Original Research Article

Daily consumption of Ambon banana (*Musa paradisiaca var. sapientum*) improve cardiometabolic indicators and reduce plasma MDA levels in adult male with central obesity

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ABSTRACT

This study aimed to determine the effect of Ambon banana fruit consumption on plasma malondialdehyde (MDA) levels and other cardiometabolic indicators in adult men with central obesity. A total of 30 volunteers were involved. The volunteers were examined for their plasma MDA levels and cardiometabolic indicators before and after treatment. The results showed that consuming Ambon banana fruit at breakfast for 28 days significantly reduced body weight, BMI, waist circumference, and systolic and diastolic blood pressure ($p<0.05$). Consuming Ambon banana at breakfast for 28 days improved cardiometabolic indicators and reduced plasma MDA levels in men with central obesity.

***Keywords*:** Ambon banana; central obesity; cardiometabolic indicator

INTRODUCTION

Central obesity is defined as excess fat accumulation in subcutaneous fat tissue and abdominal visceral fat. This condition is a form of non-functioning subcutaneous fat tissue in the face of an energy imbalance in the body. This body energy imbalance, among others, is caused by increased nutritional intake and lack of physical activity [1].

People with obesity tend to experience an increase every year, especially in developing countries, including Indonesia. Lampung Province is one of the provinces with a large number of obese people in Indonesia. The results of Riskesdas in 2013 showed that 13 % of obese people in the population aged over 18 years in Lampung Province. It is much higher than the last survey data in 2007. Similar to obesity, central obesity also tends to increase. In 2007, the prevalence of central obesity was still 13 %, but in 2013 it increased to 19 % [2].

Central obesity is characterized by an increase in waist circumference or the ratio of waist circumference to hip circumference. Central obesity triggers disturbances in fatty acid regulation, resulting in higher cholesterol, triglycerides, LDL, total fat and saturated fatty acids [3,4]. Several studies have revealed that changes in cardiometabolic indicators in central obesity, such as an increase in waist circumference, LDL levels, as well as higher blood pressure, are risk factors for cardiovascular disease [5-7]. In Indonesia, cardiovascular disease is one of the leading causes of death. It is estimated that there are 30 % of deaths from cardiovascular disease [8].

Central obesity is also associated with oxidative stress. Central obesity is known to increase lipid peroxidation [9]. Lipid peroxidation is an oxidation process in polyunsaturated fatty acids by free radicals, forming aldehyde compounds, such as malondialdehyde (MDA) [10,11]. Previous studies have shown a significant increase in MDA blood levels in obese people compared to healthy people [12,13]. Increased MDA levels are also closely related to increased plasma cholesterol levels and hypertension [14].

Bananas are one of the most consumed fruits. Traditionally, the consumption of bananas is believed to improve the digestive system, lower blood pressure, prevent heart disease and strengthen bones [15]. Bananas are rich in various nutrients, such as vitamins (A, C, B6 and B12) and minerals (potassium, iron, magnesium and calcium) [16]. Bananas are also rich in fibre which is slower to digest, thus making us feel full longer, reducing calorie intake, which will lead to weight loss. Consumption of banana flour has been shown to reduce weight in obese rats [17]. Ambon banana (*Musa paradisiaca var Sapientum*) is one of the most popular bananas in Indonesia. Besides being rich in nutrients and fibre, Ambon bananas also

have a high antioxidant content. Ambon bananas are rich in saponins and tannins, which can reduce blood cholesterol levels [18,19]. Therefore, Ambon banana intake is predicted to inhibit lipid peroxidation and improve cardiometabolic indicators such as body weight, BMI, waist circumference, abdominal circumference and systolic and diastolic blood pressure in adult males with central obesity.

MATERIALS AND METHODS

A total of 30 adult male volunteers with central obesity with a waist circumference of more than 90 cm, not on a diet, not on medication, not addicted to alcohol and drugs, and do not have physical abnormalities were involved in this study. All volunteers have signed written informed consent. This research has passed the ethical review of the Health Research Ethics Committee of the Medical Faculty, the University of Lampung with the EC number 2542/UN26.18/PP.05.02.00/2022.

