

Tender coconut water as alternative food to increase potassium intake among prehypertension adult female?

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Abstrak

Latar belakang: Hampir seluruh populasi di dunia mengonsumsi kalium lebih rendah dari rekomendasi yang dianjurkan. Air kelapa muda merupakan minuman khas yang tinggi kalium. Tujuan penelitian ini adalah untuk menganalisis asupan kalium pada perempuan prahipertensi dan menentukan peningkatan asupan kalium dengan pemberian air kelapa muda untuk menurunkan tekanan darah di antara subyek prahipertensi.

Metode: Pada uji klinis paralel single blind dengan subyek sebanyak 32 guru perempuan dan karyawan prahipertensi berusia 25-44 tahun di Surabaya bulan April – Juni 2013. Pemilihan subyek penelitian dengan randomisasi blok, 16 subyek tiap kelompok. Kelompok perlakuan (P) mendapat air kelapa muda disertai penyuluhan gizi, sedangkan kelompok kontrol (K) mendapat air putih disertai penyuluhan gizi. Penilaian asupan kalium dengan food record 2x24 jam selama fase run in, minggu pertama, dan minggu kedua periode penelitian. Food record dianalisis menggunakan nutrisurvey, dan kandungan kalium dalam air kelapa muda segar dan air putih dianalisis dengan metode atomic absorption spectrophotometry (AAS).

Hasil: Pada awal penelitian, rerata asupan kalium subyek $1420,28 \pm 405,54$ mg/hari atau sekitar $30,22\% \pm 8,63\%$ dari angka kecukupan gizi (AKG). Selama perlakuan, didapatkan peningkatan asupan kalium sebesar 2 kali lipat dan meningkat signifikan pada kelompok perlakuan, tetapi masih lebih rendah dari rekomendasi AKG dan WHO.

Kesimpulan: Pada perempuan prahipertensi, asupan kalium dikategorikan rendah, dan air kelapa muda segar 300 ml dua kali sehari selama 14 hari berturut-turut dapat meningkatkan asupan kalium. (*Health Science Journal of Indonesia 2015;6:12-16*)

Kata kunci: asupan kalium, air kelapa muda segar

Abstract

Background: Most populations around the world consume less than the recommended intake of potassium. Tender coconut water (TCW) is a typical drinks high in potassium. The study aimed to analyze potassium intake in prehypertension subjects and to identify the increase of potassium intake.

Methods: This parallel single blind randomized clinical trial study consisted of 32 female prehypertension teachers and employees aged 25-44 years in five Islamic Education Foundation in Surabaya in April – June 2013. The selected subjects randomly allocated into 16 subjects for treatment (T) group received TCW 300 ml twice daily for 14 days and nutritional counseling, and 16 subjects for control (C) group received 300 ml plain water twice a day for 14 days and nutritional counseling. Dietary intake of potassium was assessed by using estimated two-day food record during run in, first week, and second week during study period. The food record was analyzed with Nutrisurvey and content of potassium in TCW and water were analyzed by atomic absorption spectrophotometry (AAS) method.

Results: At baseline, mean dietary intakes of potassium were 1420.28 ± 405.54 mg/day or only $30.22\% \pm 8.63\%$ compared to recommended daily allowance (RDA). There were double increase of potassium intake ($61.09 \pm 12.5\%$ compared to RDA) and increased significantly in the T group ($P < 0.00$), but it was still lower than RDA as well as WHO recommended.

Conclusion: Among prehypertension female, dietary intakes of potassium was categorized as low, and TCW 300 ml twice daily for 14 consecutive days increased significantly the potassium intake. (*Health Science Journal of Indonesia 2015;6:12-16*)

Key words: potassium intake, tender coconut water

Hypertension affects approximately 25% of the adult population worldwide, and the prevalence is predicted to increase around 60% by the year of 2025. Prehypertension (PHT) is 3-fold greater risk to develop hypertension, and roughly twice the number of cardiovascular diseases (CVD) than normotension.^{1,2}

Low potassium consumption has been associated with hypertension and CVD.^{1,2} Population studies shown an inverse relation of potassium intake to blood pressure (BP).³ Most populations around the world consume less than the recommended levels of potassium.⁴ Fruits and vegetables are food high in potassium. On the other hand data National Socio Economic Survey in 2004 showed approximately 60-70% of Indonesian people consumed less fruit and vegetable as recommended 4-5 servings per day with an average of only eating one serving per day.⁵

Non-pharmacological therapy are the main strategy recommended for PHT subjects. Lifestyle modification such as weight loss, exercise, and dietary alteration are important to reduce blood pressure (BP).^{1,2} The Dietary Approaches to Stop Hypertension (DASH) diet showed that BP was significantly reduced in PHT by using a diet rich in vegetables and fruits (high potassium).⁶ World Health Organization (WHO) recommended an increase in potassium intake from food at least 90 mmol/day (3510 mg/day) for adults or 4700 mg/day based on recommended daily allowance (RDA).⁷ Tender coconut water (TCW) is a typical topical drinks which is high in potassium.⁸ However, research about the role of TCW to increase potassium intake has been never done in Indonesia

The study aimed to analyze potassium intake in PHT subjects and to determine the increase of potassium intake with TCW 300 ml twice daily for 14 consecutive days.

