

Dietary Goat Milk Potential in Prevention of Hypertension in Sedentary Women

Yusni

Department of Physiology, Faculty of Medicine, Syiah Kuala University, Indonesia

yusni@unsyiah.ac.id

Abstract— There are persistent rumors in Indonesia, including Aceh people that the consumption of goat milk can effect to increases blood pressure (BP) and cause of hypertension, but there is no scientific evidence to support this. This research was conducted to analysis the effect of dietary goat milk on blood pressure and it's relation with serum calcium in sedentary women. This research were randomized clinical trial with randomized double blind design, using 18 sedentary women aged 18-19 years. The treatment was goat's milk 250 ml/day, given at 8:00 to 09:00 pm, for 110 days. The result showed that systolic (101.11 ± 3.09 and 93.33 ± 1.66 vs 112.22 ± 3.23 and 110 ± 2.88 mmHg) and diastolic blood pressure (70 ± 2.35 and 67.78 ± 3.32 and 75.56 ± 1.75 and 80 ± 2.34 mmHg) in the trial group decreased significantly ($p < 0.05$) compared to the control group, after treatment. There were significant ($p < 0.05$) differences of serum calcium in treatment between control group (8.9 ± 0.05 ; 9.3 ± 0.09 vs 9.08 ± 0.06 ; 9.56 ± 0.14 mg/dl) and significant ($P < 0.05$) correlation was found between serum calcium and systolic ($r = 0.68$, $t = -0.38$, $p = 0.04$ mmHg) and diastolic blood pressure ($r = 0.76$, $t = -2.24$, $p = 0.01$) after treatment. It can be concluded that goat's milk lowers blood pressure and prevent hypertension in sedentary women.

Keywords— blood pressure, calcium, goat milk, exercise, hypertension, untrained

I. INTRODUCTION

Hypertension is the most common condition seen in primary care and leads to myocardial infarction, stroke, renal failure, and death if not detected early and treated appropriately [1]. Hypertension remains one of the most important preventable contributors to disease and death. Hypertension is defined as a Systolic blood pressure equal or greater than to 140 mmHg or diastolic blood pressure equal or greater than to 90 mmHg, or currently taking medication to lower high blood pressure [1], [2]. Hypertension affects more than 50 million Americans, and can lead to the development of cardiovascular disease, stroke, and renal failure. [3], [4], [5] According to World Health Organization, 2014, Incident of high blood pressure in Indonesia about 29.1% (males) and 26,6 (females), a total 27.8% Indonesian people.

[6] Incident of hypertension in Aceh, Indonesia about 19,5–46,1% (average 30,2%) [7].

The cause of hypertension is multifactor, including lifestyle: food consumption patterns. Habits of the people of Aceh since a long time is consumed goat meat or in the Achenese language called "Kare kambing or Kuah Beulangong". The myth that has long been developing in Indonesia, including Acehnese are eating goat meat will increase blood pressure resulting in hypertension and would be the same if we consume goat milk. But this has not been vetted. However, some experts actually found the opposite, consume goat milk can actually reduce the blood pressure [8]. High calcium content in goat milk is allegedly one of the factors that influence the blood pressure [9], [10], [11]. On this basis that we are interested to study the effect of goat milk consumption on blood pressure.

Non-pharmacological approach such as dietary modification likes goat milk plays an important role in controlling blood pressure [2], [4]. Dietary goat milk regularly may be could reduce blood pressure in normotensive patient. Goat milk components such as sodium, potassium, calcium, and magnesium have been studied substantially in the past decades [2], [4]. Low levels of calcium, either due to dietary deficiencies or altered calcium metabolism, have been linked by several epidemiological and laboratory studies to higher blood pressure, or hypertension [12], [13]. Disturbances in calcium metabolism that cause calcium deficiency have been linked to abnormal blood pressure control. [12] This study aimed to analyse the influence of goat milk on blood pressure reduction that goat milk can be used as an antihypertensive.

II. METHODS

A. Research Design

This research was randomized clinical trial (randomized double-blind design). Subjects are sedentary women with normotensive patient. A total of 18 subjects in the age group of 18-19 years participated in the study. They were divided into two groups: (1) control group (without given goat milk) and (2) trial group (given goat milk). Selection of subject research conducted by simple random sampling using a lottery system.

B. Treatment procedures, examination of Serum Calcium Levels and Blood Pressure

The treatment was fresh goat's milk. Before it was given, the milk is checked in the lab. Goat milk dose given is 1x250 ml / day, given in the morning at 8:00 am to 9:00 pm, for 110 days. Before collecting the blood sample, subjects were fasted for 10-12 hours from 8:00 pm-20.00 pm. The collection of a blood sample performed in the morning (07:00 to 8:30 pm). Examination of serum calcium was conducted using O-cresolphthalein complexone, using a photometer 4010. Normal serum calcium levels are 8.6 to 10.3 mg / dl. Measurement of blood pressure are conducted using mercury sphygmomanometer. Examination of blood pressure (systolic and diastolic) and serum calcium levels before and after administration of goat's milk.

