

Decoction of *Morinda Citrifolia* L. Leaves as a Herbal Medicine*

Experimental Pharmacology – Two Synergistic Combination Effects for One Therapy

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Abstract

Morinda citrifolia L. belongs to the family of Rubiaceae and is known as “mengkudu” in Indonesia., The decoction of the leaf of *Morinda citrifolia* has been used traditionally as an anthelmintic and a laxative.

In this research, these two activities of the decoction of “mengkudu” leaves were investigated in experimental pharmacology based on the traditional use of this herbal medicine.

The anthelmintic activity was tested by using *Ascaris suum* (an intestinal worm parasite) obtained from pig intestine and the laxative activity was investigated on male Swiss Webster mice. Both activities were compared with those of the reference medicines, piperazine citrate and istizin, respectively.

The results showed that a decoct of 20% “mengkudu” leaves *in vitro* could significantly paralyze 80% of *Ascaris suum* worms and in a dose of 25 ml/kg body-weight of mouse showed a significant laxative effect. These two activities support the use of “mengkudu” leaves in the therapy of worm parasites, as an anthelmintic to paralyze the worm and then to remove them from the intestine

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by its laxative effect. These two activities in one herbal medicine (*Morinda citrifolia* L. leaves) can be used for one therapy of worm infection.

Summary

The use of traditional medicine is one of the ways of self-medication which has been known for generations in Indonesia. It is usually resorted to for simple symptoms, felt easily.

Worm infection cases in Indonesia have a high prevalence, which was 70-90% in 1994 (TVRI news) and 60 % in 2008 (Antara News).

Anthelmintic medicinal plants belong to the medicinal plants that should be developed in Indonesia according to the regulation of Indonesia Minister of Health Regulation for Indonesian Traditional Medicines (PerMenKes RI no 760/Menkes/Per/IX/1992).

For worm infection, *Mengkudu* leaves (*Morinda citrifolia* L.) have been used traditionally by Indonesian peoples. Besides as an anthelmintic, *Mengkudu* has also been used as a laxative. The activity of *Mengkudu* as an anthelmintic and laxative in one medicine shows a synergistic combination effect in worm infection therapy. As an anthelmintic it causes a placid paralysis of the worms and as a laxative it expels the paralyzed worms.

In this research, these two effects, anthelmintic and laxative, were investigated to explore “*Mengkudu*” leaves in experimental pharmacology based on the traditional use of this medicine.

The anthelmintic activity was evaluated *in vitro* using *Ascaris suum* (intestinal worm parasite) and the laxative activity was tested *in vivo* on male Swiss Webster mice. These two activities were compared with the reference medicines, piperazin citrate (for the anthelmintic activity) and istizin (for the laxative activity).

The results showed that a decoct of 20% *Mengkudu* leaves could paralyse *in vitro* 80% *Ascaris suum* worms, and in a dose of 25 ml/Kg BW had a significant laxative effect on male Swiss Webster mice. These results also support the traditional use of *Mengkudu* leaves in the therapy of worm infections which have a high prevalence in Indonesia .

With these two synergistic combination effects in this worm infection, it is found that the traditional use of *Mengkudu* leaves in the form of a decoct amounts to the same as 33.3 g leaves for adults (60 Kg) in one single dose.

Even though, an acute toxicity test of *Mengkudu* (*Morinda citrifolia*) leaves is needed in order to assure its safety. It is suggested to elucidate the active principle(s) responsible in this leaf for anthelmintic and/or laxative activities.

Introduction

The Indonesian peoples have used traditional medicines as self medication for many generations.

One of the diseases which have a high prevalence in Indonesia is worm infection. Its prevalence was 70-90% in 1994 (1) and 60% in 2008 (2). Parasitic worms live in the human body and can damage the organs infested. One of these parasites is *Ascaris lumbricoides*, highly prevalent in humans. Ascariasis causes malnutrition, pneumositis, abdominal disturbances and allergic reactions. For that reason, anthelmintic medicinal plants belong to the herbal medicines that should be developed in Indonesia (3).

Traditionally, Indonesian peoples use medicinal plants for worm infections. One of them is “mengkudu” (*Morinda citrifolia L.*) leaves as an anthelmintic (4, 5, 6, 7). Apart from an anthelmintic action, these leaves also have a laxative activity (4, 5, 6).

These two actions (anthelmintic and laxative) in one herbal medicine constitute a synergistic effect for worm infection therapy: firstly the anthelmintic action causes a placid paralysis of worms, and, secondly, the laxative action expels the paralyzed worms. This means that “mengkudu” leaf is one herbal with two synergistic effects for one therapy, worm infection. Raj (7), also has found that a *Morinda citrifolia* tender leaves alcoholic extract had an anthelmintic action in a test tube.

In this research, these two effects of “mengkudu” leaves will be investigated by means of pharmacological experiments. This study was conducted with a decoct of 20% “mengkudu” leaves as traditionally used.

