Relationship of Global DNA Methylation with Cardiovascular Fitness and Body Composition

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Abstract

Global DNA Methylation (GDM), an epigenomic modification has been linked to the development of Cardiovascular Disease and its risk factors. The research focus is to identify the relationship between cardiovascular fitness measurements and epigenetic alterations specific to chronic disease states in adult subjects. Twenty-six adult human subjects were required to complete a physical activity and diet questionnaire. Each individual donated a small blood sample (600 μL) in order for us to analyze the Global DNA Methylation (GMD). Then, their body composition was evaluated by using the Dual-Energy X-ray Absorptiometry (DEXA Scan) machine. The Pearson’s “r” value was used to reveal the correlation between GDM and various variables, while t-tests were used to assess if any differences exists between high and low value groups for each variable. The Body Mass Index was significantly correlated (p-value, r-value; 0.031, -0.556) with GDM in females only. Individuals with high folate intake had significantly greater GDM than the low folate groups (high= 3.1±1.2%, low=2.3±0.7, p=0.034) as determined by the diet questionnaire. No significant correlations or differences were found in males. The results conclude that as BMI increases, GDM decreases in females. In attempts to further investigate the relationships between GDM and these variables, auxiliary research needs to be conducted with larger subject pools containing additional sedentary participants.

Methodology

Subjects: Apparently healthy subjects (18-44 years old) primarily from the UNLV community

Instrumentation:
- Dual Energy X-ray Absorptiometry (DEXA)
- MOXUS Metabolic Cart
- Wizard Genomic DNA Purification Kit
- Methylamp Global DNA Methylation Kit

Procedures:
- Informed Consent and Health Questionnaire
- Physical activity and diet questionnaire
- DEXA Scan
- VO2Max Test
- Statistical Analysis

Pearson product-moment correlation coefficient (“r”) for GDM and VO2Max as well as GDM and percent body fat.

Results

The Table 2.1 below shows the results.

<table>
<thead>
<tr>
<th>Article</th>
<th>Subjects</th>
<th>Dependent Variable</th>
<th>Independent Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lund et al. (2004)</td>
<td>n=27 mice</td>
<td>GDM</td>
<td>Prevalence of atherosclerosis</td>
<td>GDM</td>
</tr>
<tr>
<td>Stenvinkel et al. (2007)</td>
<td>n=191 males &amp; females</td>
<td>GDM</td>
<td>Inflammation measured by IL-6 and IL-10</td>
<td>GDM in patients with inflammation</td>
</tr>
<tr>
<td>Kim et al. (2010)</td>
<td>n=286 males &amp; females</td>
<td>GDM</td>
<td>CVD</td>
<td>GDM in CVD patients</td>
</tr>
</tbody>
</table>

GDM – Global DNA Methylation, CVD – Cardiovascular Disease

Conclusion/Further Research

A larger and more diverse sample with sedentary or less physically fit subjects would be necessary for more conclusive results. A 2.7% GDM was obtained from this study which is similar to the findings shown by McGuinness et al. (2012). The GDM ranges from 0.85 to 91% (Bronberg, Bersudsky, & Agam, 2009). As this research shows, there is not much consistency between the DNA isolation and GDM quantification, which makes the comparison between studies very misleading. An inverse relationship between GDM and BMI is present in females, but not in males. Subjects who reported higher levels of sedentary in their diets have increased levels of GDM than those who do not. A relationship between cardiovascular fitness via VO2max measurement, and GDM was not found. There is a need of more studies and for our case there is a need of a larger sample size because DNA methylation is an important biomarker in detecting the cardiovascular disease risk and its prevention.

References