C. Data analysis and Ethical Clearance

Analysis of the data used: test of homogeneity of variance according to Levene's test ($p > 0.05$), test of normality of Kolmogorov-Smirnov ($p > 0.05$), paired t-test ($p < 0.05$) and Pearson correlation test ($p < 0.05$).

This research has been conducted based on the ethical considerations of the Medical Research Ethics Committee at the Faculty of Medicine, University of Syiah Kuala in Banda Aceh, according to the letter number 304 / KE / FK / 2015.

III. RESULTS AND DISCUSSION

A. Characteristics of research subjects

Table 1 shows that the characteristics of the research subjects such as: age (years), weight (kg), height (cm), body mass index ($BMI = kg / m^2$) between trial and control group was not significantly different ($p > 0.05$).

B. Homogeneity test

The results of the test homogeneity of variance using Levene-test ($p > 0.05$) on systolic and diastolic blood pressure and serum calcium levels indicate that the data variance is homogeneous Table 2.

C. Normality test

The results of the normality test Kolmogorof-Smirnov ($p > 0.05$) on blood pressure and serum calcium levels indicate that the data has a normal distribution, as listed in Table 3.

D. Differences Effect of Goat Milk on Blood Pressure and Serum Calcium Levels

Comparison of the average and paired t-test of systolic and diastolic blood pressure and serum calcium levels before and after administration of goat milk between trial and control groups, as shown in Table 4.

TABLE I
COMPARISON OF MEAN VALUE FOR AGE, WEIGHT, HEIGHT AND BMI BETWEEN TRIAL AND CONTROL

Variables	Trial group		Control group		t value	p-value
	Mean	SD	Mean	SD		
Age (years)	18.77	0.44	18.66	0.50	0.50	0.62
Weight (kg)	51.77	8.60	47.72	3.91	1.28	0.21
Height (cm ²)	154.33	2.69	153.56	2.12	0.68	0.50
BMI (kg/m ²)	21.80	3.98	20.25	1.77	1.06	0.30

TABLE II
TEST HOMOGENEITY OF VARIANS FOR SYSTOLIC, DIASTOLIC AND SERUM CALCIUM BETWEEN TRIAL AND CONTROL

Variables	Groups	Levene statistic-F	p- value
Systolic (mmHg)	Trial	0.37	0.67
	Control		
Diastolic (mmHg)	Trial	0.18	0.78
	Control		
Calcium (mg/dl)	Trial	0.07	0,55
	Control		

TABLE III
TEST OF NORMALITY FOR SYSTOLIC, DIASTOLIC AND SERUM CALCIUM BETWEEN TRIAL AND CONTROL

Variables	Trial group		Control group	
	Kolmogorof-Smirnov Z	p- value	Kolmogorof-Smirnov Z	p- value
Systolic (mmHg)	0.27	0.48	0.34	0.30
Diastolic (mmHg)	0.27	0.44	0.35	0.40
Calcium (mg/dl)	0.28	0.16	0.33	0.10

TABLE IV
PAIRED T TEST FOR SYSTOLIC, DIASTOLIC AND CALCIUM SERUM BETWEEN TRIAL AND CONTROL

Variables	Groups	Data	N	Mean±SD	t test	p- value
Systolic (mmHg)	Trial	Pretest	9	101.11±9.27	-3.5	0.00*
		Posttest	9	93.33±5.00		
	Control	Pretest	9	112.22±9.71	-1.51	0.16
		Posttest	9	110.00±8.66		
Diastolic (mmHg)	Trial	Pretest	9	70.00±7.07	0.68	0.51
		Posttest	9	67.78±9.71		
	Control	Pretest	9	75.55±5.27	2.53	0.03*
		Posttest	9	80.00±0.00		
Calcium (mg/dl)	Trial	Pretest	9	8.90±0.16	4.66	0.00*
		Posttest	9	9.36±0.29		
	Control	Pretest	9	9.08±0.20	3.87	0.16
		Posttest	9	9.56±0.14		

TABLE V
PEARSON CORRELATION TEST FOR CORRELATION BETWEEN SYSTOLIC AND CALCIUM SERUM BETWEEN TRIAL AND CONTROL GROUPS

Groups	R	T	p- value
Trial	0.76	3.14	0.04
Control	0.06	2.30	0.48

Notes: Correlation (r): ≥0,70 = strong correlation; .40-.69 = Moderate correlation; Low correlation = 0.20 to 0.39; .00-.19 = Correlation is very low

