



TRIVALENT CHROMIUM ON EUCHEUMA SPINOSUM AS TYPE 2 DIABETES THERAPY

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Abstract

Diabetes mellitus (DM) is increasingly rapid nowadays. DM itself is a chronic metabolic disease characterized by elevated blood sugar level to the body. However, it requires the patient to take a lot of drug for the whole life. In order to reduce the rate incident of DM, the isolation method becomes an alternative for researchers to find its potential substance as an anti diabetic agent. This paper will highlight the role in improving insulin action by trivalent chromium of *Eucheuma spinosum*. An initial research conducted via PubMed, Google Scholar databases, news articles, and relevant websites using the keywords trivalent chromium, chromium (III), *Eucheuma spinosum* and type 2 diabetes. Inclusion criteria derived from original Indonesian and English publications of related topic published in 1995-2017. A research based on in vivo study yielded that trivalent chromium on *Eucheuma spinosum* extracted and commonly synthesized with picolinic acid and chloride acid. Synchronously, the data reinforce the therapeutic value of trivalent chromium in maintaining the insulin function on type 2 diabetes.

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1. INTRODUCTION

Epidemic of diabetes mellitus (DM) in Indonesia nowadays continues to escalate swiftly. DM itself is a metabolic abnormality which indicates by elevated blood glucose levels to the body for a long period of time. In general, DM is categorized into two main types: insulin-dependent diabetes mellitus (IDDM) or type 1 diabetes and insulin-independent diabetes mellitus (IIDM) or type 2 diabetes (Harimurti and Komalasari, 2015). To alleviate this scourge, most patients were recommended to start a healthy diet and exercise (Kronenberg *et al.*, 2008). Besides, patients require combinations of anti-diabetic drugs to regulate the glucose level. However, many synthetic drugs proved have side effects and less efficacy that occur during therapy. To resolve this matter, researchers are trying to find new alternative medicine for treat patient with diabetes. Chromium, one of the most trace mineral which exists in our environment in several oxidation states, particularly as metallic, trivalent chromium, and hexavalent chromium (Cefalu, 2004). Yet data in humans focusing chromium's mechanism on induction of insulin action based on in vivo or on cellular aspects of insulin mechanism were rare. Many of the data still have a contradiction. Due to figure out the synchronic findings of trivalent chromium that specifically drawn as an effective type 2 diabetes therapy, the systematic research particularly in Indonesia as one of the highest of diabetes patients are





urgently needed. This review focuses on providing recent information about biological mechanisms clinical trials in patients as type 2 diabetes therapy.

2. RESEARCH METHOD

Based on the selection journals that were acquired through PubMed, Google Scholar databases, news articles, and relevant websites using keywords in combination or separately: trivalent chromium, *Eucheuma spinosum*, insulin resistance therapy, and type 2 diabetes. Inclusion criteria derived from original Indonesian and English publications of related topic published in 1995-2017, the topic of using *Eucheuma spinosum* for anti-diabetic agent was searched to completing the different perspective about one to another research. Thirteen journals and articles are included in the inclusion data, which divided of eleven scientific journals published in English and two journals in the Indonesian language. Then, each journal were evaluated on the research objectives, methods, and keynotes used as well as the results and discussion of research.

From the selected journals that have been done, the data amplify the therapeutic value of trivalent chromium in maintaining the insulin function on type 2 diabetes.

3. RESULT AND ANALYSIS

Nowadays, the pharmacological and non pharmacological treatment were known as therapy for diabetes. The pharmacological therapy which commonly used is the hypoglycemic oral drugs such as sulfonyl urea, glinid, thiazolidindiones, biguanid groups, or its combination of these drugs (Sabtanti, 2016). Whereas non pharmacological therapies are some mechanism that can aid to control normal glucose blood levels such as start a healthy lifestyle and changing behavior (i.e. avoiding smoking and alcohol), taking diet, and doing a physical exercise (Eko, 2011). In addition, therapy with traditional medicine is more accepted by community since it is considered to have low side effects than synthetic drugs when properly used (proper dosage, indications, timing, manner of use and accuracy of determination material from herbal medicine) (Karto, 2008). Besides as an anti-diabetic agent, *Eucheuma spinosum* had also been broadly studied as anti-cancer, anti hypertension, decrease the obesity and alleviate blood cholesterol. However, our research are congruent with a recent study related to the topic which is to discover a new safe alternative for type 2 diabetes patients who are taking much of synthetic medicines.





3.1 Physicochemical properties of *Eucheuma spinosum*



Figure 1. Seaweed (*Eucheuma spinosum*)

Eucheuma spinosum is one of red seaweeds (*Rhodophyceae*) which consumed as a readily available among coastal area particularly in Asia (24,25). In addition, *Eucheuma spinosum* has also been prescribed for numerous of medical treatment. Seaweed is rich in unsaturated fatty acid containing two or more methylene-interrupted double bonds which is important to against type 2 diabetes mellitus.