Experimental Design

In this study, all volunteers were asked to consume 250 g of Ambon banana at breakfast every day for 28 days. The number of bananas consumed by the volunteers was obtained based on the number of bananas that humans can tolerate every day and the results of a previous study by Cressey *et al*. in 2014 earlier [16]. Cardiometabolic indicators, such as body weight, BMI, waist circumference, abdominal circumference and blood pressure, and plasma MDA levels of volunteers, were examined before and after 28 days of treatment.

MDA Assays

The volunteers' venous blood samples were collected before and after treatment for 28 days. Venous blood was taken using a five-cc vacutainer and then centrifuged until the serum was separated. The serum obtained was stored at -20 °C until the time of testing. MDA levels were tested using a modified Thiobarbituric Acid (TBA) method spectrophotometrically [20].

Statistical Analysis

Statistical analysis was performed using SPSS version 23. Descriptive statistics were presented in terms of mean±SD and median (Min-Max). Differences in the mean levels of MDA and cardiometabolic indicators before and after treatment were tested using the paired T-test and the Wilcoxon single-rank test at 95 % confidence intervals.

RESULTS

General Characteristic

This study was conducted on 30 adult men with a mean age of 43.60±10.38 years. Most of the samples were in the age range of 46-56 years (53.3 %). The average height of the sample was 166.67±4.92 cm, with an average weight of 84.29±12.04 kg and a median BMI of 29.38 (25.07–38.67). All samples had a waist circumference of more than 90 cm, with a median waist circumference of 98.50 (91–119) cm. The sample also had a systolic blood pressure higher than the normal systolic blood pressure, which was 130.50 (115–145) mmHg. In line with the systolic pressure, the median diastolic blood pressure of the sample was also higher than the normal diastolic pressure, which was 84.00 (70–95) mmHg (Table 1).

Daily Consumption Ambon Banana Fruits Improves Volunteer Cardiometabolic Indicators

The results showed that taking Ambon bananas at breakfast for 28 days was able to reduce body weight by 2.48 % and BMI by 2.41 %. Waist circumference also decreased by 2.54 % (Table 2). The results of paired T-test and Wilcoxon showed a significant reduction in body weight, BMI and waist circumference ($p<0.05$) after 28 days of treatment (Figure 1). Despite the decline, the BMI and waist circumference of the sample did not match the recommended normal reference value.

Table 1. General Characteristic

Parameter	Mean±SD / Median (Min-Max) n=30	Normal Value
Age, tahun	43.60±10.38	
-. 25 – 35 years	6 (20.0%)	
-. 36 – 45 years	8 (26.7%)	
-. > 46 years	16 (53.3%)	
Height, cm	166.67±4.92	
Body Weight, kg	84.29±12.04	
IMT, kg/m^2	29.38 (25.07 – 38.67)	18 – 25
Waist Circumference, cm	98.50 (91 – 119)	< 90 cm
Systolic pressure, mmHg	130.50 (115 – 145)	120
Diastolic pressure, mmHg	84.00 (70 – 95)	80

This study also showed that the intake of Ambon banana reduced systolic blood pressure by 4.98 % and diastolic blood pressure by 4.76 % (Table 2). Wilcoxon test results showed a significant decrease in systolic and diastolic pressure ($p<0.05$) (Figure 2).

Besides reducing various metabolic indicators, the intake of Ambon banana for 28 days was proven to reduce MDA plasma levels, which are markers of oxidative damage, by 11.42 % (Table 2). Paired T-test results showed a significant decrease in MDA levels in the sample after treatment (Figure 1).