Results of paired t test ($p < 0.05$) showed that the average value of systolic blood pressure after treatment goat milk in the trial group showed a significant reduction ($p = 0.00$), while diastolic blood

pressure decreased but not significant statistically ($p = 0.51$). In contrast, the average diastolic value in the control group increased after the administration of goat milk ($p = 0.03$). The average value of the

serum calcium level after the administration of the goat milk in the trial group increased significantly ($p < 0.05$); while the average of serum calcium levels in the control group did not increase ($p < 0.05$), as shown in Table 4. The results of this study indicate that: giving goat milk can lower systolic blood pressure ($p = 0.00$) and stimulate increased serum calcium levels ($p = 0.00$).

The correlation between a decrease of systolic blood pressure with an increase of serum calcium levels in trial group performed a Pearson correlation test (r), $p < 0.05$. The results of Pearson correlation test (r), $p < 0.05$ indicates a strong correlation significance ($p = 0.04$) between systolic blood pressure and serum calcium. That is a decrease in systolic blood pressure was associated with increased serum calcium levels in sedentary women. The results of Pearson correlation test (r) can be seen in Table 5.

The results of this study showed that the consumption of goat milk regularly can lower systolic blood pressure in sedentary women with normotensive and a decrease of systolic blood pressure was associated with increased serum calcium levels. Calcium plays a role in blood pressure (BP) regulation, but the importance of supplemental calcium intake for the prevention of hypertension is still debated [14]. Dietary deficiencies or altered calcium metabolism can result in low serum calcium levels. Disturbances in calcium metabolism include increased urinary calcium excretion and abundance of calcium-regulating hormones such as parathyroid hormone and calcitriol. These hormones cause decreases in bone mineral content and increase intracellular calcium in vascular smooth muscle. Increased $[Ca^{2+}]$ produces contraction and therefore vasoconstriction. Low calcium levels and elevated PTH and calcitriol may also affect blood pressure control by the central and peripheral nervous systems by stimulating the release of norepinephrine (a potent vasoconstrictor) and increasing its post-synaptic effect [15]. Calcium supplementation (1g/day) may significantly reduce systolic BP by 1.9 mmHg and diastolic BP by 1.0 mmHg. The BP effect tended to be more pronounced in populations with a habitually low calcium intake (2.6/1.3 mmHg). Blood pressure

showed no further decrease when calcium doses exceeded 1 g/day. [14] Goat milk contains protein, lipid, carbohydrate, vitamin and mineral [11]. Goat milk is reported to have higher content of Potassium, Calcium, chloride, Phosphorus, Selenium, Zinc and Copper than cow milk. [16], [17]. Administration of calcium salts have had the effect of reducing hypertension in the spontaneously hypertensive rat and also models of salt-sensitive hypertension rat [3], [13], [14], [15]. Effects of dietary calcium in human have varied from study to study. Increased calcium results in lower blood pressure. Increases in calcium intake produced a mild antihypertensive response, with the average decrease of 4-7 mmHg systolic and 2-4 mmHg diastolic [12]. Increased calcium intake like goat milk reduces risk of hypertension.

Goat milk has a distinct antihypertension impact and its specific composition may result in the decreased blood pressure [11]. An in-vitro study has shown that human who had been consumption goat milk were triggered to release nitric oxide (NO). Goat milk was able to active NO release from blood cells. NO is a vasodilator substance and exerts a cardio-protective and anti-atherogenic affect [18]. Goat milk also contain casein. Casein derived from goat milk yogurt showed blood pressure lowering effect and caused major changes of the SBP in the treated DOCA-salt hypertensive rats for more than 50mmHg [19].

IV. CONCLUSIONS

It is concluded that: (1) Consumption of goat milk regularly can lower systolic blood pressure in sedentary women with normotensive, (2) Consumption of goat milk regularly may increase serum calcium levels in sedentary women with normotensive, (3) The decrease in blood pressure due to consumption of goat milk regularly associated with increased serum calcium levels in sedentary women with normotensive.

ACKNOWLEDGMENT

We acknowledge the ministry of research and technology higher education Republic of Indonesia for funding this project and Institute for Research and Community Service (LPPM) of Syiah Kuala University Banda Aceh for overseeing the project

and administering the contract. Thank to Clinical Laboratory of Prodia Banda Aceh for the collaboration and supported this research.

CONFLICT OF INTEREST

This article does not have a conflict of interest with the various parties and this article is an original article that has not been published. None of the authors had an existing or potential conflict of interest with this article.

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