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Research

# The Benefits of Acupuncture Combined with a Low Purine Diet to Improve Uric Acid and Total Cholesterol in Diabetes Mellitus Patients with Hyperuricemia

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## ABSTRACT

**Backround:** Diabetes mellitus with hyperuricemia causes the accumulation of monosodium urate crystals in the synovial joint tissue. The incidence of gout in Indonesia according to the Indonesian Rheumatology Association, namely: gout 1-2 percent of adults, is the most cases of arthritis in men and is estimated to be between 13.6 per 1,000 men and 6.4 per 1,000 women. The prevalence of gout increased with age, an average of 7 percent of men >75 years and 3 percent of women >85 years.
**Subjects dan Method:** Quasi Experimental with pre and post test designs. The research time is between March to September 2021 at the Posyandu for the elderly in Surakarta City. The population of this study were all objects with fasting blood sugar levels between 100 mg/dl - 125 mg/dl and above 126 mg/dl, female blood uric acid levels exceeding 5.6 mg/dl in men and exceeding 6.5 in the city. Surakarta, sample selection using purposive sampling, sample size 40 subjects. The dependent variable is uric acid, cholesterol and total blood levels, the independent variable is combination acupuncture therapy with a low purine diet. The research instrument used a checklist for blood analysis and physical examination. Data analysis using t test.
**Results:** Uric acid levels after acupuncture therapy in the intervention group were lower (Mean= 3.31; SD= 0.61) than the control group (Mean= 5.83; SD= 1.29), and not statistically significant (p= 0.935). Total cholesterol level after acupuncture therapy in the intervention group was lower (Mean= 166.00; SD= 34.20) than the control group (Mean= 222.30; SD= 55.43), but it was statistically non-significant (p= 0.676).
**Conclusion:** Acupuncture therapy can reduce uric acid levels and total cholesterol levels.

**Keywords:** Acupuncture, low purine diet, uric acid level, cholesterol level

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## BACKGROUND

Diabetes mellitus is a disease characterized by high blood glucose levels (hyper-glycemia) caused by the inability of pancreatic beta cells to produce insulin or a lack of insulin sensitivity in these target cells. Also due to abnormal carbohydrate, fat and protein metabolism due to lack of insulin activity in target cells (Kerner and Brückel, 2014).

Hyperuricemia (concentration of uric acid in blood serum is greater than 7.0 mg/dl) causes the accumulation of monosodium urate crystals in the connective tissue of synovial joints. A sudden increase or decrease in serum uric acid levels results in a gout attack. When urate crystals settle in a joint, the body responds to inflammation and begins to attack the gaout. If the attacks occur repeatedly, resulting in a buildup of sodium urate crystals called tofus. Furthermore, monosodium urate crystals settle in the peripheral joint tissues of the body such as the big toes, hands, and ears (Smeltzer and Bare, 2002).

Serum uric acid levels are the result of normal metabolism from the intake of animal and vegetable foods (animal foods, especially from meat, liver, kidneys, and plant foods, especially vegetables such as beans and beans) or from the breakdown of purine compounds that should be excreted through the kidneys, feces, or lightening (Sastiani, 2004).

Hyperuricemia (concentration of uric acid in blood serum is greater than 7.0 mg/dl) for men and more than 6.0 mg/dl for women and causes the accumulation of monosodium urate crystals. A sudden increase or decrease in serum uric acid levels results in a gout attack. When urate crystals settle in a joint, an inflammatory response occurs and a gout attack begins. If the attacks occur repeatedly, resulting in the accumulation of sodium urate crystals called tofus which will settle in the peripheral parts of the body such as the big toes, hands, and ears. The monosodium urate crystals stimulate the formation of immunoglobulin G (IgG). Furthermore, IgG will perform phagocytosis of these crystals, as an immunologic response to the prevention of inflammation (Smeltzer and Bare, 2001).

Traditional Chinese Medicine (TCM) believes that acute gout is triggered by climate change, consumption of foods rich in monosodium urate crystals, alcohol consumption or strenuous physical activity. Gout occurs due to the accumulation of dirty water in one location, gradually forming pockets of water. Water obstruction is triggered by exposure to wind, injuries, blunt object impact. Wounds can generate heat and form moist. Uric acid is thought to moisturize fluid circulation in the joints and block the circulation of qi and blood and cause pain (Cheng et al., 2011).

