



The effect of rosella tea on weight loss among overweight women in Yogyakarta, Indonesia: An interventional pilot study

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ABSTRACT

Background: Rosella tea is an anthocyanin-rich herbal remedy known to have an anti-obesity effect. Overweight women are expected to lose weight by consuming herbal tea without improving their lifestyles.

Objectives: This pilot study evaluated the effects of rosella tea on reducing body weight among overweight women without improving their lifestyle.

Materials and Methods: A quasi-experimental design pre-post intervention was used in this study. Twenty-three overweight women aged 30-60 years were involved. The control and treatment groups consisted of twelve and eleven respondents, respectively. The treatment group consumed ± 250 ml rosella tea twice a day for 14 days. During the study, both groups were instructed to not change their lifestyles. Paired t-test and independent t-test were performed to test the effect of rosella tea consumption within and between groups, respectively.

Results: After 14 days of consumption of rosella tea, the body weight was decreased by -0.15 ± 0.24 kg (from 63.5 ± 10.35 kg to 63.35 ± 10.33 kg) for the treatment group and -0.21 ± 0.25 (from 64.65 ± 9.54 kg to 65.65 ± 9.99 kg) for the control group but the difference did not reach significant levels ($p > 0.05$). In both groups, dietary intake (e.g., calorie, carbohydrate, protein, and fat) and sedentary behaviour in the initial study were not different compared to at the end of the study, except for the lesser extent of dietary fibre in the control group.

Conclusion: Administration of rosella tea for 14 days did not induce weight loss in overweight women without any lifestyle improvement (increase dietary fibre).

Keywords: body weight, lifestyles, overweight women, rosella tea, weight loss

BACKGROUND

Indonesia is undergoing a nutrition transition as one-third of adults are overweight or obese. The prevalence of overweight among adults doubled from 17.1% in 1993 to 33.0% in 2014.¹ According to National Basic Health Survey in 2018 showed that the prevalence of overweight and obese were 13.6% and 21.8%, respectively.² That obesity prevalence is greater among females (29.3%) compared to the male (14.5%) population. Among women, the prevalence of overweight was 15.1% while the prevalence of obese was 29.3%.³ Obesity is known related to the development of non-communicable diseases, including insulin resistance, metabolic syndrome, type 2 diabetes mellitus (T2DM), and coronary heart disease (CHD).⁴ Increasing obesity is related to an increase in energy intake, reduction of energy expenditure, and sedentary behaviour.⁵ Increasing diet quality and physical activity were highlighted as an early treatment to prevent and cease obesity progression for overweight and obese young adults,⁶ as well as increasing antioxidant intake status.⁷

Rosella tea is known as an herbal remedy that has potential therapeutic and has been used by Indonesian people. Rosella (*Hibiscus sabdariffa*) is known as red sorrel which has a red colour and contains anthocyanin, organic acid, and vitamin C.⁸ Bioactive compounds such as flavonoids (quercetin, luteolin, and glycoside); chlorogenic acid, gossypetin, hibiscetin, phenols, some phenolic acids, anthocyanin such as delphinidin-3-sambubioside, and cyanidin-3-sambubioside were detected as the main components in the aqueous extract of *H. sabdariffa*.⁹ Studies on the phytochemical properties of *H. sabdariffa* which were linked to the presence of bioactive compounds revealed that it has several health benefits and could be used as a potent material for the treatment of various diseases.¹⁰ A previous study showed that rosella tea can control blood pressure, blood glucose, lipid profile, and cortisol as well as reduce body weight among the elderly with metabolic syndrome.¹¹ Rosella plays a role in the adipogenesis process via the P13-K/Akt and ERK pathways. Moreover, rosella increased the activity of the alpha-amylase enzyme, increased absorption and blocking sugars, thereby reducing weight during in vitro and in vivo studies.¹¹

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Overweight women expected to reduce body weight by only consuming herbal tea without improving their lifestyle. Many herbal weight loss products in the market claim to have remarkable reducing weight, however, there is limited supporting published pre-clinical and clinical data evidence.¹² The study about the anti-obesity effect of rosella has been tested in animals¹³⁻¹⁵ and in humans¹⁶ as an extract of rosella. However, none of the clinical study related to rosella tea focused on overweight women. The anti-obesity effect of *H. sabdariffa* was demonstrated by the significant reduction of weight gain and abdominal weight in diet-induced obese rats.¹⁷ This research aims to investigate the anti-obesity effect of rosella tea on reducing the weight of overweight women.

