MATERNAL VITAMIN D DEFICIENCY AND AUTISM DEVELOPMENT

BY KELSEY GIRARDELLI
INTRODUCTION

• Most vitamin D is obtained by sunlight exposure, and it is then photosynthesized by the skin.

• Many factors affect vitamin D deficiency (i.e. age, race, latitude and season).

• Maternal Health outcomes associated with vitamin D deficiency

• Childhood health outcomes associated with vitamin D deficiency
• Aging can decrease the capacity of the skin to produce provitamin D₃ by greater than twofold (MacLaughlin and Holick 1985).

• Another reason for the reduction in circulating vitamin D levels is a decrease in renal function that occurs with age (Gallagher 2013). – study explanation

• Aging may affect the intestinal concentration of vitamin D receptor (VDR) and thereby lead to decreased calcium absorption, as demonstrated in aging rats (Horst, Goff, and Reinhardt 1990).
**AGE AND AUTISM**

- Risk of ASD increased significantly with each 10-year increase in maternal age (adjusted risk ratio (RR), 1.31; 95% confidence interval [CI], 1.07-1.62) (Croen et al. 2007).
- A similar study conducted on Swedish medical records showed that risk of autism among mothers <29 years old was about the same, but after age 30 risk increased. Ages 40-45 were characterized by an odds ratio (OR) of 1.75 [95% (CI): 1.63–1.89] (Idring et al. 2014).

![Maternal Age and Autism in California: 1990-1999 Rate Per 10,000](image)

<table>
<thead>
<tr>
<th>Maternal Age</th>
<th>Autism Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25</td>
<td>16</td>
</tr>
<tr>
<td>25-29</td>
<td>23</td>
</tr>
<tr>
<td>30-34</td>
<td>31</td>
</tr>
<tr>
<td>35-39</td>
<td>38</td>
</tr>
<tr>
<td>40 and up</td>
<td>44</td>
</tr>
</tbody>
</table>
The effectivity of UVB on production of provitamin D$_3$ is influenced by melanin. (Armas et al. 2007).

Experiment on effect of increased skin pigment on the cutaneous production of vitamin D$_3$ (Clemens et al. 1982).

National Health and Nutrition Examination Survey stated that the prevalence rate of vitamin D deficiency among US adults was 41.6%, with the highest rate seen in blacks (82.1%), followed by Hispanics (69.2%) (Forrest and Stuhldreher 2011).
Interestingly, surveillance data from the U.S. Census Bureau and the U.S. Centers for Disease Control and Prevention's (CDC) revealed that the rate of autism among black children in the high socioeconomic group was higher than that among white or Hispanic children between 2002 and 2010 (“Race, Class Contribute to Disparities in Autism Diagnoses” 2017).

In essence, they are not finding prevalence of autism across races, but prevalence of diagnosis.

Generally speaking, “Black children are much more likely to be in the low-socioeconomic group than white children,” says Maureen Durkin, lead researcher and professor and interim chair of population health sciences at the University of Wisconsin-Madison (“Race, Class Contribute to Disparities in Autism Diagnoses” 2017).
LATITUDE, SEASONAL LIGHT PATTERNS AND VITAMIN D DEFICIENCY

- Florida study results: These statistically significant results include a 14% summer increase in 25(OH)D concentrations in men and a 13% increase in women (Levis et al. 2005b).

- Lack of sunlight and the larger zenith angle that characterizes northern winters, increase risk of deficiency in dark-skinned minorities as they migrate to northern latitudes.

- High incidence of subnormal vitamin D levels observed in women from ethnic minorities in South Wales (Datta et al. 2002).

- Studies on South East Asian populations in the UK and type II diabetes (Lowe and Bohjani, 2017).
LATITUDE, SEASONAL LIGHT PATTERNS AND AUTISM PREVALENCE

• Prevalence study conducted by the CDC across 14 states found that New Jersey had the highest autism prevalence and Alabama had the lowest autism prevalence (“Prevalence of Autism Spectrum Disorders — Autism and Developmental Disabilities Monitoring Network, 14 Sites, United States, 2008” n.d.).

• Multiple studies have demonstrated that dark-skinned immigrants in countries with relative lack of sun have an elevated autism prevalence (Fernell et al. 2015).

Strong positive correlation between increasingly northern latitudes and increased rates of infantile autism disease (IAD) (Grant and Soles 2009).
CONCLUSION

• Strong basis for current and future research
• Current research in Immunogenetics lab
• Further research in collaboration with Intermountain Healthcare
• Clinical trials are what will ultimately help people get adequate supplementation and potentially prevent these adverse health outcomes.
<table>
<thead>
<tr>
<th>Status</th>
<th>ARUP Laboratories</th>
<th>Endocrine Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficient</td>
<td>&lt; 20 ng/ml</td>
<td>0-20 ng/ml</td>
</tr>
<tr>
<td>Insufficient</td>
<td>20-29 ng/ml</td>
<td>21-29 ng/ml</td>
</tr>
<tr>
<td>Sufficient</td>
<td>30-80 ng/ml</td>
<td>30-100 ng/ml</td>
</tr>
<tr>
<td>Toxic</td>
<td>&gt;150 ng/ml</td>
<td></td>
</tr>
</tbody>
</table>
ZENITH ANGLE

**DEFINITION:** It is the angle between the vertical from the earth’s surface, and an imaginary line drawn from the center of the sun to the earth’s surface.