In the literature, besides as an anthelmintic and laxative, “mengkudu” leaves have been used traditionally for many disorders, e.g., colds, queasy, diabetes, and also as an antipyretic agent and expectorant. The fruits of this plant are most popular as a herbal medicine and have been used for many diseases (4, 5, 6).

Materials and Methodology

Materials

The tested plant, “Mengkudu” (*Morinda citrifolia L.*), was collected from Cisarua Bandung-Indonesia at 745 – 800 m above sea level. Leaves of this plant were used as the simplex to be tested.

Istizin/Danthron (as a laxative) and piperazine citrate (as an anthelmintic) were used as reference drugs, together with aqua dest. and filter paper. Worm:

Ascaris lumbricoides varietas suum taken from pig intestine.

Preparation of 20% *Morinda citrifolia* L. leaves decoction: put an amount of leaves powder into a decoction pan and add enough aqua dest. to reach about ± 3 cm above the surface of the herbs. Then bring the pan to boil and boil at 90° C for 30 minutes while stirring sometimes. Filter while hot and then add aqua dest. to the residue till the volume needed for 20% w/v of the decoction is reached.

Methodology

This research was conducted in two steps:

I. Characterization of “mengkudu” (*Morinda citrifolia* L.) leaves:

In accordance with the herbarium specimen of this plant at the Herbarium Bandungense – Department of Biology, Institut Teknologi Bandung, and the official characteristics of Herbal Medicines. The determination of the plant tested was conducted macroscopically by comparing it with the same plant in the Herbarium Bandungense – Department of Biology ITB and with the determination key for several characteristics of the plant.

II. Pharmacological Activity Researches:

1. Anthelmintic activity (8):

Ascaris lumbricoides var. suum was collected from pig intestines. The worm was soaked in in test solution (contain 1% piperazine citrate or 20% decoction). In this study piperazine citrate was used as a reference anthelmintic drug. Parameter study: anthelmintic action caused placid paralysis or death of worm. Laxative activity (9):

2. *In vivo* study on male Swiss Webster mice given orally the decoct of 20% “mengkudu” leaves. Istizin, a laxative drug, was used as a reference drug in this study.

Parameters study: increase of defecation frequency, amount of feces (feces weight) and consistency of feces.

The data were evaluated statistically.

Results and discussion

The characteristics of the tested plant compared with the official literature (5) are shown on Table I and Figure 1.

Table 1. Identity Examination of tested Plant (*Morinda citrifolia L.*)

Name of tested plant	Plant Characteristics(5)	
	Observation	Official Literature
<i>Morinda citrifolia L.</i>	Tree: "perdu" (clump) plant	Tree: "perdu" (clump) plant
Rubiaceae	Leaves: oval, length up to 1.5 cm	Leaves: oval, length up to 1.5 cm
Region name: - Mengkudu (Indonesia) - Pace (Java) - Cengkudu (Sunda) - Kondhuk (Medan)	Flower: White, cup-shaped Fruit: "bongkol" (knops) with lots of lumps, lots of seeds	Flower: white, cup / trumpet-shaped Fruit: "bongkol" (knops) with irregular lumps, lots of seeds

The tested plant was compared with the figure of *Morinda citrifolia L.* in the official literature (5) such as on following figure (Figure 1).

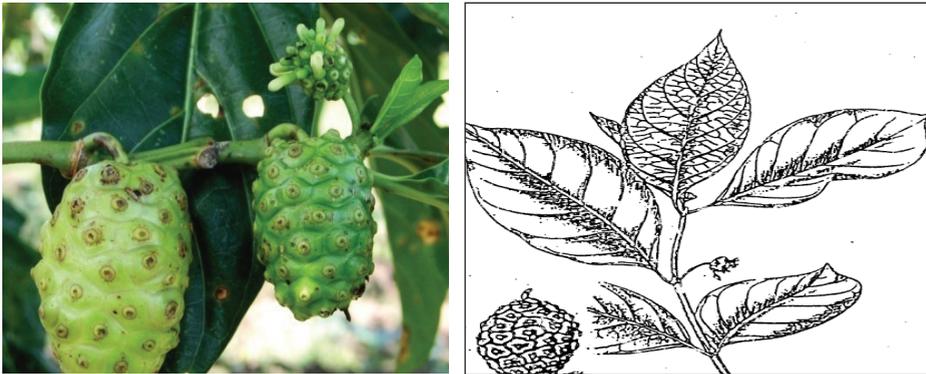


Figure 1. Tested Plant Picture (left) and Official Figure of *Morinda citrifolia L.* (right).

The determination of the tested plant was also conducted macroscopically by comparing a similar plant in the Herbarium Bandungense of the Biology Department of ITB and the key determination of the plant. These data showed that the tested plant was exactly *Morinda citrifolia L.* The simplex from *Morinda* leaves was used for this research.

