The effects of diet and vanadyl sulfate supplementation on blood glucose levels of diabetics: review of current human data and recommendations for further study

Abstract

Studies in the literature have shown that vanadium supplementation has an insulin mimetic effect on the blood glucose levels of both animals and humans. In the current literature, several studies have examined the effects of vanadium supplementation on blood glucose levels of both type 1 and type 2 diabetics. However, dietary intake of vanadium has not been considered. It is highly probable that vanadium from food sources may be more effective than supplementation alone due to the synergistic effects of the various food components. This raises several questions: Could a diet high in food sources of vanadium be more effective in controlling blood sugar levels in diabetics compared with vanadium supplements alone? Could a diet high in food sources of vanadium increase the intestinal absorption of vanadium? Could a diet high in food sources of vanadium reduce the need for vanadium supplements while maintaining the effects of lowering blood glucose levels in diabetics? This review examines current human studies in the literature which report the lowering effects of vanadium on blood glucose levels of both type 1 and type 2 diabetics. The authors also recommend further study to determine whether a diet high in vanadium containing foods will improve blood glucose levels in type 1 and type 2 diabetics thereby providing an alternative and complementary means of managing both type 1 and type 2 diabetes.

Keywords: vanadyl sulfate, vanadium, supplementation

Introduction

A number of studies have suggested the ability of vanadium to improve the blood glucose control of diabetics and also to improve the negative side effects associated with diabetes. Human studies have specifically shown a reduction in blood glucose levels and hemoglobin A1C (hgbA1C) levels in both type 1 and type 2 diabetics. Goldfine et al., reported improved insulin sensitivity in type 2 diabetics who were given vanadium supplements and Soveid et al., indicated that type 1 diabetics, who were supplementing with vanadium, showed a decreased need for insulin. Vanadium is found in many food sources. Vanadium is found abundantly in food items such as dill seeds which contain 430mcg/kg and black pepper which contains 987mcg/kg. Foods such as whole grains, seafood, meats and dairy provide 5-30mcg of vanadium per kilogram and smaller amounts of vanadium, 1.5mcg/kg, can be obtained from oils, fats and vegetables. According to Ulbricht et al., a safe level of vanadium intake for humans is less than 1.8mg per day. However, the average diet provides about 6-20mcg of vanadium per day.

Mishra et al., reported that vanadium can activate the tyrosine kinase and glycogen synthase activity of insulin receptors in adipocytes. Vanadium can also increase the concentration of fructose 2, 6-biphosphate which can activate glycolysis in hepatocytes. Vanadium salts mimic several of the effects of insulin which include metabolic and growth promoting factors, and have also been shown to stimulate glycogen synthesis in muscles.

Vanadyl sulfate

Vanadium as vanadyl sulfate is believed to be a potent regulator of fasting blood glucose by improving the sensitivity to insulin at the receptor level. Vanadyl sulfate is known to be 6-10 times less toxic than other forms of vanadium such as vanadate. In fact, ten percent of dietary vanadium exists as vanadyl sulfate. Based on an analysis of the current literature, vanadyl sulfate shows very promising results with regard to management of diabetes. Vanadyl sulfate has been studied more extensively in both rat and human studies and produced more significant results with less risks of toxicity. Several human studies were reviewed in which both type 1 and type 2 diabetics were participants. Soveid et al., conducted a study in which they examined the effects of vanadyl sulfate supplementation on the blood glucose levels of type 1 diabetics. This study showed very promising results. The study was conducted for a period of 3 months. During weeks 2-5, study participants were given an adaptive dose of 40-60mg/day of vanadyl sulfate. The dosage was then progressively increased to 225-300mg/day which was given in three equal dosages for the duration of the study.

