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Research Article

Diuretic Activity of Different Organs of Matoa (*Pometia pinnata*) Extracts and its Influence on Potassium and Sodium Levels

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ABSTRACT

The purpose of this study was to determine diuretic activity of matoa (*Pometia pinnata*) extracts (leaves, peel, seeds) and its influence on potassium and sodium levels. Each crude drug was extracted by maceration method followed by evaporation using rotary evaporator. Male Wistar rats were divided into 11 groups i.e. furosemide (1.8 mg/ kg bw), control group CMC 0.5%, and matoa extracts (leaves, peel, seeds) each with doses of 50 mg/kg bw, 100 mg/kg bw, 150 mg/kg bw. Rats were placed in metabolic cages. Urine volume was measured for 4 hours. Potassium and sodium levels in urine were determined by using Atomic Absorption Spectrophotometry.

The effective dose of ethanolic matoa leaves extract for diuretic activity was 100 mg/kg bw which could increase the excretion of sodium and potassium in the urine of the male Wistar rats.

Keywords: matoa (*Pometia pinnata*), diuretic, urine volume, potassium levels, sodium levels

INTRODUCTION

Diuretics are drugs act on kidneys to increase urine output and sodium excretion[2]. Diuretics reduced the amount of fluid in the bloodstream therefore some diuretics are used to treat high blood pressure. Urine is a mixture of water with polar compounds that must be removed from the body. If urinary excretion is not smooth from the bladder or kidneys can cause crystallization of substances that should be discarded[3-4].

Fluid retention is a key of acute heart failure, which was manifested as ankle swelling, ascites, and/or pulmonary edema. Therapeutic strategies to control fluid balance, and shift of fluid out of the interstitium, lead to significant symptomatic relief and improved health-related with quality of life [5]. Medicinal plants contain known and unknown important medicinal chemical substances. Previous study [6] estimated that over 75 % of the world's population still depends on plant derived medicines for the treatment of common ailments. One of the reasons to use herbal medicines is probably the presence of synergistic and or side effects which can neutralize combination of phytochemical constituents [7]. Another reason for the shifting trends towards natural product is the harmful effects of synthetic chemicals[8].

Previous study by Suedee [9], succeed to isolate epicatechin, kaempferol-3-O-rhamnoside, quercetin-3-O-rhamnoside, glycolipid, 1-O-palmitoyl-3-O-[A-galactopyranosyl-(1→6)-β-galactopyranosyl]-sn-glycerol, steroid glycosides, stigmasterol-3-O-glucoside and triterpenoid saponin pentacyclic, 3-O-α-arabinofuranosyl-(1→3)-[α-rhamnopyranosyl-(1→2)]-α-arabinopyranosyl hederagenin from matoa leaves extract that had activity as anti HIV.

Based on the background mentioned above, related to the extent of diuretics in the treatment, as well as the lack of utilization of matoa as a diuretic, the study aims to test diuretic activity of different organs of matoa (leaves, peel and seeds) and its effect on potassium and sodium levels in urine. Determination of potassium (K^+) and sodium (Na^+) levels in urine can be done by AAS (Atomic Absorption Spectrophotometry) method. The AAS has several abilities: it has a high sensitivity (lower detection limit of less than 1 µg/ml), wide boundary determination level (from µg/ml until %), the implementation is relatively simple, and a little interference. Atomic absorption spectrophotometry based on the absorption of visible light or ultraviolet light by atoms of neutral [10].

MATERIALS AND METHOD

Materials

Leaves, peels and seeds of matoa (*Pometia pinnata),* nitric acid, potassium, sodium standard, furosemide standard, carboxy methyl cellulose and distilled water.

Preparation of sample

Samples (leaves, peels and seeds) of *Pometia pinnata* were collected from Sukoharjo, Center of Java, Indonesia. Leaves sample as namely as L, peels sample as P and seeds as S. were thoroughly washed with tap water, sorted while wet, cut, dried at 50° C for five days and grinded into powder (40 Mesh).

Extraction

Each sample was extracted by maceration using 96 % ethanol for 3 days and shaking out every day. Liquid extract was filtered and then evaporated using rotary evaporator at 40 °C and speed of 20 rpm. So there were

