

The Effects of Herbs-Infused Water on Body Weight and Waist Circumference in Patients With Metabolic Syndrome

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Abstract— Adults with metabolic syndrome have higher risks to suffer non communicable diseases like diabetes mellitus and cardiovascular diseases. In daily life, some Indonesian communities have routinely drunk spices and herbs-infused water instead of drinking pure water. However, the efficacy of this mixed water for patients with metabolic syndrome has not been established. The aim of this study was therefore to evaluate the effects of herbs-infused water (HIW) on body weight and waist circumference in patients with metabolic syndrome. This study used a quasi-experiment with pre-posttests control group design. A number of 24 patients who had metabolic syndrome and visited to Cakranegara Health Centre was participated in this study. They were randomly divided into two groups: control group drank water as usual whilst treatment group drank water as usual + 250 ml herbs-infused water for 14 days. Their body weight and waist circumference were measured before and after intervention. There were only 23 research participants who completed this study. Herbs-infused water contained 12,769 ppm of total antioxidant activity. After 14 days treatment, the body weight mean (56.7 ± 9.3 kg) in the treatment group reduced significantly, compared with body weight mean (59.8 ± 10.2 kg) before treatment and (68.1 ± 18 kg) in the control group. In addition, a slightly reduction of waist circumference occurred in the treatment group but not in the control group. In conclusion, regular drinking of 250 ml herbs-infused water for 14 days is able to reduce by 3 kg body weight in patients with metabolic syndrome. This finding may provide an alternative nutrition therapy for metabolic syndrome in future.

Keywords— *metabolic syndrome, body weight, waist circumference, herbs, infused water*

I. INTRODUCTION

Global prevalence of metabolic syndrome is approximately a quarter or more than one billion of population [1] and 21.66% Indonesian people have metabolic syndrome [2]. In addition, 20-25% adults with metabolic syndrome around the world have 3 times higher risk to suffer coronary heart disease [3]. Institute for Health Metrics and Evaluation (2017) also showed that stroke is the highest cause of death in Indonesia, followed by coronary heart disease and diabetes mellitus [4]

The diagnosis of metabolic syndrome mainly relies on the presence of central obesity and followed by two alternative disorders like hyperglycemia, hypertension, hypertriglyceridemia, or low High-Density Lipoprotein Cholesterol (HDL-C) levels [5]. Furthermore, International Diabetes Federation (IDF) and World Health Organization (WHO) confirmed that the main criterion for metabolic syndrome is waist circumference, which reflects to central obesity compared with two other criteria [6]. So far, measurement of waist circumference becomes an important predictor for cardiovascular diseases in adult people with metabolic syndrome [7]. Fat accumulation in adipose tissues induces oxidative stress, resulting in increases of pro-inflammatory cytokines such as interleukin (IL-1 and IL-6) and tumor necrosis factor (TNF- α) and decreases of various adipocytokines including leptin, adiponectin and resistin, which are important factors in energy regulation. All together it will rise insulin resistance and develop into diabetes mellitus [8] [9].

Healthy lifestyle intervention is recently considered as more appropriate management of metabolic syndrome than pharmacological intervention in order to reduce the risk of coronary heart disease [10]. For example, consumption of herbs and herbal products has been investigated for its benefits for the improvement of several metabolic syndrome markers. Those natural products act as food supplements or functional foods since they content bioactive compounds, particularly natural antioxidants [1].

To achieve this goal, infused or detoxified water is one way to bring phytochemical compounds from fruits, vegetables and herbs entering the human body [11]. This method has been widely used and developed in the community, but lacking of scientific evidence. Basically, infused water can replace plain water to provide the daily requirement of body fluids for water hydration [12]. The other benefits provide some micronutrients and bioactive compounds such as carotenoids (vitamin A precursor), tocotrienols, tocopherols (vitamin E), ascorbic acid and polyphenols (flavones, flavanones, anthocyanins, isoflavones and catechins) [13]. Therefore, the aim of this study was to investigate the effects of herbs-infused water on body weight

and waist circumference of patients with metabolic syndrome.

II. MATERIALS AND METHOD

A. Study Design and Participant Selection

A quasi-experimental study with pre-posttest control group design was conducted adult patients with metabolic syndrome for one month (February 2020). They were recruited from Cakranegara Primary Health Center, Mataram City, West Nusa Tenggara and fulfilled research criteria: aged between 18-60 years old and had normal activities. On the other hand, patients who were reported to have acute inflammatory conditions, took antioxidant supplements, got pregnant or breastfeeding, received insulin injection, smoked and consumed alcohol excluded from this study.