The Indonesian Rheumatology Association wrote that gout affects 1-2 percent of adults, and is the most cases of inflammatory arthritis in men. The prevalence of gout is estimated to be between 13.6 per 1,000 men and 6.4 per 1,000 women. The prevalence of gout increased with age, averaging 7 percent in men >75 years of age and 3 percent in women >85 years of age. Research in Indonesia by Putra et al. (2019) reported that the prevalence of hyperuricemia in Bali was 14.5 percent, further research on the Sangihe ethnicity in North Minahasa Island by Ahimsa and Karema (2019) reported that the prevalence of gout in North Minahasa Island was 29.2 percent.

Chinese medicine treats patients with hyperuricemia choosing the spleen main meridian Taibai point (SP 3) is the main point (Yuan) spleen meridian, Zusanli point (ST 36) is the ocean point (He) gastric meridian. These two points are chosen to strengthen the function of the spleen and stomach, clear heat and remove moisture. Then add the gastric meridian as a complement, namely: the Fenglon point (St 40) to reduce the plegma and improve the meridian; also choose the spleen meridian, namely the Sanyinjiao point (Sp 6) is the meeting point of the three foot yin

meridians can help strengthen the spleen and kidney, regulate qi and blood, can also clear heat, expedite blockage, remove toxins and dispersion and stagnation (Jun et al., 2000) and sometimes only select the Sanyinjiao point (Sp 6) and the Zusanli point (St 36) only (Lee et al., 2013).

Based on these considerations, this study aims to determine the effect of acupuncture therapy on blood uric acid and cholesterol levels in diabetes mellitus patients with hyperuricemia in Surakarta.

## SUBJECTS AND METHOD

### 1. Study Design

This research was conducted using a quasi-experimental method, with pre-test and post-test designs.

### 2. Population and Sample

The population is all objects with fasting blood sugar values between 100 mg/dl - 125 mg/dl and above 126 mg/dl, female blood uric acid levels exceed 5.6 mg/dl in men and exceed 6.5 in Surakarta City. The sample is using purposive sampling. The number of samples was 40 subjects, divided into 2 groups (treatment group and control group).

### 3. Study Variables

The dependent variable is blood uric acid level and total blood cholesterol. The independent variable was acupuncture therapy combined with a low-purine diet.

### 4. Operational Definition of Variables

Acupuncture therapy is acupuncture therapy technique using fine needle acupuncture at the Shu-points performed bilaterally, namely: Ganshu (BL 18), Pishu (BL 20), and Shenshu (BL 23), Yuan points- bilaterally, namely: Taichong ( LR 3), Taibai (SP 3), and Taixi (KI 3). Mu-acupoints bilaterally, namely: Tianshu (ST 25) and Guanyuan (CV 4). A low-purine diet is consuming foods with low purine levels such as sweet potatoes. Hyper-uricemia is a state of uric acid levels (Uricacid) above normal, women> 6.0 g/dl, men> 7.0 g/dl.

### 5. Study Instruments

To identify the characteristics of the respondents (age and gender using a questionnaire. To identify the blood uric acid status using a checklist character check blood analysis and physical examination.

### 6. Data analysis

Data were analyzed using t-test.

### 7. Research Ethics

This research has obtained ethically appropriate information from the Health Research Ethics Commission of the Surakarta Health Polytechnic with No: LB.02.02/1.1/-2412/2021 on October 26, 2021.

## RESULTS

In the research results, presented the results of univariate analysis which is the sample characteristic data and bivariate analysis which is the result of the analysis of the influence between variables.

**1. Univariate Analysis**

**Table 1. Sample Characteristics**

| Characteristics | Category | Frequence | Percentage |
|---|---|---|---|
| **Age** | <50 | 2 | 10 |
| | 51-55 | 2 | 10 |
| | 56-60 | 7 | 35 |
| | 61-65 | 4 | 20 |
| | 66-70 | 4 | 20 |
| | >70 | 1 | 5 |
| **Fasting Blood Glucose Level** | Pre-diabetes | 3 | 15 |
| | Diabetes | 17 | 85 |
| **Fasting Uric Acid Level** | Female <4.3 / male <5.6 | 9 | 45 |
| | 4.3-5.1 /5.6 - 6.5 | 7 | 35 |
| | Female >5.1 / male >6.5 | 4 | 20 |
| **Fasting Total Cholesterol Levels** | < 200 | 12 | 60 |
| | 201 - 239 | 5 | 25 |
| | > 240 | 3 | 15 |