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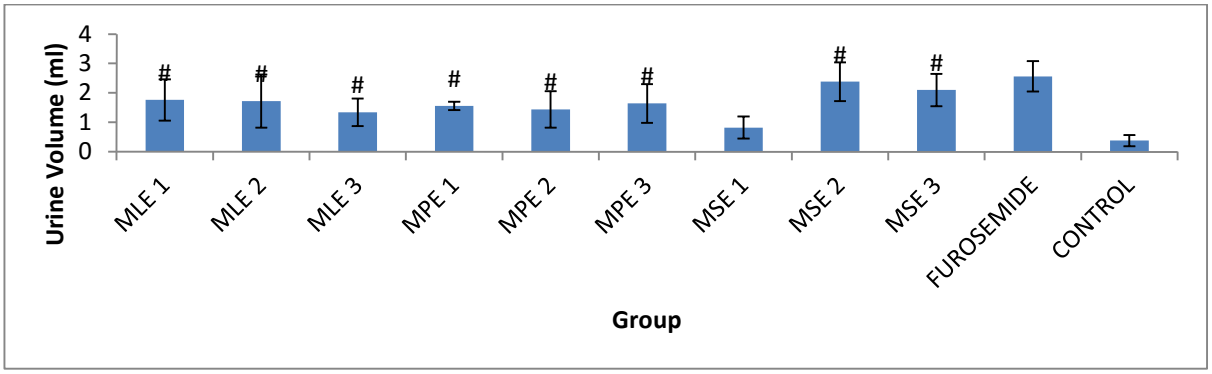

Figure 1: Urinary excretion of different organ extracts of *Pometia pinnata*
= not significantly different compared to furosemide

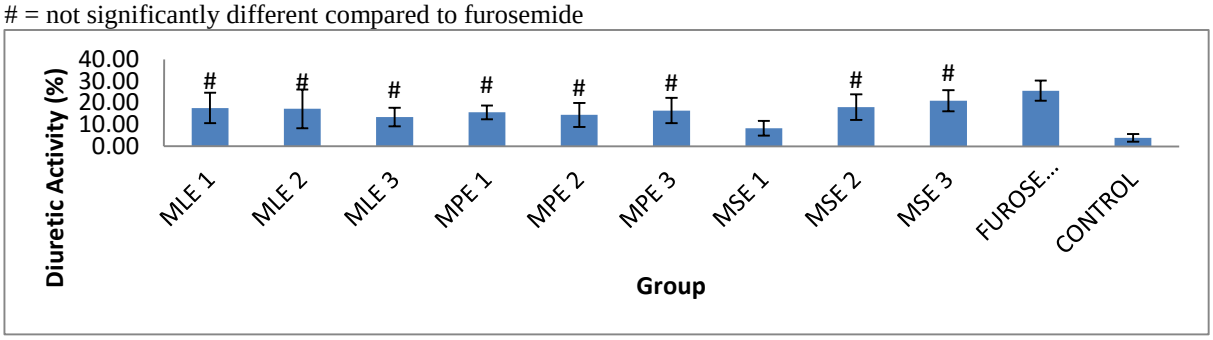

Figure 2: Diuretic activity of different organs extract of *Pometia pinnata*
= not significantly different compared to furosemide

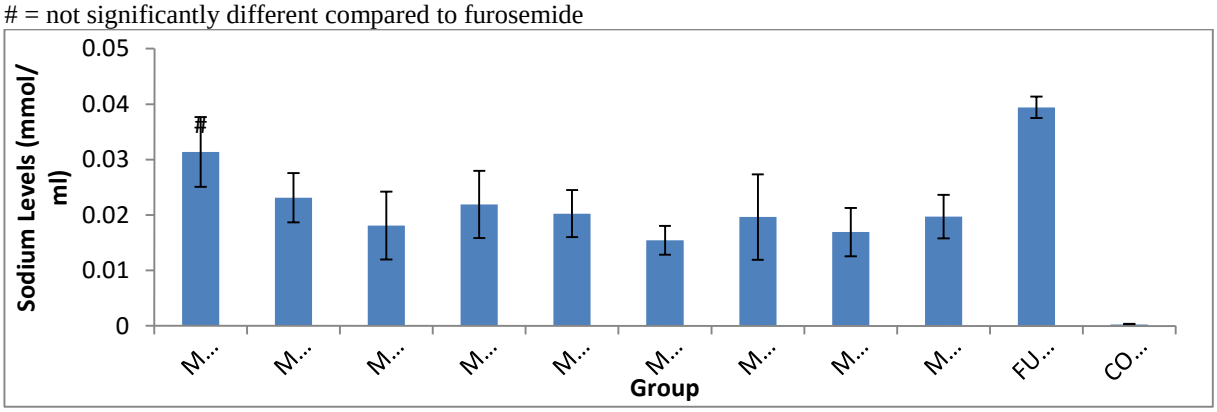

Figure 3: Sodium levels in urinary excretion
= not significantly different compared to furosemide

