Deficiency**: 11.01%.
- **Insufficiency**: 21.51%.

**Southern, Abha**
- **Sadat-AlI et al. [12]**: 92.62%.
- **Deficiency**: 92.62%.
- **Insufficiency**: 7.33%.

**Abha, Khamis**
- **Elhumidi et al. [23]**: 31.32%.
- **Deficiency**: 31.32%.
- **Insufficiency**: 31.32%.
### TABLE 2.
Low Vitamin D in KSA regions for healthy participants, Vitamin D25 <30 ng/ml.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Sample Size</th>
<th>Sex</th>
<th>Vitamin D &lt; 20</th>
<th>Vitamin D &lt; 30 +20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>M</td>
<td>N %</td>
</tr>
<tr>
<td>Central Riyadh</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Alsuwadia et al.[11]</td>
<td>488</td>
<td>243</td>
<td>245</td>
<td>145 256</td>
</tr>
<tr>
<td>3. Elshafei et al.[13]</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>55 55</td>
</tr>
<tr>
<td>4. Kanan et al.[14]</td>
<td>1556</td>
<td>1556</td>
<td>--</td>
<td>1230 1230</td>
</tr>
<tr>
<td>5. Bin-Abbas et al.[15]</td>
<td>100</td>
<td>--</td>
<td>--</td>
<td>59 59</td>
</tr>
<tr>
<td>Qassim</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Naeem et al.[17]</td>
<td>180</td>
<td>97</td>
<td>83</td>
<td>51 122</td>
</tr>
<tr>
<td>Total pooling, Central Region</td>
<td>2755</td>
<td></td>
<td></td>
<td>1870 2052</td>
</tr>
<tr>
<td>West, Jeddah</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Adrawi et al.[18]</td>
<td>1172</td>
<td>1172</td>
<td>--</td>
<td>938 1045</td>
</tr>
<tr>
<td>8. Adrawi et al.[19]</td>
<td>834</td>
<td>--</td>
<td>834</td>
<td>732 813</td>
</tr>
<tr>
<td>9. Kari et al.[20]</td>
<td>85</td>
<td>44</td>
<td>41</td>
<td>33 69</td>
</tr>
<tr>
<td>Total pooling, West Region</td>
<td>2239</td>
<td></td>
<td></td>
<td>1829 2066</td>
</tr>
<tr>
<td>East, Dammam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Elsammak et al.[26]</td>
<td>139</td>
<td>52</td>
<td>87</td>
<td>-- 35</td>
</tr>
<tr>
<td>Total pooling, East Region</td>
<td>339</td>
<td></td>
<td></td>
<td>22 99</td>
</tr>
<tr>
<td>North, Tabouk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Al Masoudi et al.[22]</td>
<td>800</td>
<td></td>
<td></td>
<td>741 798</td>
</tr>
<tr>
<td>South, Abha, Khamis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Pooling for All Regions</td>
<td>6478</td>
<td></td>
<td></td>
<td>4694 5355</td>
</tr>
</tbody>
</table>

### TABLE 3.
Low vitamin D in healthy KSA children.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Sample Type</th>
<th>Severe</th>
<th>Moderate</th>
<th>Mild</th>
<th>Low Vitamin D &lt; 30 n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Number</td>
<td>%</td>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>Abdulaziz et al.[13] Riyadh</td>
<td>331 Children 6-14 y</td>
<td>37</td>
<td>227</td>
<td>56</td>
<td>330</td>
</tr>
<tr>
<td>Bin-Abbas et al.[16] Riyadh</td>
<td>100 healthy hospital children</td>
<td>1</td>
<td>6</td>
<td>52</td>
<td>59</td>
</tr>
<tr>
<td>Kari et al.[20] Jeddah</td>
<td>85 healthy hospital children</td>
<td>8</td>
<td>25</td>
<td>36</td>
<td>69</td>
</tr>
<tr>
<td>Total</td>
<td>664</td>
<td>46 (6.93%)</td>
<td>394 (59.34%)</td>
<td>156 (23.49%)</td>
<td>596</td>
</tr>
</tbody>
</table>
recommendations (< 30 ng/ml). Central region, in Riyadh and Qassim cities with 6 articles represented the most investigated by 2755 participants; followed by the western region, at Jeddah and Makkah cities with 2239 participants.

Eastern region (two articles in Dammam and Al Khobar cities) with 339 participants shows the lower frequency of vitamin D deficiency by 29.2%, followed by the central region at 74%.

Table 3 shows low vitamin D in KSA healthy children by four articles. The prevalence of pooled children was high (89.8%) compared with total healthy pooling (82.7%) but statistically not significant.

Figure 1 shows the distributions of frequency of vitamin D deficiency in healthy participants at different regions of KSA in comparison to the nearby countries (Mecca = Makkah).