Findings from this most recent study revealed that insulin requirements decreased thirty percent (30%) among participants from...
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Table 1 Pre and post FBG and A1C levels in human studies

<table>
<thead>
<tr>
<th></th>
<th>Pre-FBG</th>
<th>Post-FBG</th>
<th>Pre-A1C</th>
<th>Post-A1C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohen et al. 1</td>
<td>210+19</td>
<td>181+14</td>
<td>9.7+0.5</td>
<td>8.8+0.6</td>
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<tr>
<td>Goldfine et al. 3</td>
<td>167.2+72.9</td>
<td>144.1+66.8</td>
<td>10.3+2.6</td>
<td>7.1/7.8+1.7/2.3</td>
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<tr>
<td>Afkhami-Ardekani et al. 5</td>
<td>175.5+35.2</td>
<td>161.6+36.9</td>
<td>7.8+0.9</td>
<td>7.8+0.6</td>
</tr>
<tr>
<td>Boden et al. 2</td>
<td>167.57+32.43</td>
<td>133.33+25.22</td>
<td>Not given</td>
<td>Not given</td>
</tr>
<tr>
<td>Soveid et al. 8</td>
<td>238+71</td>
<td>152+42</td>
<td>Not done</td>
<td>Not done</td>
</tr>
</tbody>
</table>

Conclusion

Based on the current studies available and reviewed, supplementation with 300mg per day of vanadyl sulfate had the greatest and most significant impact on fasting blood glucose levels of diabetics. In addition, the studies that were reviewed indicated that fasting blood glucose levels remained stable for up to one month after cessation of the study regimen. Findings also suggested that another potential advantage of vanadyl sulfate supplementation is its ability to decrease total cholesterol levels.1,2,13,14 Human studies reviewed did not examine the effects of dietary intake of vanadium. It is highly probable that studies could show beneficial effects with lower doses of vanadyl sulfate supplementation. These effects are most likely to be evident in those studies that focus on dietary intake of vanadium rich food sources as well as on supplementation of vanadium. Only one study was designed to examine the long term benefits of vanadyl sulfate supplementation and was of 30months duration. Other studies were of shorter duration with the study regimen generally averaging between 1-3months in length. Further studies are definitely needed to determine the efficacy and safety of vanadyl sulfate supplementation for long term management of type 1 and type 2 diabetes. Future studies may also be designed to determine the potential benefits of intermittent supplementation.

Future directives

Based on a review of the literature, vanadyl sulfate supplementation has never been studied in conjunction with diet. The authors propose a preliminary study to look at the synergistic effects of a diet high in food sources of vanadium in addition to vanadyl sulfate supplementation. The proposed study will help to determine whether a diet high in vanadium containing foods will further improve blood glucose levels in diabetics who are taking vanadium supplements. The authors hypothesize that a diet high in food sources of vanadium, along with vanadyl sulfate supplementation, will further improve blood glucose levels in diabetics compared to a diet low in food sources of vanadium and/or vanadyl sulfate supplements alone. Study participants will be recruited from the population of metro Atlanta. Flyers will be placed in doctor’s offices, churches, colleges, and community centers. In addition, an online craigslist advertisement will be posted. Based on the methodology utilized in the vanadium supplementation studies referenced above and assessment, a total of thirty (30) type one and type two diabetics will be selected. Exclusion criteria for potential study participants are the history or occurrence of hepatic issues, renal issues, cardiovascular disease, respiratory issues, anemia, bleeding disorders, abnormal hemoglobin/hematocrit, or unstable weight in the last two months prior to recruitment. Pre-menopausal women will also be excluded unless there is proof of current contraception or sterility.

The study is of three (3) months duration and is designed so that study participants are randomly divided into three equal groups; a control group in which participants receive a placebo and stay on their regular diets, one group in which participants receive vanadyl sulfate supplementation along with a diet low in food sources of vanadium, and the third group of participants receive vanadyl sulfate supplementation along with a diet rich in food sources of vanadium. The vanadyl sulfate supplementation groups will begin supplementation with an adaptation dose of 100mg/day of vanadyl sulfate per day which will

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None.

Conflict of interest

The author declares no conflict of interest.

References


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