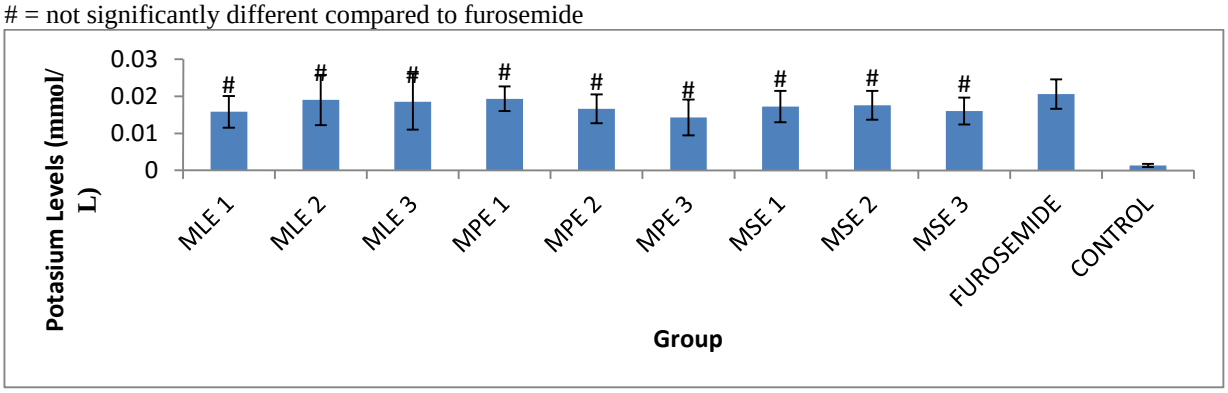

Figure 4: Potassium levels in urinary excretion
= not significantly different compared to furosemide

matoa leaves extract (MLE), matoa peels extract (MPE) and matoa seeds extract (MSE). The concentrated extracts were used for diuretic activity test, potassium and sodium levels.

Diuretic activity

This study used 55 male rats weighing between 130-170 g. The rats were weighed and marked respectively, were randomly divided into 11 groups, each group consisted of 5 rats. Previously rats were fasted for 12 hours. Prior to treatment the rat were given warm water 4 ml/200 g body

weight (bw) (loading dose). Group I was matoa leaves extract with dose of 50 mg/kg bw (MLE 1), group II matoa leaves extract 100 mg/kg bw (MLE 2), group III matoa leaves extract 150 mg/kg bw (MLE III), group IV matoa peels extract 50 mg/kg bw (MPE 1), group V matoa peels extract 100 mg/kg bw (MFE 2), group VI matoa peels extract 150 mg/kg bw (MFE 3), group VII matoa seed extract 50 mg/kg bw (MSE 1), group VIII matoa seed extract 100 mg/kg bw (MSE 2), group IX was matoa seed extract 150 mg/kg bw (MSE 3), group X was furosemide 0.5%, group XI was the negative control group. Immediately after administration sample or standard and vehicle, animals were placed in metabolic cages individually. During this period no water and feed was available to animals. Urine was taken for 4 hours [11-12]. Total concentration of Na^+ and K^+ were measured by Atomic Absorption Spectrophotometry [13].

Statistical analysis

Data were expressed as mean ± SD (Standard Deviation). Statistical analysis was performed by using one-way analysis of variance (ANOVA) followed by post hoc Tukey. Significant differences were set at values less than 0.05.

RESULT

Urinary excretion

Ethanolic leaves, peels and seed extract of matoa which was given by orally could increase urinary excretion (Fig 1). Study regarding relationship between observation time (hours) against the average volume of urine for 4 hours, revealed that all of extracts sample showed diuretic effect. Matoa seed extract with dose of 100 mg/kg bw (MSE 2) showed the highest diuretic effect, which was comparable with furosemide as control.

In Fig 2 it could be seen that diuretic activity of all of treated extract (except MSE 1) had no significant difference with furosemide. Matoa leaves extract with dose of 50 mg/kg bw (MLE 1) gave the highest sodium levels which was not significantly different compared to furosemide, while the other groups had significant difference with furosemide ($p<0.05$).

Fig 4 exposed that potassium levels in all of extracts sample had no significant difference with furosemide.

DISCUSION

The results of urine volume for 4 hours after treated with different organs extracts of matoa was given as in Fig1, which demonstrated that matoa seed extract with a dose of 100 mg/kg bw had the highest urinary excretion and was not different statistically with furosemide. The average volume of urine of mice in control group was 0.38 ± 0.20 ml and in furosemide group was 2.56 ± 0.52 ml. The extracts expressed higher urine volume than control but less than furosemide. Statistically, urine volume in MLE 1, MLE 2, MLE 3, MPE 1, MPE 2, MPE 3, MSE 2 and MSE 3 showed significantly difference compared to control group ($p <0.05$), and not significantly different compared to furosemide. Based on the result it can be concluded that ethanolic extract of leaves and seed of matoa had diuretic effect and their activity similar with furosemide. In previous study which was conducted by Sa'roni [12] demonstrated that ethanol leaves extract of *Desmodium triquetrum* with doses of 3.1 mg, 9.3 mg and 31 mg/100 g body weight in mice, showed significantly difference in urine volume compared to distilled water ($p<0.05$), but also had significant difference with hydrochlorothiazide. It means its diuretic effect was lower compared to furosemide. Previous research [2] reported that ethanol extract of *Rumex vesicarius* (500 and 1000 mg/ml) gave high urinary excretion more than furosemide standard.