FIGURE 1.
Distributions of frequency of vitamin D deficiency in healthy participants at different regions of KSA in comparison to the nearby countries (Mecca = Makkah).

DISCUSSION

Meta-analysis is a method that uses statistical techniques to combine results from different studies and obtain a quantitative estimate of the overall effect of a particular intervention or variable on a defined outcome, it is a statistical process for pooling data from many trials to obtain a clear answer. Meta-analysis produces a stronger conclusion than can be provided by any individual study. Clinicians rarely have the time or resources to critically evaluate the evidence relevant to a particular clinical question, and a systematic review can facilitate this investigation[24-26]. Bassil et al.[27] systematically reviewed the articles for prevalence of hypovitaminosis D, rickets and osteomalacia, their predictors and impact on major outcomes in the Middle East and North Africa region.

Global and regional prevalence: We restricted the articles to a period of five years to avoid bias of different lab techniques and we considered the level of <30 ng/ml as low levels in our analysis. Global prevalence of the five regions showed high prevalence with a significantly lower prevalence of deficiency in the eastern region, Elsammak et al.[6] and Sadat-Ali et al.[12] with a prevalence of 29.2% (Figure 1 and Table 2). This prevalence is higher than the previously reported figure of 20% from the Eastern Province[28]. This could be explained by sun exposure because the eastern province is sunnier than the North, prevalence of 99.8%, South, prevalence of 98.5% and West, 92%; but this needs review by more research. Also the Eastern Province of Saudi Arabia is located on the coast of the Arabian Gulf and high fish consumption would be expected[12].

This is similar to the findings from other countries in the Middle East (Table 4)[31-36]. In Jordan[34], a lower
prevailing was seen near the eastern province; this may be due to that the samples were population based rather than hospital based.

Previous research in Riyadh, KSA by Al Faraj and Al Mutairi\textsuperscript{[29]} found a prevalence of 83% in 299 patients and by Al-Turki \textit{et al.}\textsuperscript{[30]} between 30-50% according to the age group.

We noted that all articles reported high prevalence with no defined level of low, intermediate or high prevalence, i.e. even a prevalence < 30% was still considered as a high prevalence similar to > 90%.

Vitamin D in children: Infants are at increased risk of vitamin D deficiency especially if they are of vitamin D deficient mothers. The most common symptom of vitamin D deficiency in children is rickets. The high prevalence of vitamin D deficiency in the Arab youth population living in a sunny-rich area is surprising and likely multi-factorial including low sun exposure, vitamin D and calcium intake\textsuperscript{[37,38]}. Most of the pooled low vitamin D was in the insufficiency level or moderate deficiency by 59.3%.

Male and female prevalence: In some studies mean serum vitamin D level of males was found to be much higher than females. As males work more outdoor than females and have higher chances of sun exposure, this is found in Alsuwadia \textit{et al.}\textsuperscript{[11]}, Elshafie \textit{et al.}\textsuperscript{[14]} and Kanan \textit{et al.}\textsuperscript{[15]} In other studies, males were found to be equal in vitamin D deficiency to females (Elsammak \textit{et al.}\textsuperscript{[6]} and Alhumidi \textit{et al.}\textsuperscript{[23]}).

Vitamin D deficiency in chronic diseases: The belief that vitamin D deficiency is more common among patients with chronic kidney diseases CKD is due to the fact that in addition to the usual reasons, disturbances in vitamin D metabolism occur in children with CKD\textsuperscript{[25,26]}. Kari \textit{et al.}\textsuperscript{[20]} presented the P-value of 0.05 between CKD children and controls which may not be significant. Alhumidi \textit{et al.}\textsuperscript{[23]} could not ascertain any significant difference in vitamin D status between patients with diabetes and without diabetes. However specifically comparing only the deficiency of 25OHD with levels less than 20 ng/mL there was statistically significant difference\textsuperscript{[23]}.

Our study has limitations. Although the distribution of the published papers in different governorates was not homogenous, and may reflect hospital and clinic based studies, the available data can be used while awaiting the population based studies, which may be more appropriate.

**CONCLUSIONS**

There are some geographic areas in the country that may be at high risk. Despite some participants having adequate exposure to sunlight and reporting an adequate intake of dairy products, 25OHD deficiency appears to be a major health problem in the Saudi community. A standardized definition of prevalence levels for the community (low, intermediate or high) may be helpful e.g. low level if < 30%, intermediate if 30-80% and > 80 % to be high prevalence. Control strategies should take these differences into account.

**Limitations**

Our work was limited by dependence on many studies, some are heterogeneous in regard to values accepted for normal, insufficient and deficient, and some areas in Saudi Arabia were not covered well.

