ORIGINAL ARTICLE

THE EFFECT OF TOMATE JUICE ON TRIGLISERIDA LEVELS OF MALE WHITE RATS INDUCED BY ALLOXAN

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ABSTRACT

Background: Tomato juice is believed to affect triglyceride levels in the blood because it contains lycopene. This study aims to determine the effect of tomato juice (*Solanum lycopersicum*) on blood triglyceride levels in the wistar strain of male *Rattus norvegicus* induced by alloxan**.**

Methods: 24 were divided into 3 groups, (1) Group K (-) experimental animals without treatment, (2) Group K (+) experimental animals induced by alloxan 150 mg /kg BW (3) Treatment group K (P) animals tried alloxan induced 150 mg / kg and got 1.75 ml / head of tomato juice. **Results:** There was a significant difference in mean triglyceride levels between groups K (-) and group K (+). This indicates that the induction of alloxan increases blood triglyceride levels. There were significant differences in the mean triglyceride levels between the K (+) and K (P) groups because tomato juice contained lycopene which could reduce triglyceride synthesis.

Conclusions: Tomato juice (*Solanum lycopersicum*) reduced wistar strain male Rattus novergicus triglyceride levels induced by alloxan.

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INTRODUCTION

Diabetes Mellitus is a chronic disease characterized by an increase in blood sugar levels (hyperglycemia) in the blood as a result of a disruption in the metabolic system in the body[1]. From several epidemiological studies in Indonesia conducted by diabetes centers, around the 1980s,the prevalence of diabetes mellitus at the age of 15 years and over is 1.5-2.3% with a lower prevalence in rural areas than in urban areas [2]

Hyperglycemia is a condition of high blood sugar (glucose) levels in the blood. The underlying thing is insulin deficiency, relative or absolute. Hyperglycemia itself is caused by decreased insulin secretion. In patients with uncontrolled diabetes mellitus, it is often accompanied by disorders of lipid metabolism which have an impact on the occurrence of dyslipidemia [3].

Dyslipidemia is defined as a lipid metabolism disorder characterized by an increase or decrease in the lipid fraction in plasma. The main lipid fraction abnormalities are an increase in total cholesterol, LDL cholesterol, triglycerides, and an increased risk of coronary heart disease[4].

Triglycerides are esters of glycerol with fatty acids. Triglycerides are a form of lipids in the body that serve as a source of energy. When the body needs energy, the lipase enzyme in fat cells will break down triglycerides into fatty acids and glycerol and release them into the blood vessels. Food regulation has an effective effect on reducing triglyceride levels in the blood. The US National Health and Nutrition Examination Survey found the influence of carotenoid-rich foods on triglyceride levels in the blood in people with diabetes. One of the foods that has been linked to a decrease in blood triglyceride levels is tomatoes [5].

Tomato (*Solanum lycopersicum*) is a plant that is well known by Indonesian people. However, its use is limited to as a salad and an additional ingredient in cooking. Tomato processing increases the bioavailability and increases the absorption of the active compounds contained therein. One of the compounds in tomatoes that functions to reduce triglycerides is lycopene. Because lycopene is an antioxidant to catch free radicals in the body. ([4;6])

Alloxan is a compound used to induce damage to the pancreas through increased formation of Species Oxygen Radicals (ROS), resulting in diabetes mellitus. Alloxan induction results in lipolysis and triggers hypertriglyceridemia. Alloxan can be given intravenously, intraperitoneally, or subcutaneously in animal experiments. Alloxan induction of 120-150 mg / kgBW can lead to diabetes mellitus in experimental animals [7,]

METHODS

This research is an experimental study post test only control group design. Twenty four male Wistar rats were divided into 3 groups, (1) Group K (-) experimental animals without treatment, (2) Group K (+), the experimental animal was induced by 150 mg / kg BW of alloxan intraperitoneal (3) The treatment group K (P) animals were induced by 150 mg / kg BW of alloxan intrraperitoneal and 3 days after induction, tomato juice was given 1.75 ml /mouseintragastricfor 14 days.

Alloxan induction

Alloxan monohydrate injection witha dose of 23.22 mg which is dissolved intoNaCL 0.9% intraperitoneally. Solutionalloxan monohydrate is injected only oncethen waited for 3 days forreach a hyperglikemia state

Tomato Juice Making

Tomatoes weighing 200 grams, washed, cut into small pieces, blended for about 5 minutes and filtered using a filter until 100 ml of tomato juice is obtained and weighed to 97.4 grams, so that 1 gram of tomato juice is equal to 1.027 ml.

