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Evaluation of Curcumin Effect in Diabetes and Diabetic Atherosclerosis

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Abstract:

Background: *Curcumin is an herbal constitute from curcuma lunga. The root of curcuma has been known for its antioxidant properties with benefical effects in diabetes and atherosclerosis. Also there are some reports about its antioxidative stress properties. According to this background, we have prepared this minireview considering 20-30 recent articles.*

Materials and Methods: *We have accumulated 23orginaland review articles from Medical Database Publication Science, Scopus, Google scholar, web of Sience and Elsevier about role of curcumin and in diabetes and atherosclerosis.*

Results: *According to these studies, curcumine through intervention in decreasing serum fatty acid (due to increased consumption of fatty acid oxidation) can reduce glucose in patients with diabetes. Also by improving pancreatic beta cell function as pre-diabetes intervention is benifical too. Alsocurcumin by reducing the pulse wave velocity, leptin levels, triglycerides, uric acid, visceral fat and total body fat as well as increased levels of adiponectin in diabetes patients can reduce the risk of atherosclerosis.*

Conclusion: *According to these results we can introduce curcumin for co-treatments in diabetic patients especially who are at risk of atherosclerosis.*

Keywords: ***Curcumin, diabetes, atherosclerosis.***

1. Introduction

Curcumin is a yellow chemical produced by some plants. It is the principal curcuminoid of turmeric (Curcuma longa), a member of the ginger family (Zingiberaceae). It is sold as an herbal supplement, cosmetics ingredient, food flavoring, and food coloring[1].

In clinical trials for several pharmacological effects of curcumin reported that Including anti-inflammatory,anti-microbial, effects of the treatment of diabetes, rheumatoid arthritis, psoriasis, cancer and Alzheimer's[2-10]. Multiple mechanisms have been proposed for pharmacological effects such as anti-oxidants and biological curcumin, inhibits inflammatory factors, induction of apoptosis, anti-carcinogenic and activation or inhibition of intracellular pathways that are involved in causing the disease.

Also, Curcumin increases the expression of adiponectin (the most important anti-inflammatory agent secreted by fat cells) as well as the delay in the differentiation of fat cells. Curcumin directly contrast with adipose tissue to suppress the inflammatory response and can regulate gene expression of inflammatory cytokines, including TNF-α, IL-1, IL-2 and IL-6 by disabling transcription factor NF –kB.

Natural products are now a lot of attention for its effective control have attracted worldwide[3]. Turmeric is a spice derived from the turmeric root and as a treatment for diabetes, traditional Chinese medicine for thousands of years is used.

One of the most active turmeric, curcumin, scholarly attention as a potential treatment for diabetes mellitus as well as treatment of complications of diabetes are considered.[5], primarily because of its effect on lowering blood sugar and blood lipid in rodents are effective and relatively inexpensive and is considered safe.[7-9]

2. Evidence Acquisition

To update about curcumin effect in diabetes and diabetic atherosclerosis, Pubmed and Google scholar database and up to date were searched for term, curcumin and diabetes and limited to the articles published in English-language journal. The qualitative results are presented here.

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3. Results

3.1: Curcumin and Diabetes-Associated Liver Disorders

Diabetic patients often suffering fatty liver disease and other disorders of the liver.[10] As In this study, Babu and Srinivasan[11] showed that diabetic rats induced by dietary curcumin for 8 weeks less excretion of albumin, creatinine, urea and inorganic phosphorus. As curcumin decrease lipid peroxidation products in plasma. The effects of curcumin independent of changes in body weight or blood sugar have occurred. Further study by this group[12] suggested that cholesterol-lowering -7 A-hydroxylase be mediated liver fat in STZ diabetic rats by curcumine.

Liver disorders induced by sodium arsenic in mice, oral administration of curcumin could total fat, cholesterol, triglycerides (TG), and the Low Density Lipoprotein[13] cut.

Lipidemia improved by stimulating the activity of curcumin may be due to PPAR – [14,15] that adipogenesis[16] attributed related. This improvement may be due to Obtain enzyme activity[17] in lipid peroxidation[18] and glucose metabolism, including antioxidant enzymes, liver enzymes regulate glucose, liver enzymes regulator of fat.

3.2: Curcumin and Adipose Tissue Dysfunction

Adipose tissue plays an important role in the control of glucose homeostasis.[19] But type 2 diabetes may not be set in the secretion of adiponectin. Recent studies showed that curcumin stimulates the differentiation of human adipose[6] and accumulation of macrophages or activated in fat tissue[20] by setting adiponectin secretion[21,22] suppressed. Further studies showed that curcumin suppressed by 3T3-L1 adipocytes through activation of Wnt signaling / beta-catenin leading to increased mRNA levels of c-Myc and cyclin D1 and [23] was mediated.