**Conflict of Interest**

There is a conflict of interest with authors of the articles collected and mentioned in the text because of a possible contradiction with their conclusions.

**Disclosure**

None of the authors received any type of commercial support either in forms of compensation or financial for

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**TABLE 4.**

Low vitamin D in KSA in comparison to other countries for healthy participants, Vitamin D25 <30 ng/ml.

<table>
<thead>
<tr>
<th>Country</th>
<th>Reference</th>
<th>Year of Publication</th>
<th>% Vitamin D Deficiency &lt; 20 ng/ml only</th>
<th>% Vitamin D Insufficiency (20-30 only)</th>
<th>Total % of Low Vitamin D (All &lt; 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>Our meta-analysis</td>
<td>2009-2013</td>
<td>72.10%</td>
<td>10.62%</td>
<td>82.72%</td>
</tr>
<tr>
<td>Qatar</td>
<td>Mahdy \textit{et al.}\textsuperscript{[31]}</td>
<td>2010</td>
<td>87.00%</td>
<td>10.00%</td>
<td>97.00%</td>
</tr>
<tr>
<td>Oman</td>
<td>Al Kalbani \textit{et al.}\textsuperscript{[32]}</td>
<td>2011</td>
<td>98.00%</td>
<td>2.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>UAE</td>
<td>Muhairi \textit{et al.}\textsuperscript{[33]} School based</td>
<td>2013</td>
<td>19.71% (&lt; 15 ng/ml)</td>
<td>45.41%</td>
<td>65.12%</td>
</tr>
<tr>
<td>Ankara, Turkey</td>
<td>Andiran \textit{et al.}\textsuperscript{[34]}</td>
<td>2012</td>
<td>25.11% (&lt; 15 ng/ml)</td>
<td>15.01% (&lt; 20 ng/ml)</td>
<td>40.12%</td>
</tr>
<tr>
<td>Jordan</td>
<td>Batieha \textit{et al.}\textsuperscript{[35]} National Population based</td>
<td>2011</td>
<td>10.12%</td>
<td>18.21%</td>
<td>28.33%</td>
</tr>
<tr>
<td>Yemen</td>
<td>Banajeh\textsuperscript{[36]}</td>
<td>2009</td>
<td>--</td>
<td>36.00%</td>
<td>36.00%</td>
</tr>
</tbody>
</table>
this study. They have no financial interest in any of the products or devices, or drugs mentioned in this article.

**Ethical Approval**

Obtained.

**REFERENCES**


Vitamin D deficiency in Saudi Arabia between 2009-2013
K.A. Bakarman and M.A. Bajubair


عن فيتامين D في المملكة العربية السعودية بين 2009-2013: دراسة تحليل تعدد

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المستخص

المقدمة: هدف البحث هو مراجعة وجمع ومقارنة معدلات انتشار نقص فيتامين (D) في المملكة العربية السعودية في مختلف المناطق والتي نشرت في مجلات علمية محاكمة.

الطريقة: باستخدام طريقة المراجعة المنتهية المنظمة والتحليل العددي، جمعنا أبحاث الفيتامين (D) من مختلف المناطق في المملكة خلال فترة الخمس سنوات بين 2010-2013، من ضمنها الأبحاث المشتركة، أو الأوراق المقدمة في المؤتمرات العلمية المحكمة.

النتائج: كان هناك 14 بحثا عن فيتامين (D)، منها 13 بحثا منشورا في مجلات علمية محكمة، وبحث واحد قدم في مؤتمر. وقد شملت خمس مناطق رئيسية في المملكة، حيث بلغ مجموع الأبحاث 34768 منهم (62%) بالنسبة لمنطقة مديرية (D) بالبلد. (30) نهج/د. و كان أكبر العينات من المنطقة الوسطى التي تشمل الرياض والقصيم بعدد 2755. ومثلكما واحدة بحثية، ثم المنطقة الغربية بمدنها جدة ومكة بعدد 383 عينة، وكانت هذه المنطقة من أقل المناطق في نسبة انتشار نقص فيتامين (D) إلى 24.2%. تتراوح المنطقة الوسطى نسبة 27.4%.

الخلاصة: على الرغم من وجود أشعة الشمس نسب عالية، ووفرة منتجات الألبان، إلا أن مشكلة نقص فيتامين (D) تبدو منتشرة في المجتمع السعودي، على الرغم من أن هناك اختلافات في نسب هذا الانتشار من الناحية الجغرافية، إذ أن بعضها تكون فيه هذه النسبة منخفضة بشكل كبير على صحة الأفراد، وعلى وضعية الخطط الصحية لمكافحة هذه النقص أخذ هذه الاختلافات بعين الإعتبار.