Table 2. Levels of Metabolic Indicators and MDA Before and After Ambon Banana Treatment

Parameter	Before	After	%Δ
Body Weight, kg	84.29±12.04	82.20±11.25	2.48 %
IMT, kg/m^2	29.38 (25.07 – 38.67)	28.67 (24.85 – 37.97)	2.41 %
Waist Circumference, cm	98.50 (91 – 119)	96.0 (90-117)	2.54 %
Systolic pressure, mmHg	130.50 (115 – 145)	124.00 (116 – 138)	4.98 %
Diastolic pressure, mmHg	84.00 (70 – 95)	80.00 (70 – 91)	4.76 %
MDA, nmol/mL	7.18±0.12	6.36±0.17	11.42 %

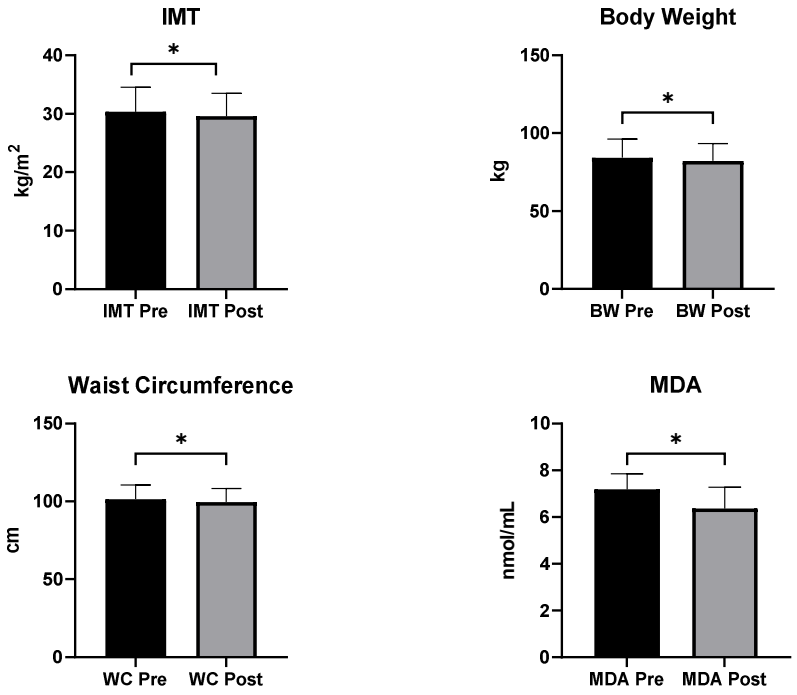

Figure 1. Comparison of body weight, BMI, waist circumference and MDA plasma levels before and after treatment. Note: * indicates a significant difference based on paired T-test and Wilcoxon at =0.05.

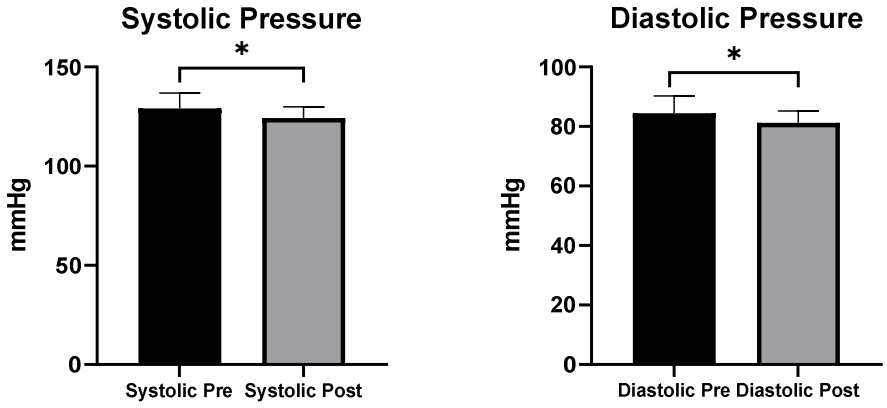

Figure 2. Comparison of systolic and diastolic blood pressure before and after treatment. Note: * indicates a significant difference based on the Wilcoxon test at =0.05.

DISCUSSION

Central obesity is the accumulation of fat in the visceral area associated with various degenerative diseases, such as cardiovascular disease, metabolic syndrome and insulin resistance [21-23]. Central obesity can be measured by indicators of BMI and waist circumference. All respondents in this study were adult men with obesity and central obesity. It is evidenced by the BMI and waist circumference of all respondents, which are higher than the normal range (Table 1).