MATERIALS AND METHODS

Subject and Design

The current pilot study is a pre-and post-quasi-experimental design with a control and treatment group conducted from December 2015 to February 2016. Twelve respondents in the control group and eleven respondents in the treatment group were involved. Respondents are overweight women aged 30-60 years old who lived in Yogyakarta, Indonesia. Inclusion criteria were body mass index (BMI) more or equal to 23, and signing the informed consent. Exclusion criteria were not undergoing a diet program, not consuming rosella tea regularly for at least 3 months. Respondents who did not comply with at least 80% of rosella tea consumption or were not following the entire research procedure were dropped out of this study. This study was approved by the Medical and Health Research Ethics Committee (MHREC), Faculty of Medicine, Universitas Gadjah Mada, Dr. Sardjito General Hospital (number: KE/FK/297/EC/2015).

Intervention

The treatment group was given \pm 250 ml rosella tea twice a day in the morning and the afternoon, for 14 days. Rosella tea was added by stevia sweeteners as a sugar replacer to control glucose intake. Respondents were instructed to consume rosella tea after a meal. Each 250 ml rosella tea contains 152.3 mg polyphenol, 15.5 mg anthocyanin, and 12.1 ng vitamin C. The control group was given rosella tea at the end of the study. Treatment subjects were administered 10 g/d rosella powder. The dosage was chosen based on previous studies.¹⁸ We reviewed several studies that administered rosella tea on human consider it safety and the respondent acceptance.^{19,20}

Measured variables

All variables in the study were taken at the initial and the end of the study. Anthropometric parameters were assessed by a nutritionist. Body weight was measured in light clothing without footwear using Personal Analytic Scale (digital weight scale, OneMed) to the nearest 100 grams. The measurements were taken in the morning before respondents had breakfast. Body height was measured using a manual stature-meter (manual, OneMed). Body mass index (BMI) was calculated as weight (kg)/height(m²). Sedentary behaviour was recorded using a sedentary behaviour questionnaire (SBQ) and food intake was recorded using 24 hours recall questionnaire. Sedentary behaviour defines the amount of time when respondents spend their weekly time (one weekly day and one holiday time) by sitting down (e.g., reading and watching tv). The SBQ has acceptable measurement properties for use among overweight adults and is reliable only for two weeks.²¹ Nutrition intakes were described as the number of nutrients (energy total, carbohydrate, protein, fat, and fibre) that had been consumed by respondents 24 hours before being interviewed by a nutritionist. The data collection process shows in Figure 1. Each food intake was explained as a percentage of recommended dietary allowance (RDA) based on the Indonesian Population in 2019.²² The RDA (%) of food intake was calculated by using formula = (Food Intake each respondent)/(RDA) x 100%. For the 30 - 49 years population, RDAs for energy, protein, fat, carbohydrate, and fibre was 2150 kcal, 60 gram, 60 gram, 340 gram, and 30 gram, respectively. While for the 50 - 64 years old population, RDAs for energy, protein, fat, carbohydrate, and fibre were 1800 kcal, 60 gram, 50 gram, 280 gram, and 25 gram, respectively.