METHODS

The study was a parallel randomized clinical trial. The method and subjects the same as the previous publication "Effect of tender coconut water on blood pressure in prehypertensive women" A total of 37 female prehypertension teachers and employees aged 25-44 years in five Islamic Education Foundation in Surabaya at April – Juni meet the criteria study as research subjects. Simple random sampling done to get 32 subjects and then subjects were randomly allocated to one of two groups using block randomized, 16 subjects each. The treatment

(T) group received TCW 300 ml twice daily for 14 days and nutritional counseling, while the control (C) group received water 300 ml twice daily for 14 days and nutritional counseling. Coconut water used came from coconut hybrid varieties aged 6-8 months were taken directly from the coconut plantation in Lumajang with potassium content was $1789 \pm 116,7$ mg/L.

Subjects were included in the study if they had a BMI within 18.5–29.9 kg/m². Exclusion criteria were hypertension, consuming antihypertensive drugs and potassium supplement, consuming tobacco and alcohol, pregnant or nursing, menopause, diabetes mellitus or random blood glucose level ≥ 200 mg/dL,⁹ and creatinine clearance test (CCT) < 60 mL/min.¹⁰

Data collected in this study consisted of age, physical activity, body mass index, intake of energy and potassium, fruit and vegetable consumption, systolic and diastolic BP. The study personnels who obtained these measurements were blinded to intervention assignments. Data of age and physical activity index were obtained by interview. Body weight was measured in light indoor clothes without shoes to the nearest 0.1 kg using a high-quality digital scale and microtoise was used to measure body height.¹¹

Dietary intake of energy and potassium were assessed by collecting a two-day food record during run in, week 1 and 2 periods of data collection. The individual energy requirement was calculated using Harris-Benedict Equation.¹² Mean potassium intake was compared with the recommended daily intake which is 4700 mg.⁷

Dietary intake of fruit and vegetable were assessed by collecting a two-day food record during run in. Mean fruit and vegetable intake was calculated in gram per day and categorized by less than 250g/d, between 250-400 g/d, and more than 400 g/d.^{7,13}

All data were checked for normality using the Saphiro-Wilk test. The unpaired t-test and Mann-Whitney was used to assess the significance of differences between two groups with the level of significance was 5%.¹⁴

The present study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures were approved by Ethics Committee of Medical Faculty Indonesia University. Written informed consent was obtained from all subjects.

RESULTS

From a total of 58 females who were provided written informed consent to participate in the study,

37 individuals met the criteria study. Simple random sampling done to get 32 subjects. At H+12 days, one subject of T group was dropped out because of suffering chikungunya. The subjects were only female since a large of (80%) teachers and employees in their schools were female.

A total of 31 subjects completed the study. The average age were 36.58 ± 5.39 years of age, had a BMI of 24.59 ± 2.89 kg/m², and 93.55% subjects have physical activity index below the average. The mean BP were 125.87 ± 6.36 mm Hg/ 79.84 ± 4.11 mm Hg respectively.

Fruit and vegetable have high potassium. There was no subject consuming fruit and vegetable more than 400 g/d, and 67.7% subjects consumed fruit and vegetable less than 250 g/d. Table 1 shows that the mean fruit and vegetable consumption in this study was $203,06 \pm 74,11$ g/day.

Table 1. The mean fruit and vegetable consumption

Variable	Treatment n=15	Control n=16	Total n=31
Fruit and vegetable consumption (g/day)	202±72,06	204,06±78,34	203,06±74,11

Table 2 shows that the treatment and control group were similarly distributed in term of several characteristic listed on this Table except for creatinine clearance. The treatment group had higher creatinine clearance.

Table 2. Several characteristic of base line data

Variabel	Treatment	Control	P
Age (years)	35.73±5.92	37.38±4.90	0.406
Body mass index (kg/m ²)	24.73±2.74	24.45±3.12	0.792
Physical activity	24.73 ±6.72	20.50 (16-42)	0.223
Systolic blood pressure (mm Hg)	124.93±6.54	126.75±6.27	0.436
Diastolic blood pressure (mm Hg)	80.20±4.35	79.50±3.98	0.643
Blood glucose level (mg/dl)	93.67±32.44	89.19±29.64	0.691
Creatinine clearance test (ml/minute)	95.67±22.69	85.81±14.98	0.162

Table 3 shows that in term of potassium intake, on pre-treatment condition the treatment as well as the control group did not differ. However, on the first and second week the treatment group had higher Potassium intake. Furthermore, in term of percentage of energy intake to energy requirements, the treatment and control group had similarly percentage.