In the Fig 2 it can be seen that ethanolic seed extract of matoa with dose of 150 mg/kg bw had diuretic activity which was almost the same with furosemide. In the present study reported that ethanolic matoa extract from different organs (leaves, peel and seed) had the higher diuretic activity than control, but lower activity than furosemide. Statistically, diuretic activity of MLE 1, MLE 2, MPE 3, MSE 2 and MSE 3 significantly different with control ($p< 0.05$), while MLE 3, MPE 1, MPE 2 and MSE 1 had no significant difference with control. Based on statistically analysis it can be shown that all of treatment extracts (except MSE 1) had no significant different in diuretic activity with furosemide standard. So it can be concluded that all of organs extract of matoa (leaves, peel and seed) had diuretic activity (except MSE 1). Study by Roa *et al*. [2] exhibited that diuretic activity of ethanol extract of *Rumex vesicarius* with dose of 1000 mg/ml higher than furosemide standard.

Fig 3 demonstrated the results of sodium levels in urinary excretion. Control group gave the lowest sodium levels in urinary excretion, while furosemide had the highest sodium levels. Sodium levels of all of matoa extracts groups were higher than sodium levels in control group. Ethanolic matoa seed extract with dose of 50 mg/kg bw had sodium levels which was similar with sodium levels in furosemide group ($p<0.05$). Research by Sa'roni [12] reported that sodium levels of ethanol leaves extract of *Desmodium triquetrum* groups with doses of 9.3 and 31 mg/100 g bw significantly different with sodium levels in aquadest group ($p < 0.05$), but no significant difference with sodium levels which was given by hydrochlorothiazide.

The results of measurements of potassium levels can be seen in Fig 4. The lowest potassium level was given by control group and the highest levels for furosemide group. Statistically potassium levels of all of matoa extract (leaves, peel and seed) was significant different with control group ($p<0.05$), but it had no significant different with furosemide group. Ethanolic matoa leaves extract with dose of 100 mg/kg bw gave the highest sodium levels compared to the other extracts, and this result was lower than furosemide group. Previous research [12] exhibited that potassium levels of ethanol leaves extract of *Desmodium triquetrum* with dose of 31 mg/100 g bw was greater than potassium levels of distilled water group, and had no significant different with potassium levels hydrochlorothiazide 0,16 mg/ 100 g bw group. Study by Roa *et al*. [2] expressed that the ethanol extract of *Rumex vesicarius* induced the urinary output which was accompanied by increasing in Na^+, K^+, Na^+/K^+ ratio.

Generally, these observations suggested that matoa extract act as diuretic, which were usually given intravenously and inert by pharmacologically. In the present research revealed that the amount of potassium was excreted by all of matoa extract group which showed significantly different compared to control group. The ethanolic matoa leaves extract with dose of 100 mg/kg bw could increase potassium excretion better than the others.

Present study showed that ethanolic matoa seed extract of 150 mg/kg bw had the highest diuretic activity, but lower effect in excretion of sodium and potassium ion. Generally, the matoa seed extract had diuretic activity but not saluretic while matoa leaves extract possessed diuretic and saluretic effect at dose of 100 mg/kg bw. Increasing in number of potassium in the blood as resulting in renin secretion is reduced and increasing in excretion of Na^+. If renin secretion is reduced then it will not be changed angiotensinogen to angiotensin I, and thus the levels of angiotensin II would be decreased. As a result, vasoconstriction effect of angiotensin II and aldosterone secretion to reabsorb sodium and water will be reduced. This was followed by vasodilation of blood vessels of the kidneys that eventually increases blood flow to the kidneys and then urine excretion volume increased [14-16]. Increasing in potassium levels can cause saluretic because it leads increasing in excretion of sodium, so the low amount of sodium will reduce blood pressure.

Matoa plant contains alkaloid and flavonoid compounds. Previous study by Melendez-Camargo [17] reported that alkaloid would inhibit or reduce the reabsorption of water and electrolytes in the tubules which can cause saluretic effect [18-19].

CONCLUSION

Ethanolic extract of leaves, peels and seeds of matoa had diuretic activity in male Wistar rats. Extract of leaves, peels and seeds of matoa can affect the amount of sodium and potassium levels in urinary excretion. The effective dose of ethanolic matoa leaves extract for diuretic effect was 100 mg/kg bw.

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