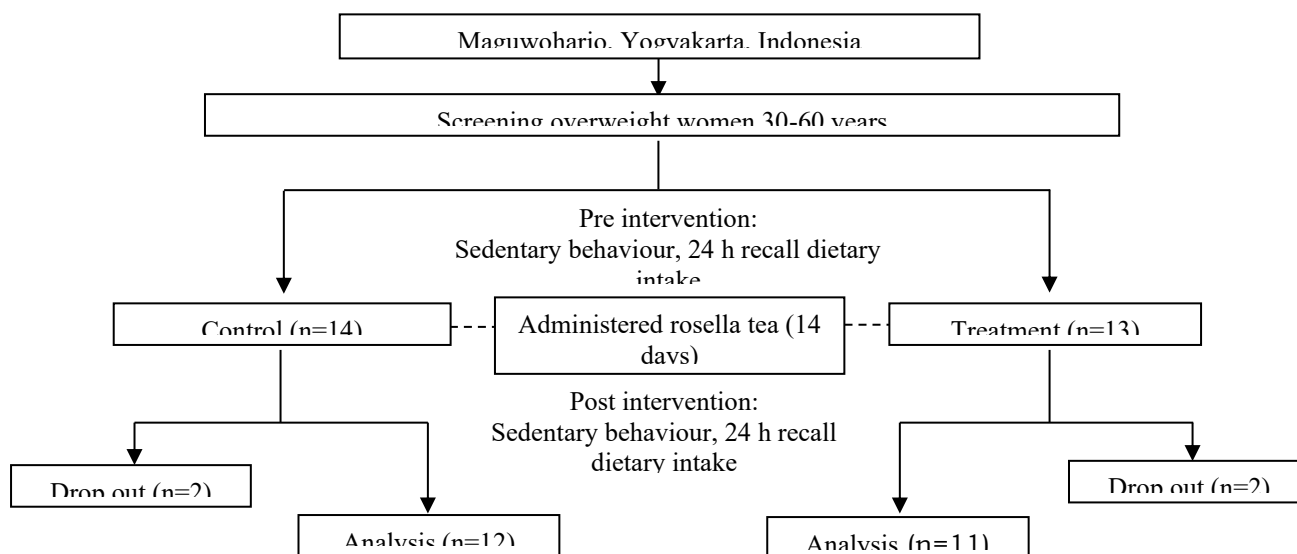


Figure 1. Data Collection Flowchart

Statistical Analysis.

The data is shown as mean \pm standard deviation (SD) for continuous data and number (percentage) for categorical data. The data was normally distributed using the *Shapiro-Wilk* test. A *paired t-test* was used to test the difference within the group (pre-post intervention) and an *independent t-test* was used to test the difference between the two groups (treatment and control group). All statistical analysis is performed using GraphPad Prism 5 (GraphPad Software, San Diego, CA, USA) and SPSS vers.21 (IBM, Armonk, NY, USA). The significance level was defined as <0.05 for *p*-value.

RESULTS

Characteristic of respondent in the study

Respondents were recruited from two different regions, one region for the treatment group and one region for the control group. Table 1. shows the baseline characteristics of respondents. The baseline characteristics were chosen considered its potential confounding factors that influence the results (e.g. overweight and obesity). The analysis shows that baseline characteristics (age, waist circumference, BMI, contraception, and education level) between treatment and control groups were not significantly different ($p>0.05$). Our data shows each group has equal characteristics; thus, no potential confounding factors were found in our study that may influence the results.

Table 1. Baseline Characteristics of Overweight Women in Difference Group

Characteristics	Treatment (n=11)	Control (n=12)	<i>p</i> -value ^a
	Mean \pm SD	Mean \pm SD	
Age (years)	47.45 \pm 8.48	48.75 \pm 6.57	0.824
Waist circumference (cm)	94.55 \pm 7.42	92.66 \pm 9.27	0.745
Body Mass Index (kg/m ²)	28.11 \pm 3.06	27.34 \pm 3.31	0.740
Contraception use (n, %)			
No	11 (91.7)	6 (54.5)	0.069
Yes	1 (8.3)	5 (45.5)	
Education (n, %)			
Elementary school	3 (25.0)	3 (27.3)	0.962
Junior high school	2 (16.7)	2 (18.2)	
Senior high school	5 (41.7)	5 (45.5)	
College/university	2 (16.7)	1 (9.1)	

^a *p*-value were performed by *independent t-test* for continues data and *chi-square* for categorical data. Significant level $p<0.05$. Contraception use was categorized as yes, including IUD, contraception hormonal, and sterilization.

Changes body weight during the study

The effect of rosella tea administration for 14 days on weight loss shows in Figure 2. Body weight at post-intervention were lower compared to pre-intervention in both groups (Figure 2.A). The delta body weight between treatment and control group indicates that consuming rosella tea for 14 days has no effect on weight loss. The delta of body weight changes in control group (-0.21 ± 0.25) is slightly higher than treatment (-0.15 ± 0.24). However, there were not statistically different (all $p > 0.05$).