**2. Bivariate Analysis**

**Table 2. Effect of acupuncture therapy with a low-purine diet on blood uric acid levels**

| Blood Uric Acid Level | Mean | SD | p |
|---|---|---|---|
| **Pre Intervention** | | | |
| Intervention | 4.53 | 1.05 | 0.037 |
| Control | 5.43 | 1.46 | 0. 570 |
| **Post Intervention** | | | |
| Intervention | 3.31 | 0.61 | 0.935 |
| Control | 5.83 | 1.29 | 0.836 |

**Table 3. Effect of acupuncture therapy with a low-purine diet on total blood cholesterol levels**

| Total Blood Cholesterol Level | Mean | SD | p |
|---|---|---|---|
| **Pre Intervention** | | | |
| Intervention | 180.15 | 36.93 | 0.068 |
| Control | 227.20 | 54.42 | 0.837 |
| **Post Intervention** | | | |
| Intervention | 166.00 | 34.20 | 0.397 |
| Control | 222.30 | 55.43 | 0.676 |

## DISCUSSION

A purine is a nucleotide consisting of a nucleoside + a phosphate group and is the basic amine and planar, aromatic and heterocyclic formations. Purines form bonds with pentoses exclusively through the nitrogen atom 9. Purines are the basic ingredients of DNA and RNA, adenine (A) and guanine (G) become purine derivatives.

Purine metabolism problems in the form of gout, have an influence between 12% of the population, characterized by hyperuri-cemia, accumulation of urate crystals in the kidneys to cause nephrolithiasis and joint inflammation (osteoarthritis) due to blockage of reabsorption (reabsorption) or absorption is blocked.

Maiuolo et al. (2015) reported that purines function to form cell formation, forming monomeric precursors of DNA and RNA nucleic acids. Purines also have a contribution to modulate energy metabolism and transduction markers have structural components of many coenzymes and show important roles in the physiology of blood coagulation, muscle and neurotransmission. All muscles require a balanced quantity of purines for growth, proliferation and maintenance of life. Physiological conditions, the enzyme uricase maintains a normal balance of purines in cells that convert uric acid into allontoin so that it is easily excreted by the kidneys with urine. When the production of excess uric acid from purine metabolism will play a role in the occurrence of human disease emergencies. For example, cardiovascular disease is caused by an increase in blood uric acid.

Kris et al. (2020) explained that, purine and pyrimidine metabolism disorders are caused by abnormal biosynthesis and interconversion and purine-adenine and guanine, and pyrimidine-cytosine, thymine and uracil are degraded. Purine metabolism disorders in humans are the final stage of purine metabolism in the form of uric acid. When uric acid levels are abundant in body fluids, uric acid and sodium urate monohydrate crystallize, causing gout. This situation is caused by excessive urate production or reduced urate secretion in the renal tubules or caused by two defects, namely excess production and decreased urate secretion in the renal tubules. In idiopathic gout, it is generally caused by genetic polymorphisms in uric acid transport. While secondary gout is caused by kidney damage, or a defect in the enzyme that facilitates purine synthesis.

Kushiyama et al. (2014) also explained that uric acid is the end product of purine metabolism that can work as an antioxidant, but several studies have reported that hyperuricemia is associated with several diseases, especially metabolic syndrome. There are 2 molecular mechanisms in inflammation associated with uric acid metabolism, namely: activation of inflammation by crystallization of uric acid, and other superoxide free radicals generated by xanthine oxidase (XO). Prevention of hyperuricemia with XO inhibitors has been reported to treat atherosclerosis and nonalcoholic steatohepatitis. The benefits of therapy with XO inhibitors can be useful in protecting the kidneys and heart. It can also reduce the risk of organ failure due to metabolic syndrome.

Several research reports including Ishak (2014) in his research found a significant negative relationship between serum uric acid with fasting blood glucose levels and blood glucose levels 2 hours postpandrial. Other studies have also shown that high blood glucose levels are not associated with high uric acid levels; It is thought that diabetes mellitus undergoes biochemical interactions between blood glucose and purine metabolism with accompanying oricusuria (excretion of uric acid through urine) during the hyperglycemia and glycosuria phases.

