BULLETIN OF NATIONAL ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN
ISSN 1991-3494
Volume 1, Number 371 (2018), 37 – 42

УДК 616.43

B. B. Benberin[1], G. A. Yermakhanova[2], A. A. Akhetov[2], T. A. Vochshenkova[2], N. A. Shanazarov[2], A. Y. Naurazbayeva[2]

[1]Medical Center of President's Affairs Administration of the Republic of Kazakhstan, Astana, Kazakhstan,
[2]Medical Center Hospital of President's Affairs Administration of the Republic of Kazakhstan, Astana, Kazakhstan.
E-mail: valeriy-benberin@mail.ru, ermakhanova@gmail.com, amir.akhetov.a@gmail.com, vochshenkova@gmail.com, nasrulla@inbox.ru, anar.naurazbayeva@gmail.com

EFFICIENCY OF GRAPE POLYPHENOLS IN PATIENTS WITH METABOLIC SYNDROME (LITERATURE REVIEW)

Abstract. Purpose of the review: to study of the efficiency of grape polyphenols in patients with metabolic syndrome.

Methodology: A literature search was conducted in electronic databases and publications included in Embase, PubMed/Medline, Science Direct, Springer Link, Cochrane Library, eLibrary. The depth of the literature search was 12 years. More than 30 publications were selected and reviewed, including full-text articles, Systematic Reviews and Meta-Analysis that were published in English.

Results and conclusions: Grape polyphenols in supported doses can delay or prevent the onset of metabolic syndrome with reducing body weight, blood pressure and blood glucose levels and improving lipid metabolism. The results indicate that polyphenols are significant metabolic modulators because of their ability to influence different targets of the cellular and molecular pathways. However, some studies have shown inconsistent results and conflicting data on the efficacy of polyphenols in metabolic syndrome management have been obtained. Perhaps, contradictory data are associated with significant limitations of their bioavailability, especially in conditions of progressive metabolic syndrome. Therefore, more extensive and in-depth scientific research are needed to determine more accurately the role of polyphenols in the progression of metabolic syndrome components.

Keywords: grape polyphenols, metabolic syndrome.

Introduction. Cardiovascular disease and diabetes mellitus are currently the leading cause of death. The prevention of these diseases is an important problem and it is based on confronting risk factors. In medical practice at the stage of metabolic syndrome (MS), early detection and elimination of risk factors for cardiovascular disease and diabetes mellitus is possible. MS is a cluster of metabolic disorders that includes insulin resistance, hypertension, dyslipidemia and abdominal obesity. The prevalence of MS varies from 10% to 84% depending on the ethnicity, age, and sex [1], which makes it an important social and economic problem worldwide.

Metabolic Syndrome. International organizations and expert groups, such as the World Health Organization, the European Group for the Study of Insulin Resistance, the International Diabetes Federation, have attempted to integrate MS parameters. Nevertheless, the definition of the consensus of the International Diabetes Federation seems to be most suitable for practical use in clinical medicine, taking into account the inclusion of threshold values for different ethnic groups [3, 4]. According to this definition, MS is a cluster of the most dangerous risk factors for cardiovascular disease: central (abdominal) obesity, increased fasting plasma glucose, diabetes, high cholesterol and high blood pressure [2].

As the MS progresses, the subcutaneous abdominal adipocytes merge their lipolytic products (free fatty acids) directly into the portal vein, thereby increasing the concentration of fatty acids in the blood serum, increasing the absorption of fatty acids by the liver, skeletal muscles and beta cells of the pancreas and reducing glucose consumption. Reducing glucose consumption increases serum glucose levels and stimulates increased insulin secretion for glucose utilization: a lack of response to an additional secreted

insulin induces glucose resistance. The constantly high secretion of insulin, in turn, causes metabolic stress in the mitochondria of beta cells of the pancreas, causing the release of reactive oxygen species that damage the mitochondria and among other causes trigger the process of chronic systemic inflammation with time mitochondria lose their ability to support cellular processes, and beta- cells undergo apoptosis, irreversibly reducing the secretion of insulin. To reduce the increase in oxidative stress and inflammatory reaction means to control the onset of irreversible changes in the human body that contribute to premature aging.