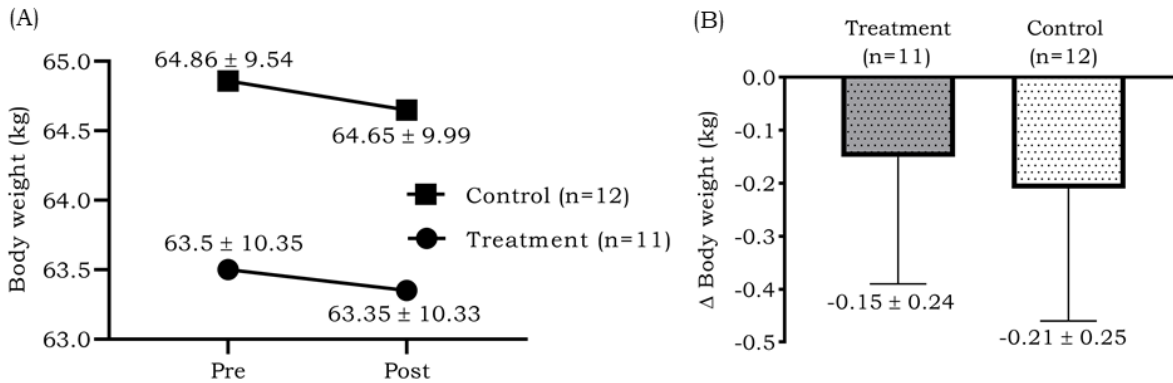


Figure 2. The Effect of Rosella Tea on Body Weight. (A) Body Weight During Intervention Period (Pre-Post) between 2 Groups. (B) Δ Body Weight between 2 Groups. Δ Body Weight = Body Weight at The End of Study- Body Weight at The Initial Study. Significant Level at $p < 0.05$.

Respondent life style

Respondent life style included, sedentary behaviour and nutrient intakes. Sedentary behaviour and nutrients intakes before and after intervention were not changed in nutrition’s parameters: (energy, protein, fat, and carbohydrate) in both the treatment and the control group ($p > 0.05$). The fibre intake in a treatment group was not changed between in the initial and in the end of this study. However, the fibre intake in the control group was borderline significant between pre and post intervention ($p = 0.05$). In the initial study, the fibre intake of control group was different with treatment group ($p < 0.05$). The data was summarized on Table 2. characteristic of respondent in the study

Table 2. Lifestyles among Study Population During Interventions.

Lifestyles	Intervention	Treatment	Control	<i>p</i> -value ^a
Sedentary activity (hours/week)	Pre	47.43 ± 22.80	36.64 ± 12.93	0.172
	Post	40.09 ± 20.99	41.65 ± 18.43	0.852
	<i>p</i> -value ^b	0.363	0.332	
Energy intake (%RDA)	Pre	62.88 ± 23.82	57.85 ± 23.34	0.648
	Post	56.89 ± 15.92	58.99 ± 19.84	0.739
	<i>p</i> -value ^b	0.416	0.860	
Carbohydrate intake (%RDA)	Pre	67.54 ± 28.07	54.63 ± 28.84	0.303
	Post	52.07 ± 14.20	53.89 ± 20.86	0.783
	<i>p</i> -value ^b	0.085	0.917	
Protein intake (%RDA)	Pre	53.17 ± 20.56	61.25 ± 28.52	0.449
	Post	62.58 ± 17.64	71.45 ± 19.88	0.783
	<i>p</i> -value ^b	0.181	0.143	
Fat intake (%RDA)	Pre	57.36 ± 31.04	63.27 ± 30.44	0.597
	Post	66.21 ± 24.02	68.29 ± 29.36	0.820
	<i>p</i> -value ^b	0.408	0.672	
Fibre intake (%RDA)	Pre	35.93 ± 20.50	21.26 ± 11.87	0.039
	Post	25.46 ± 16.48	35.12 ± 20.74	0.220
	<i>p</i> -value ^b	0.424	0.050	

RDA = Recommended dietary allowance based on Indonesian Population. ^a *p*-value were performed by *independent t-test* for normal distribution data and *Mann-Whitney U-Test* for not normal distribution data, ^b *p*-value were performed by *Paired t-test* for normal distribution data and *Wilcoxon Signed Ranks Test* for not normal distribution. Significant level at $p < 0.05$.

DISCUSSION

As far as we are known, this is among the first study to investigate the effect of the administration of rosella tea among overweight women in Indonesia. Using an experimental study design, we found that 14 days of the administration of rosella tea were not affected by weight loss without improving lifestyle. Reducing body weight among obese women may be associated with an improved lifestyle (such as increasing fibre intake).