Age is one of the factors that influence the incidence of central obesity. The older a person's age, the more weight will tend to increase [24]. The results of this study support this statement. In this study, the prevalence of men with central obesity increased with the increasing age of the volunteer. Central obesity was most commonly found in the age group over 46 (Table 1). This result is in line with a previous study which found that central obesity was most commonly found in the age range of 40-59 years [25]. The tendency of obesity in older men can be caused by unhealthy consumption patterns, low physical activity, and slower body metabolism than younger men [26].

People with central obesity generally tend to develop hypertension [27]. A study in Brazil even found that for every 1 cm increase in waist circumference, there will be an increase in the risk of developing hypertension by 1,045 times [28]. In line with this study, a recent study showed that the mean systolic and diastolic blood pressure was higher than the normal reference value (Table 1). Hypertension in centrally obese patients is usually associated with excess visceral fat that causes insulin resistance. The presence of insulin resistance can reduce the nitric oxide produced by endothelial cells. Nitric oxide is usually used to stimulate vasodilation in vascular tissue. Therefore, the presence of insulin resistance will reduce the ability of vasodilation of vascular tissue, thus causing hypertension [29].

Ambon banana is one of the most consumed fruits by the people of Indonesia. Ambon bananas are known to be rich in various antioxidants, such as saponins and tannins, which have been shown to reduce blood glucose levels and are antihyperlipidemic in this study, consuming Ambon banana fruits at breakfast for 28 days significantly reduced

body weight, BMI, waist circumference and systolic and diastolic blood pressure (Figures 1 and 2). It is related to the ability of saponins and tannins, which are found in Ambon bananas, to reduce body fat. Saponins and tannins are known to be able to lower cholesterol, by increasing secretion and preventing reabsorption [30], decreasing enterohepatic circulation of bile acids [18], and inhibiting their biosynthesis [19].

In addition to reducing these metabolic indicators, the intake of Ambon banana fruit has also been shown to reduce oxidative damage in patients with central obesity. It is evidenced by the decrease in respondents' MDA levels after consuming Ambon bananas for 28 days (Figure 1). This decrease is thought to have occurred through two mechanisms. First, through a decrease in lipids in the respondent's body. Ambon bananas are rich in saponins and tannins, which have been shown to reduce cholesterol levels, thereby reducing lipids stored in the respondents' adipose tissue. Oxidative stress in obese patients can be triggered by various biochemical processes associated with lipid accumulation in the visceral area, such as the formation of superoxide due to NADPH oxidation, oxidative phosphorylation, autoxidation of glyceraldehyde, activation of Protein Kinase C (PKC) and through polyol and hexosamine pathways [31,32]. A decrease in lipid accumulation will decrease these biochemical processes and reduce lipid peroxidation so that MDA levels will decrease. The second mechanism, the antioxidant content in Ambon banana, such as saponins and tannins, can directly bind to free radicals formed in respondents with central obesity. In patients with central obesity, it is known that there is a significant increase in free radicals [33]. These high free radicals cause an increase in oxidative stress, which is the source of various metabolic diseases related to central obesity [34]. Antioxidants, such as saponins and tannins, will bind to these free radicals, thus becoming more stable molecules. The reduced number of circulating free radicals causes a decrease in lipid peroxidation, characterized by a decrease in MDA levels.

CONCLUSION

Ambon banana intake at breakfast for 28 days improved cardiometabolic indicators and reduced MDA levels in adult men with central obesity. Our study has

examined the effect of Ambon banana consumption on the cardiometabolic indicator and plasma MDA levels in adult men with central obesity. It differs from a previous study which investigated the effect of banana consumption, especially Ambon banana, on metabolic response and oxidative stress characteristics in healthy men [35] and calves [36]. Our study provides early evidence that daily consumption of Ambon banana fruits improved cardiometabolic indicators and reduced oxidative stress levels in adult men with central obesity.

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