3.3: Curcumin and serum fatty acid, lipid profiles, body fat

A double blinded, placebo controlled trial which was planned to show the result of curcumin supplementation on patients with type 2 diabetes, showed that in 3 months of curcumin supplementation, those who received curcumin had their serum free fatty acid(FFA) significantly reduced. Also the level of serum triglyceride was reduced and lipoprotein lipase (LPL) activity increased.[24]

A recent study aimed to treat non-alcoholic fatty liver disease with curcumin. A double blinded, placebo controlled trial was arranged and two groups of randomized patients received placebo or curcumin. Results showed in the patients with curcumin supplementation, liver fat content significantly reduced (78.9% improvement). There were also significant reductions in body mass index and serum levels of total cholesterol, low-density lipoprotein cholesterol, triglycerides, aspartate aminotransferase, alanine aminotransferase, glucose, and glycosylated hemoglobin compared with the placebo group.[25]

In a randomized, double-blind, placebo-controlled, crossover trial in patients suffering from obesity, curcumin treatment effects on dyslipidemia feature were as following: weight, BMI, waist circumference, hip circumference, arm circumference, and body fat remained statistically unchanged by the end of trial serum triglycerides were significantly reduced. But curcumin did not effect on serum levels of total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, and high-sensitivity C-reactive protein.[26]

A 6-month randomized, double-blinded and placebo-controlled clinical trial aimed to show the effects of curcumin treatment on Inflammation-associated cardiovascular conditions such as atherosclerosis which is common in patients with type 2 diabetes mellitus. The pulse wave velocity, and other metabolic parameters in patients treated with placebo and curcumin were compared. In the end, curcumin supplementation reduced pulse wave velocity, increased level of serum adiponectin and decreased level of leptin, levels of homeostasis model assessment-insulin resistance, triglyceride, uric acid, visceral fat and total body fat also were decreased. Also the curcumin extract helped to improve relevant metabolic profiles in this high-risk population,[27] Also in a study that was done by Somlak Chuengsamarn and colleagues concluded thata 6-month curcumin intervention in type 2 diabetic population lowered atherogenic risks. In addition, the extract helped to improve relevant metabolic profiles in this high-risk population.

3.4Curcumin and Diabetic Nephropathy

Diabetic nephropathy is a clinical syndrome with symptoms such as albuminuria, reduction in glomerular filtration rate and increased blood pressure[28] along Nowadays, diabetic nephropathy, the leading cause of chronic kidney disease.[29] Curcumin has multiple mechanisms may improve kidney damage such as, reduce the levels of albuminuria[30,31] and Enzymuria, such as the level of N-acetyl-D-glucose, lactate dehydrogenase (LDH), aspartate aminotransferase, alanine aminotransferase, and alkaline phosphatases and acid. A large clinical trials show the effect of curcumin on the final stage of kidney disease that curcumin decreased levels of growth factor β (TGF-β), IL-8, and the level of protein in the urine.[32]

3.5: Curcumin and Diabetic Neuropathy

Diabetic neuropathy and neuropathic disorders that are associated with diabetes mellitus said. This process is caused by damaged capillaries and activity of protein kinase C[33] In a study by Suryanarayana and colleagues[34] conducted showed that curcumin reduces osmotic stress-

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induced reduction of blood sugar concentration and protein depletion lens solution is.

In addition, curcumin reduced the cognitive deficits caused by diabetes and reduce impaired cholinergic system by regulating the activity of the enzyme acetylcholinesterase and cholinergic receptors.[35,36] Curcumin decreased expression of hypocrisy 2 (SIM2)[37], which damage nerve-hyperglycemia and impaired memory plays a role as well. Curcumin is also effective in improving Alzheimer's disease.[38]

3.5: Effect of Curcumin on Pancreatic β-Cell Dysfunction

Many studies have been done on the effect of curcumin on pancreatic cells and ROS production delayed by islands and increased number of small islands and decrease lymphocyte infiltration in pancreatic islets[39] also, links bone marrow regeneration of islet cells and insulin secretion is increased.[40]

Another double blinded, placebo controlled trial was done to see if curcumin supplementation can prevent type 2 diabetes mellitus in the prediabetic population or not. After 9 months of treatment with placebo and curcumin, 16.4% of subjects in placebo group were diagnosed with T2DM whereas none were diagnosed with T2DM in curcumin treated group. The function of Pancreatic β-Cells in curcumin treated subjects was improved compared to placebogroup with higher HOMA-β (61.58 vs. 48.72; $P < 0.01$) and lower C-peptide (1.7 vs. 2.17; $P < 0.05$). A lower HOMA-IR (3.22 vs. 4.04; $P < 0.001$) and higher adiponectin (22.46 vs. 18.45; $P < 0.05$) was observed in curcumin group compared to placebo group.[27]

3.6: Curcumin and Its Antioxidant Actions

A recent double blinded, randomized, placebo controlled study showed that in a number of forty patients treated with radiotherapy, those who received curcumin, had their plasma total antioxidant capacity (TAC) significantly increased and the activity of superoxide dismutase (SOD) decreased in comparison to the values which were measured before radiotherapy, but in comparison to the placebo group, there was no significant differences between the 2 groups regarding treatment outcomes.[41]

In another study on subjects with metabolic syndrome results showed that in curcumin-peperine received group, SOD activity was significantly increased a malondialdehyde (MDA) and CRP concentration were decreased.[42]

To investigate the effects of curcumin on exercise-induced oxidative stress on humans, another study was arranged. Consisted of 3 groups: 1-Placebo 2-Single (only before exercise) 3-double (before and after exercise). Results showed that concentration of serum derivatives of oxygen metabolites after exercise were significantly increased in placebo group compared to pre-exercise values , but not in single or double group. Serum biological antioxidant potential concentrations measured after exercise were significantly elevated in single and double curcumin supplementation trials.[43]

Conclusion:

Previous studies have provided scientific basis for curcumin indicating that curcumin plays an important role in the prevention and treatment of diabetes and complications to it. Curcumin on many issues related to diabetes, such as insulin resistance, blood fat, blood sugar and necrosis and apoptosis islet cells (Figure 2). Also effective curcumin can prevent diabetes complications destructive. According to these results we can introduce curcumin for co-treatments in diabetic patients especially who are at risk of atherosclerosis.

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