Rosella contains a bioactive compound that is generally believed to have anti-obesity effects. Main bioactive compounds in rosella with anti-obesity, including, organic acids, anthocyanins, flavonoids, and phenolic acids.²³ The effect of the bioactive compound from rosella has been tested in several animal studies. The study in male obese mice resulted that *H. sabdariffa* water extract administration constitutes an effective and viable treatment strategy against the development and consequences of obesity.¹³ *H. sabdariffa* calyx extract components in the intermediate and greater concentrations could be considered possible anti-obesity agents in rats.¹⁴ Moreover, male Sprague-Dawley rats treated with daily intra-gastric administered anthocyanin 6 mg/kg and 24 mg/kg for 40 days, significantly lowered body weight compared to daily intra-gastric administered water.²⁴ In contrast with previous animal studies, our study suggests that rosella tea was not effective in reducing body weight among overweight women. However, our study was similar to a previous human study that investigated the benefits of concord grape juice (CGJ) as a rich-phenolic antioxidant among seventy-six men and women adults. The study found consumption CGJ did not respond body weight reduction.²⁵ Our previous study showed rosella tea can lower fasting blood glucose but not 2-hours post-prandial blood glucose level in prediabetic women.¹⁸ The clinical study showed the administration of *H. sabdariffa* extract for 12 weeks reduced obesity, abdominal fat, serum GGA and improved liver steatosis.¹⁶

The underlying mechanism of the effect of *H. sabdariffa* on reducing body weight is still unclear. However, the potential mechanism of reducing body weight was associated with reducing the intake of food. An animal study showed that supplementation of *H. sabdariffa* at 10% and 15% were significantly reducing body weight by reducing food intake. A previous study suggested that Blueberry extract (which contain antioxidant such as polyphenol) may act as a satiety inducer which effect reducing food intake among Rats. The food intake reduction may be associated with a decrease in body weight in experimental animals.²⁶ Badshah and colleagues found that anthocyanin from black soybean has anti-obesity capacity via regulating neuropeptide Y (NPY) and γ -amino butyric acid receptor (GABAB1R) in the hypothalamus which influenced appetite and weight gain control as well as obesity. Anthocyanin affects reducing body weight and food intake.²⁴ In contrast, in our study, no nutrient intake reductions were found. Anthocyanin from black wolfberry potentially prevents diet-induced obesity by alleviating oxidative stress, reducing inflammation and accelerating fat decomposition in diet-induced obesity.²⁷

In our study, respondents were instructed to not change their lifestyle including nutrient intake and sedentary activity. We found that our respondents in the treatment group did not change their habits including sedentary activity and all nutrient intakes (all $p > 0.05$). The control group also does not change sedentary activity and nutrient intakes ($p > 0.05$), except for fibre intake (borderline significant, $p = 0.05$). A previous study suggested that the addition of functional fibre to a weight-loss diet should be considered.²⁸ We expected that weight loss in the control group might be associated with increased fibre intake. Moreover, the sedentary activity of respondents did not change in this study. The sedentary activity was associated with adiposity markers in adults.²⁹ Overall, obesity is preventable and treatable. Dieting and physical exercise can produce weight loss that can be maintained.³⁰

Our present study has several limitations that need to consider during the interpretation of the results. First, our study's limitation lies in the small number of participants willing to be involved in the intervention. The duration of administered rosella tea in this study is fourteen days may be not appropriate to improve body weight change. However, we choose the short duration of treatment to maintain the compliance of respondents because rosella has a sour taste. One limitation of the study was the use of 24 h recalls since the alternative of dietary records could have given more precise information. We found underreporting dietary intake (a high percentage of dietary intake below the RDA's guideline). Since our population, overweight women, underreporting nutrient intakes were greater in the overweight and obese population.³¹

CONCLUSIONS

The findings of this pilot interventional trial did not support rosella tea consumption twice a day for 14 days without improving lifestyle effectively to reduce body weight among overweight women in Yogyakarta. Nonetheless, overweight women suggested combining rosella tea consumption with lifestyle modifications such as increased fibre intake. Further research is necessary to find conclusive results with increased sample size and duration of administered rosella tea.

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