Table 3. Potassium intake and percentage of energy intake to energy requirements (%)

Variabel	Treatment	Control	P
Potassium intake (mg/day)			
Pre treatment	1387.28±339.58	1451,21±117,04	0.669
First week	2743.68±540.05	1755.43±530.84	0.000
Second week	2871.10±587.59	1675.73±561.52	0.000
Percentage of energy intake to energy requirements (%)			
Pre treatment	89.88±20.80	95.64±16.21	0.286
First week	89.62±21.99	96.01±16.56	0.367
Second week	93.97±21.99	92.26±6.45	0.844

DISCUSSION

The study was a single blind, however, the treatment and control subjects knew the taste of coconut water differed from water. Confounding variables in this study included age, sex, obesity, physical activity, smoking, alcohol intake, blood glucose level, kidney function (CCT) had been controlled by using exclusion criteria. The characteristic data of the two groups at base line were not significantly different or closely matched (Table 2). so the difference of value was only caused by intervention.¹⁴

The percentage of energy intake compared to the total energy requirement at weeks 0, 1, 2 between two groups were not significantly different. Coconut water contains only about 44 kcal/L⁸, so it did not affect the energy intake of the subjects. Moreover, counseling about well balanced diet seemed to be playing a role in the observance of the subjects followed a diet balanced nutrition diet.¹⁶

The similar previous studies showed that mean dietary potassium intake of their subjects were lower than adequate intake of potassium (4700 mg/d).¹⁷⁻²⁰ This study found mean dietary intakes of potassium were 1420.28 ± 405.54 mg/day or only $30.22 \pm 8.63\%$ compared to RDA which categorized as low intake. Moreover, laboratory finding of low plasma potassium level in this study (plasma potassium level was 3.71 ± 0.41 mmol/L, and 7 subjects (22.58%) were categorized as hypokalemia) showed that low intake of potassium had happened for long time. A Low-potassium intake for long-term could lead to decrease plasma potassium level and induce hypokalemia.^{21,22}

Among others, the causes of low potassium intake was the low intake of vegetables and fruits (high in potassium). In this study, the mean total fruit

and vegetable consumption was $203,06 \pm 74,11$ g/day which were lower than the recommendation of Agriculture Ministry 250 g/d and World Health Organization 400 g/d. There was not any subject consuming fruit and vegetable more than 400 g/d (table 1). Data National Socio Economic Survey in 2004 showed approximately 60-70% of Indonesian people consumed less fruit and vegetables as recommended 4-5 servings per day with average of only eating one serving per day.⁵ Analysis fruit and vegetables from data Riskesdas 2010 in adult female 20-55 years old in Indonesia showed the mean of consuming fruit and vegetables was $139,7 \pm 55,9$ g/d (which were lower than the suggestion of Agriculture Ministry 250 g/d or World Health Organization 400 g/d).¹³ From analysis of fruit and vegetable consumption as a source of potassium in this subjects, it was concluded that total consumption of potassium from fruit and vegetable was $54,65 \pm 3,24\%$ of total daily requirement of potassium, so low consumption of fruit and vegetable contributed to low potassium intake in this study.

Tropical tender coconut water (TCW) is a typical drinks high in potassium. Indonesia is the country with the most coconut production followed by Phillipines in the second and India in the third.²³ In treatment period, potassium intake increased significantly within the T group (table 2) since the potassium level in coconut water (1800 mg/L) greater than water (4 mg/L). Coconut water used came from coconut hybrid varieties aged 6-8 months and were taken directly from the coconut plantation in Lumajang city (Java). It was observed that potassium was the highest in the coconut water of the 6-8 month old.⁸ Hybrid variety had chosen because it had high potassium level (± 5000 mg/L) based on prior study.²⁴ This study revealed that the potassium level in hybrid analyzed by atomic absorption spectrophotometry (AAS)¹⁵ method was only ± 1800 mg/L. The difference was likely due to potassium contents of hybrid varieties, climate, soil conditions, and fertilization.^{8,23}

A double increased of potassium intake (from $29,52 \pm 7,23$ to $61,09 \pm 12,5\%$ compared to RDA) with the addition of TCW 300 ml twice daily, but it was still lower than RDA and WHO recommended. It is similar to Braschi et al²⁰ (potassium intake 3000 mg + KCl/K-cit 1180 mg), but contrast to other studies (potassium intake 2700 mg + KCl 4700 mg,¹⁸ potassium intake 3200 mg + KCl/K-cit 3800 mg,¹⁷ and diet DASH 4700 mg.⁶

In this study, the analysis of potassium intake used food record 2x24 hours. In analysis using food record,

subjects did not record directly the food consumed, so the result could be bias.¹¹ Laboratory finding of potassium level and sodium level in 24 hours urine is reliable measurement to assess intake, because of the close biological relationship between dietary intake and urinary excretion. The limitation in this study among others we did not examine sodium and potassium urine because of difficult to perform, not comfortable, inadequate urine pooling, insufficient if performed over only 1 day, and thus measurement over several days is considered necessary.²⁵

In conclusion, dietary intakes of potassium was categorized as low, and tender coconut water could be used as alternative food to increase potassium intake.

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