Measure Triglyceride Levels

The method of checking triglycerides is the colorimetric enzymatic method of GPO-PAP (Glycerol Peroxidase Phosphate Acid), triglycerides will be enzymatically hydrolyzed to glycerol and free acids with special lipases will form a color complex that can be measured using a spectophotometer. [9]

RESULTS

In this study, the results showed that the induction of an increase in the mean blood glucose level of the K (+) group was 401.5 mg / dl compared to the K (-) group of experimental animals without treatment of 195.7 mg / dl. This indicates that there has been a decrease in insulin secretion which results in hyperglycemia.

Measurement of triglyceride levels can be seen in table 1

Table 1. The results of the examination of triglyceride levels

NO	Triglyceride level (mg/dl)		
	K(-)	K(+)	K(P)
1	39	86	66
2	60	73	68
3	39	91	59
4	32	74	21
5	56	62	36
6	23	75	40
7	39	77	58
8	48	53	26
mean	42	73,88	46,75

Note:
K (-) : Group of experimental animals without treatment
K (+): Alloxan induced experimental animal group
K (P): Group of experimental animals induced by alloxan and receiving tomato juice (Solanum lycopersicum)

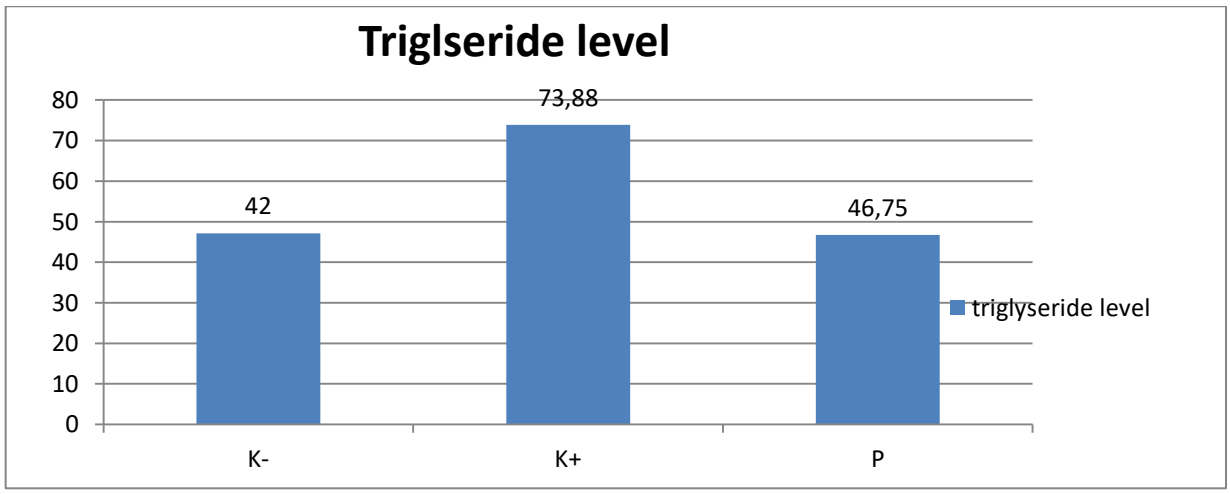

Figure 1. Average Triglyceride Levels of experimental animals

Note:
K (-) : Group of experimental animals without treatment
K (+): Alloxan induced experimental animal group
K (P): Group of experimental animals induced by alloxan and receiving tomato juice (*Solanum lycopersicum*)

From these data, it can be seen that there was an increase in the mean serum triglyceride levels in the experimental animal group which was induced by alloxan, when compared to experimental animals without treatment. A decrease in the mean serum triglyceride levels occurred in the experimental animal group which was induced by alloxan and tomato juice (Solanum lycopersicum), when compared to the experimental animal group which was induced by alloxan.

Furthermore, the analysis of normality test data was carried out and continued with the homogeneity test which showed that the triglyceride levels between groups were normal and homogeneous. Next, the test was carried out to determine whether there were differences between groups using the One-Way Anova test.

And the ANOVA test results showed a significant difference and was followed by the Poshoc test.