Grape Polyphenols. Obviously, abdominal obesity, high blood pressure, impaired glucose tolerance, dyslipidemia and increased oxidative stress and inflammation are the interacting factors of the metabolic syndrome that can be effectively modified with dietary interventions involving polyphenol-rich foods or beverages [5]. Clinical researchers are increasingly attracted by natural healing factors in MS and one of the promising factors are grape polyphenols [6].

Polyphenols are a part of the group of antioxidants of natural origin and are plant pigments contained in large quantities in grapes and other fruits and vegetables. In addition, complexes of plant polyphenol compounds become one of the most important food additives of recent decades. Among plant polyphenols, the greatest attention is given to the research of red grape polyphenols.

Purpose of the Review. To review human studies of the effects of grape polyphenols intake in patients with MS.

Methodology of the Review. A literature search was conducted in electronic databases and publications included in Embase, PubMed/Medline, Science Direct, Springer Link, Cochrane Library, eLibrary. The depth of the literature search was 12 years (2005–2017). The following search terms were used (including synonyms and closely related words): “metabolic syndrome”, “grape polyphenols”, “effects of grape polyphenols”, “grape polyphenols”, “effect on the metabolic syndrome”, “hypertension” or “blood pressure”, “lipids” or “cholesterol”, “insulin” or “glucose”. More than 30 publications were selected and reviewed, including full-text articles, Systematic Reviews and Meta-Analysis that were published in English. They involved a clinical trial in healthy adults or adults suffering from the MS or closely related diseases such as obesity, coronary artery disease or type 2 diabetes.

Effects of Grape Polyphenols on Metabolic Syndrome. As is known, the evolution of MS passes in two directions: the development of dysfunction of β-cells of the pancreas and hyperinsulinemia with compensatory insulin resistance. Given that pro-oxidant status and chronic systemic inflammation accompany MS and that its severity, grape polyphenols manifest themselves as good dietary drugs to prevent the progression of MS by using certain mechanisms of action [7]. By modifying the inflammatory response and reducing the levels of free radicals, grape polyphenols reduce the severity of the chronic systemic inflammatory process. The mechanisms of action include both the manifestation of the antioxidant properties of polyphenols or the enhancement of the expression of antioxidant genes and proteins, as well as a decrease in the intensity of stress signals of the endoplasmic reticulum [8, 9].

According to the studies, oxidative stress occurs with systemic inflammation, endothelial dysfunction, impaired secretion of pancreatic cells and utilization of glucose in peripheral tissues, which lead to long-term secondary complications [10]. Many data from epidemiological studies indicate a positive relationship between a decrease in metabolic disorders and consumption of a diet rich in polyphenols [11].

Since polyphenols increase the antioxidant capacity of plasma, the reversibility of metabolic disorders can be explained by the adoption of an electron from active oxygen species and the formation of relatively stable phenoxy radicals. Active forms of oxygen are considered toxic by-products and pose a threat to cells, causing lipid peroxidation, protein oxidation and nucleic acid damage, inhibition of the enzyme, and activation of programmed cell death [12]. Polyphenols protect the cell constituents from oxidative damage and limit the risk of various degenerative diseases associated with oxidative stress.

Effects of Grape Polyphenols Intake in Patients with Metabolic Syndrome. At the present time, there are a number of clinical studies that are showed efficacy and safety of grape polyphenols intake in patients with MS, cardiovascular diseases, and diabetes mellitus. They indicate that polyphenols improve insulin resistance [13], reduce blood pressure [14], and body weight [15], and improve lipid metabolism [16]. However, results of other clinical studies show differential effects of grape polyphenols on MS components, and it depends on the number of MS components in every patient. However, dietary strategies may be less effective for patients with a group of MS risk factors in general than for patients with