Furthermore, according to Pu et al. (2020) and Yu et al. (2018) explained that, the principles and goals of acupuncture therapy in hyperuricemic patients are to eliminate heat and humidity, break phlegm and open blockages, connect collateral meridian channels and facilitate circulation of qi and fluids as well as improve spleen and kidney function to stop pain.

As for the acupuncture points, the Taibai (SP3) point was chosen as the yuan (main) spleen meridian point; Then the Zusanli point (ST36) is the He point (ocean) of the stomach meridian. All these points can

strengthen the function of the spleen and stomach, eliminating heat and moisture. Complementary acupuncture points (additional) namely Fenglong point (ST.40) can reduce phlegma and smooth the meridians and Sanyinjiao point (SP.6) is a cross linking 3 meridians Yin nutrition to strengthen spleen and kidney function, regulate qi and blood and also eliminate dampness, neutralize toxins and break down blockages in the spleen and stomach meridians. In addition to these complementary points, it also uses local points, such as Taichong point (LR.3), Yuan point (Primary) liver meridian, Taibai point (SP.3), Yuan point (Primary) spleen meridian and Dadu point (SP.2). Ying point (Spring) meridian spleen to eliminate heat and toxins in the blood, especially in the joint area. The Waiguan (TE.5) and tender (ashi) points are used for hand joint pain.

The results of this study are also supported by Hisatome et al. (2020) in their research report that, high serum uric acid can increase the risk of developing high LDL, as well as hypertriglycerinemia. Likewise, by Lim et al. (2020) reports the results of his research that, there is a positive correlation between blood uric acid levels and LDL cholesterol levels.

Pang et al. (2000) reported that acupuncture can reduce blood lipid levels, including total cholesterol, low-density lipoprotein cholesterol, triglyceride, and high-density lipoprotein cholesterol levels. Liu et al. (2017) reported that acupuncture and moxibustion have the ability to be an effective therapy of choice in hyperlipidemic patients. Further explained that, acupuncture and moxibustion is a rational therapy in cases of hyperlipidemia. Zhang and Val-Laillet (2021) explained that acupuncture with electrostimulators can reduce blood lipids, especially cholesterol and triglycerides, especially the points Li11, CV12, and ST40 can effectively reduce LDL cholesterol, total cholesterol and triglycerides. According to Ling Li et al. (2014) that ST40 point acupuncture can reduce total cholesterol and triglycerides.

Furthermore Xue-Song et al. (2020) and Ling et al. (2014) described the excitatory effect of electroacupuncture at the ST40 point to induce the expression of nNOS and Mt1 enzymes. NNOS enzymes mediate nitric oxide (NO) signaling and play important roles in cellular signaling, vascular tone, blood pressure, insulin secretion, respiratory tract tone, angiogenesis and intestinal peristalsis.

Mt1 plays an important role in protecting cells against oxidative stress in the body, therefore electroacupuncture is effective in lowering cholesterol and triglycerides.

The functional theory of the nervous system when stimulated through certain acupuncture points encourages the brain stem, cerebral cortex, hypothalamus and finally the hypothalamic-pituitary gland to control chemically through neurotransmitters and hormones, increases cell fat metabolism, blood circulation, sends more oxygen, thereby stimulating and nourishes brain tissue properly and is able to stimulate brain centers related to cell metabolism including: total cholesterol, LDL, HDL and triglycerides. The acupuncture points used to stimulate blood lipid metabolism include: GV20, ST40, ST11, ST12, TH16, TH17.

Based on the results of the study showed that uric acid levels obtained a t-count value of 5.826 compared to the t-table value at n 20 of 0.69) at a significance level of 5% and a $p< 0.001$, in the treatment group total cholesterol was obtained. The calculated t value is 2.756 compared to the t table value at n 20 of 0.68695 at the 5% significance level and the $p= 0.013$,

meaning that there is a significant difference.

## AUTHOR CONTRIBUTION

Researcher I, Researcher II, Researcher III in this study have the same contribution in the preparation of research proposals, research reports, data analysis, revision of research journal articles from the beginning to the end of research activities and publication of research articles.

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## CONFLICT OF INTEREST

There is no conflict of interest in this study.

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