To diagnose metabolic syndrome, we collaborated with the general physician in that Primary Health Care and used the IDF criteria: waist circumference ≥ 90 cm (males) and ≥ 80 cm (females) with two or more other parameters: fasting blood glucose level ≥ 100 mg/dl, blood pressure $\geq 130/85$ mmHg, triglyceride level (TG) ≥ 150 mmHg, and HDL-C levels for men ≤ 40.0 mg/dl and for women ≤ 50 mg/dl or had history of dyslipidemia treatment. The Research and Ethics Committee at RSUD dr. Moewardi Surakarta, Central Java approved this study protocol and consent form.

The participants were divided into control and treatment groups. Herbs-infused water was given in treatment group for 14 days combined with dietary counseling, otherwise control group only received dietary counseling. Routine daily pure water consumption and activities were not intervened in both groups. Daily food intakes were recorded with exception in special days, for examples feast or fasting days.

B. Data Collection and Statistical Analysis

Firstly, all patients with metabolic syndrome were screened by personal interview and filled food record and physical activity short form questionnaires. Eligible patients were then measured their body weight and waist circumference, which were carried out in the morning of the beginning and end of this study. All data were processed using SPSS program for statistic version 17.0. Mean \pm standard deviation was used to present numeric data whilst frequency was for categorical data. Normality and homogeneity data were evaluated using Shapiro-Wilk and Lavene test respectively. To compare mean differences between before and after treatment in control and treatment groups, we used independent and paired t-tests for data with normal distribution or Mann Whitney and Wilcoxon tests for data with non-normal distribution. Finally, we considered a significant difference as p value < 0.05 .

C. Herbs-Infused Water Preparation and Procedures

Spices and herbs used in this study were 2.5 g coriander, 2 g cinnamon, 5 g ginger and 5 g turmeric, which were obtained from a local market in Bertais district. Firstly, all materials were washed with tap water whereas cleaned ginger and turmeric were peeled and sliced thinly. A combination of herbs were then brewed with 250 ml hot

water. After that, the herbs-infused water was allowed to cool at room temperature for at least 9 hours and poured into bottles. Some samples of herbs infused water were examined for antioxidant activity level at Pratama Chem-Mix Laboratory, Yogyakarta.

III. RESULT

A. General Characteristic of Research Participants

Twenty four adult with metabolic syndrome participated in this study but one research participant resigned at the end of the study. They were 23 total participants who divided into control (n=11) and treatment (n=12) groups. Table 1 showed that general characteristics of research participants in the treatment group were similar to the control group. Female was more dominant than male in both groups. Lower average of BMI was observed in research participants in the treatment group (25.8 \pm 5.8 kg/m²), compared to their counterparts (28.1 \pm 6.8 kg/m²). In addition, the majority of research participants in both groups had moderate physical activity.

B. Effect of herbs-infused water on body weight and waist circumference

Although body weight and waist circumference are a poor predictor for fat distribution, these anthropometric measurements remain important for assessing metabolic risk of clinical and epidemiology studies in developing countries including Indonesia. The participants weight before intervention did not diverse significantly between two groups (p=0.09). On the contrary, there was significantly different on body weight after 14 days infused water consumption (p=0.024). Significant weight loss after intervention mainly occurred in treatment group (p=0.000).

The average waist circumference of participants at the beginning of the study was significantly different between two groups (p=0.049). Furthermore, significant differences were also found in the mean waist circumference after treatment (p=0.005).

TABLE I. GENERAL CHARACTERISTIC OF RESEARCH PARTICIPANTS (N=23)

Variables	Treatment group (n=12)	Control Group (n=11)	p
Age (y)	52.25 \pm 3.5	50.73 \pm 3.1	0.283 ^a
Sex			0.493 ^b
Male	1(8.3)	2(18.2)	
Female	11(91.7)	9 (81.8)	
BMI(kg/m ²)	25.8 \pm 5.8	28.1 \pm 6.8	0.420 ^a
Waist Circumference (cm)	91.97 \pm 5.8	98.6 \pm 9.3	0.049 ^a
Male	90 \pm 0.0	93.5 \pm 0.7	
Female	92.14 \pm 6.0	99.8 \pm 9.8	
Physical Activity			0.732 ^b
Mild	3(25)	2(18.2)	
Moderate	8(66.7)	8(72.7)	
Severe	1(8.3)	1(9.1)	

^a. Data are presented in n(%) or mean \pm SD. a = independent t test or b = Mann Whitney test.