3.2 Action mechanism of trivalent chromium

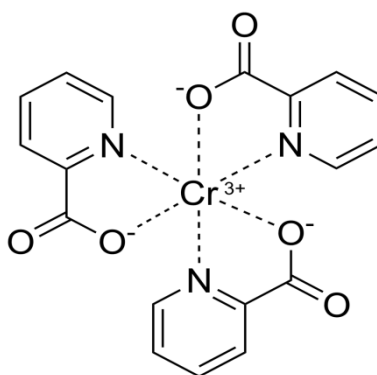


Figure 2. Structure of trivalent chromium picolinate

Micro-minerals that have a role as cofactors in increasing glucose metabolism are chromium. Chromium has the potential to increase work of insulin in transferring glucose into cells. In addition, it is known that chromium increases insulin attachment, the number of insulin receptors and insulin sensitivity at the cellular level. The results of the study showed the benefits of chromium in increasing muscle mass, decreasing fat and improving glucose metabolism and serum fat levels in patients with or without diabetes.



Chromium consumption can help improve blood sugar levels and conversely chromium deficiency in food intake will result in insulin resistance (Yinan, 2012).

Chromium is an element that plays a role in increasing insulin sensitivity and has been recognized as an essential nutrient that functions in the metabolic processes of carbohydrates, lipids and nucleic acids (Dharma, 2010). It has a function of influencing the ability of receptors to interact with insulin. However, insulin can actively regulate the blood sugar levels. An active insulin will increase the uptake of glucose which may then be processed into fat. In protein synthesis, the presence of chromium affects the formation of amino acids glycine, serine and methionine, whereas in the metabolism of nucleic acids, chromium which is able to bind to nucleic acids can protect the RNA from denaturation by heat and maintain a tertiary structure of nucleic acids. Trivalent chromium deficiency in the body causes a decrease work of insulin hormone which can then lead to diabetes mellitus, hyperglycemia and glycosuria, causing a decrease in body weight, high levels of fatty acids, respiratory disorders, and abnormalities in nitrogen metabolism. In doses of 20-50 µg/100 g of body weight, chromium has a good function in carbohydrate metabolism, lipid metabolism, protein synthesis, and nucleic acid metabolism.

Based on the related findings that were conducted, we figured out that chromium supplementation can control HbA1C and FPG for patients with type 2 diabetes mellitus. Besides, this trace compound does not improve the risk of adverse events. Besides, chromium also improve trigliseride levels (Alanazi, 2016).

4. CONCLUSION

Due to the popularity of chromium that have gained in health aspect, when compared to the side effects of synthetic of anti-diabetic drugs, the studies suggest that trivalent chromium could be used as possible to regulate the blood glucose level to the body. Additionally, there is evidence supporting trivalent chromium as an initial alternative, at least as successful as a current alternative synthetic drugs. Available data showed that trivalent chromium is proven as a safe alternative to control the insulin rate and further studies become a new challenge for researchers to evaluate the health impact of trivalent chromium on long-term use, particularly, and those experiments comparing the effects of using synthetic medicines.

More rigorous research and comprehensive data are important before any solid conclusions that drawn about the efficacy of trivalent chromium in its extract, fractional compound and combination with synthetic drug or other herbal.

REFERENCE

- [1] Bethesda, M. (2014). Insulin Resistance and Prediabetes. *National Institute of Diabetes and Digestive and Kidney Disease* , 1.
- [2] Andreas Pfützner, M. P. (2011). Elevated Intact Proinsulin Levels Are Indicative of Beta-Cell Dysfunction, Insulin Resistance, and Cardiovascular Risk:. *Journal of Diabetes Science and Technology* , 2.





- [3] Guo, S. (2014). Insulin Signaling, Resistance, and the Metabolic Syndrome:. *NIH Public Access*, 2.
- [4] Jeong-a Kim, Y. W. (2010). Role of Mitochondrial Dysfunction in Insulin Resistance. *NIH Public Access*, 5.
- [5] Guo, S. (2014). Insulin Signaling, Resistance, and the Metabolic Syndrome:. *NIH Public Access*, 5.
- [6] Christian K. Roberts1. A. (2013). Metabolic Syndrome and Insulin Resistance: Underlying Causes. *NIH Public Access*, 2.
- [7] Sulistyoningrum, E. (2010). Tinjauan Molekuler dan Aspek Klinis Resistensi Insulin. *Mandala of Health* , 1.
- [8] Surya Dharma, Z. B. (2010). Pengaruh Pemberian Kromium (III) Klorida terhadap Kadar Glukosa Darah Mencit Putih. *Jurnal Sains dan Teknologi Farmasi* , 1-2.
- [9] Kronenberg HM, Melmed S, Polonsky KS, Larsen PR. Williams textbook of endocrinology. 11th ed. Canada: Saunders, Elsevier Inc. 2008; 1329-89.
- [10] Yinan Hua, S. C. (2012). Molecular Mechanisms of Chromium in Alleviating Insulin. *NIH Public Access* , 2.
- [11] Henry H. Ting, F. K. (1996). Vitamin C Improves Endothelium-dependent Vasodilation in. *The Journal Clinical and Investigation*.
- [12] Mertz W. 1995. *Risk assessment of essential trace elements: New approaches to setting recommended dietary allowance and safety limits*. Nutrition Reviews.
- [13] CCRC. (2016, 07 31). *Cancer Chemoprevention Research Centre*. Dipetik 07 31, 2016, dari http://ccrc.farmasi.ugm.ac.id/?page_id=183: http://ccrc.farmasi.ugm.ac.id/?page_id=183.
- [14] Harimurti, S. Komalasari, T. (2015). A Review on the Anti-diabetic Activity of *Andrographis paniculata* (Burn. f.) Nees based on In-vivo study. *International Journal of Public Health Science (IJPHS)*. Vol.4, No.4, December 2015, pp. 256-263