Table 2 The Results of Post Hoc Test with LSD Test

Group	Group	p value
K(-)	K(+)	0,001
	K(P)	0,52
K(+)	K(P)	0,001

Based on Table 2 it was found that there was a significant difference in triglyceride levels between the experimental animal group without K (-) treatment and the experimental animal group induced by alloxan with K (+) and there was a significant difference in triglyceride levels between the experimental animal group induced by alloxan K (+) and experimental animal group induced by alloxan and tomato juice K (P) (*Solanum lycopersicum*). There was no significant difference in triglyceride levels in the experimental animal group without K (-) treatment with the experimental animal groupinduced by alloxan and tomato juice K (P) *(Solanum lycopersicum*)**.**

DISCUSSION

Alloxan induction will increasing lipid profile, in this study, reseacher only focused on triglyseride level because it is easier for changes to occur with changes in diet.In this study the alloxan-induced group showed an increase in serum triglyceride levels in experimental animals. This can be seen in the results of data analysis which show that there is a significant difference in triglycerides (p = 0.00) between the experimental animal group without K (-) treatment (42 mg / dL) and the experimental animal group induced by alloxan K (+) (73.88 mg / dL).

Alloxan induction causes an increase in ROS resulting in damage to pancreatic β cells, so that insulin production will decrease and hyperglycemia occurs, this condition triggers lipolysis so that fatty acids in the blood increase. Lipolysis increases the formation of free fatty acids. Free fatty acids will enter the fat tissue or muscle cells by penetrating the endothelium and then re-oxidizing or being converted back into triglycerides [10]. This situation causes VLDL, LDL and triglycerides in the blood to increase (11).

From the results of this study, it was concluded that there was a significant difference between the mean triglyceride levels in the experimental animal group induced by alloxan K (+) with a level of 73.88 mg / dL and the experimental animal group induced by alloxan and tomato juice K (P) with a level of 46 , 75 mg / dL

This study used tomato juice (*Solanum lycopersicum*) because tomato juice (*Solanum lycopersicum*) is known to play a role in reducing triglyceride levels in the blood. Tomato (*Solanum lycopersicum*) is a type of vegetable that contains various kinds of antioxidants, including beta-carotene, vitamins C and E, anthocyanins and lycopene. Lycopene as a potential antioxidant can reduce oxidative stress by providing defense against free radicals and can also inhibit the increase in ROS so that it can prevent hypertriglyceridemia (11).

Giving tomato juice (*Solanum lycopersicum*) which contains lycopene which is a group of carotenoids such as beta-carotene which is responsible for the red color of tomatoes. In the body, lycopene can protect against diseases such as prostate cancer as well as several other types of cancer and coronary heart disease. The ability of lycopene in absorbing single oxygen is twice as good as beta carotene and ten times better than alpha-tocopherol [6, 11]

Tomatoes contain an oxidized fatty acid called 3-oxo-ODA which is an isomer of 9-oxo-oda. 13-oxo-oda is a strong agonist for Peroxisome Proliferator Activated Receptor Alpha (PPARα). PPARα serves as a major regulator for fatty acid oxidation. 13-oxo-oda will activate PPARα causing increased fatty acid oxidation. The increase in fatty acid oxidation will cause a decrease in triglyceride levels in the blood. The activation of PPARα will also lead to an increase in triglyceride levels [12]. In addition, PPARα functions as a regulator of energy balance (lipid

metabolism), especially as a regulator of fatty acid oxidation [13].

Tomatoes that are processed in the form of juice increase their bioavailability, so that they are easier to digest and absorb the active compounds. Fresh tomatoes contain 9-oxo-ODA, processing tomatoes into tomato juice converts 9-oxo-ODA to 13-oxo-ODA. 9-oxo-ODA which is a 13-oxo-ODA isomer, but 13-oxo-ODA is a more potent PPARα agonist than 9-oxo-ODA. PPARα is a member of the receptor family that functions as a regulator of the balance of energy (fat) metabolism. The ligands can be fatty acids or their derivatives, and 13-oxo-ODA. The bond between the ligand and PPARα can activate PPARα and result in a decrease in the concentration of triglycerides in plasma and in tissues [12], so it can be concluded that triglyceride levels in the blood can decrease due to the presence of 9-oxo-ODA found in tomatoes. [12;13, 14.]

The activated PPARα will increase the oxidation of fatty acids in the tissue, so that the fatty acids will be oxidized, this will cause a decrease in the accumulation of triglycerides in the tissue. The activated PPARα will increase the expression of the lipoprotein lipase (LPL) gene so that the lipoproteins that undergo lipolysis will ncrease [12, 15]

From the results of the above research, it can be concluded that giving tomato juice (Solanum lycopersicum) can significantly reduce triglyceride levels in male white rats (*Rattus norvegicus)* Wistar strain induced by alloxan.

CONCLUSION

Alloxan induction can increase serum triglyceride levels of male white rats (Rattus Norvegicus) and administration of tomato juice (Solanum lycopersicum) can reduce serum triglyceride levels of male white rats (Rattus novergicus) wistar strain induced by alloxan.

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