TABLE II. ANTIOXIDANT ACTIVITY IC₅₀ OF HERBS INFUSED WATER

Test	Results
Antioxidant activity IC ₅₀ (ppm)	12,769.22

TABLE III. CHANGES IN BODY WEIGHT BEFORE AND AFTER INTERVENTION IN PATIENTS WITH METABOLIC SYNDROME

Group	Body weight (kg)		Δ	p
	Before	After		
Treatment	59.8±10.2	56.7±9.3	-3.1	0.000 ^a
Control	69.6±18.1	68.1±18.0	-1.5	0.212 ^a
p	0.09 ^b	0.024 ^b		

^b a = Paired t-test b = Mann Whitney test

TABLE IV. CHANGES IN WAIST CIRCUMFERENCE BEFORE AND AFTER INTERVENTION IN PATIENTS WITH METABOLIC SYNDROME

Group	Waist Circumference (cm)		Δ	p
	Before	After		
Treatment	91.97±5.8	89.5±6.9	-2.5	0.118 ^a
Male	90±0.0	86±0.0	-4.0	
Female	92.14±6.0	89.8±7.1	-2.3	
Control	98.6±9.3	99.9±9.1	+1.3	0.647 ^a
Male	93.5±0.7	90.0±5.7	-3.5	
Female	99.8±9.8	102.1±8.3	+2.3	
p	0.049 ^b	0.005 ^b		

^c a = paired t-test b = independent t-test

Consumption of infused water for 14 days did not show significant differences in waist circumference in the treatment group (p=0.118) or the control group (p=0.648).

IV. DISCUSSION

Antioxidant activity in this study examined use a quantitative DPPH (2,2-diphenyl-1-pikrilhidrazil) method. This method was to measure radical captured by antioxidant from a compound using UV-Vis Spectrophotometry and it expressed by IC₅₀ (Inhibitory Concentration) value. In other words, IC₅₀ value is the ability of compounds to reduce free radicals by 50%. It categorized to three levels as follows: very strong if less than 50 ppm, strong 50-100 ppm, moderate 100-150 ppm, weak 151-200 ppm, very weak > 200 ppm [14]. The smaller IC₅₀ value indicates that sample is more active as an antioxidant. Although herbs infused water has antioxidant values classified as very weak, it still stronger than Manalagi or Rome Beauty fresh apple. Antioxidant IC₅₀ value of Rome Beauty apples is 49,870.8 ppm [15], while Manalagi apples is 36,848.9 ppm [16].

The average waist circumference of participants was 95.2 centimeter with standard deviation 8.2 centimeter. After 14 days intervention, the waist circumference decreased by 2.47 cm in the treatment group, while in the control group it increased by 1.3 cm. reduction in waist circumference in treatment group was followed by significant weight loss of 3.1 kg (p=0,000). Previous studies have shown that regular consumption of cinnamon for 8 weeks by 3 g can reduce body weight and body mass index of type 2 diabetes mellitus patients [17]. Other studies on normal obese subjects by giving 4 g of cinnamon capsules for 56 days showed a decrease in BMI, but not significantly different [18]. Waist circumference can be the best predictor of oxidative stress, shown in a study of Awadallah et al. in subjects with large waist circumference showed significantly lower levels of

antioxidant enzymes and GSH, thus higher levels of MDA and carbonyl protein [19].

Cinnamon can interfere lipogenic processes, regulate the expression of transcription factors and target genes directly involved in lipogenesis. Consequently, it enables molecular adaptation that can prevent an increase in circulating cholesterol levels and lipid accumulation in adipose and liver tissue [20]. Ginger extract can regulate glycogen and inhibit gluconeogenesis process. In addition, ginger increases significantly on glycogen content, especially in kidney, but not significant in liver and muscle glycogen [21].

In the other study, giving coriander powder of 2 g/day for 40 days to hyperlipidemic subjects showed a reduction in BMI but not significant [22]. Linalool as a component of coriander is known to be able to reverse the profile of hyperlipidemia by modulating gene expression related to glucose metabolism, utilization of fatty acids and major lipogenic genes [23]. Curcumin in turmeric shows the inhibitory effect of adipocyte proliferation and differentiation as well as increased catabolism in adipose tissue [24]. A meta-analysis by Akbari et al. concluded that intake of curcumin in patients with metabolic syndrome had a significant effect in reducing BMI, waist circumference and leptin levels, and increasing adiponectin levels [25].

Herbs infused water in this study can be an alternative drink to help reducing body weight although it is not significant alleviate waist circumference in metabolic syndrome patients. A decline in weight and waist circumference in obese people through diet management and lifestyle regulation can improve other components metabolic syndromes [26]. Metabolic syndrome that controlled by weight and waist circumference loss can improve the prognosis of the disease in the future [27].

V. CONCLUSION

To summarize, regular consumption of 250 ml herbs-infused water for 14 days is able to reduce by 3 kg body weight in patients with metabolic syndrome.

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