Table 2. Anthelmintic Activity of 20% Decoction of *Morinda citrifolia* L. Leaves against *Ascaris lumbricoides* var. suum *in vitro*.

No. disc	Material/ Tested drugs Treatment		
	Control	<i>M Citrifolia</i> leaves 20%	Piperrazine citrate* 1%
1	+	P	P
2	+	P	P
3	+	P	P
4	+	+	P
5	+	P	p
Average	Live (100%)	Paralysis (80%)	Paralysis (100%)

* Worms were soaked in a test solution at 36°C; + = alive; P = paralysis.

Table 2 shows the *in vitro* activity of 20% w/v *Morinda citrifolia* L. leaves decoction towards *Ascaris lumbricoides* var.suum. The decoction of the tested plant showed a significant anthelmintic activity (80% paralysis), but the activity of the piperazine citrate as a reference drug (100% paralysis) showed better results compare to the decoction. This result was the same as or analogous with the research of Raj (7), who found that the alcoholic extract of *Morinda citrifolia* L. tender leaves had an anthelmintic action against human *Ascaris lumbricoides* in a test tube (*in vitro*).

The anthelmintic activity of 20% decoction against *Ascaris lumbricoides* var.suum is shown as a histogram in Figure 2.

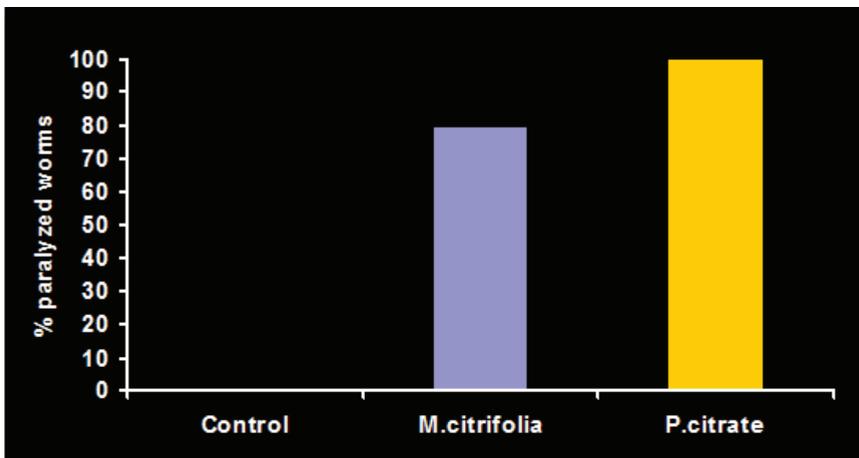


Figure 2. *In vitro* Antelmintic Activity of 20% *Morinda citrifolia* L. Leaves Decoction Against *Ascaris lumbricoides* var.suum.

Figure 2 shows more significantly the anthelmintic effect of 20% “mengkudu” leaves decoction.

Table 3 shows the results of the laxative activity test of 20% *Morinda citrifolia* L. leaves decoction on male Swiss Webster. The tested plant paralyzed 80% of *Ascaris suum* worms.

Table 3. The effect of *Morinda citrifolia* L. leaves 20% decoction on male Swiss Webster mice defecation (laxative activity).

Treatment Group	Time of Observation																	
	0-1 hour			1-2 hours			2-3 hours			3-4 hours			4-5 hours			Cumulatif		
	F	C	W	F	C	W	F	C	W	F	C	W	F	C	W	F	C	W
I. Control	1.6	0	23.1	0.4	0	4.7	0.6	0	7.5	0	0	0	0	0	0	2.6±1.4	0	35.3±23.3
II. Istizin' 12.5 g/kg BW	2.6	0	157.9	2.6	1.4	198.3	2.7	2.1	185.4	2.6	2.7	151.6	0.6	0.9	48.5	11.1±3.4	1.4±0.9	741.8±336.0
III. <i>M. citrifolia</i> . Leaves 20% 25 ml/kg BW	3	0	75.2	2.6	1	231.4	2.0	1.6	139.2	1.0	1.6	31.5	0.3	0.3	24.2	8.9±1.0	4.5±0.6	501.5±430.8

* Reference drug. Average of n = 7 mice. F = defecation frequency; C = feces consistency: normal (hard) = 0; a bit compact = 1, soft = 2, liquid = 3; W = Feces weight (mg), 0 = no defecation

The data on Table 3 show the effect of 20% *Morinda citrifolia* L. leaves decoction and Istizin as a reference drug on the defecation of male mice. Three parameters (frequency of defecation, consistency and weight of feces) were used for evaluation of the laxative activities.

Istizin showed laxative activities more effective significantly ($P < 0.05$) than a *Morinda citrifolia* decoction that has a significant laxative action ($P < 0.05$) compared with the control group.

Figures 3, 4 and 5 below show up laxative activities of Istizin and tested plant more clearly when compared to the control group.

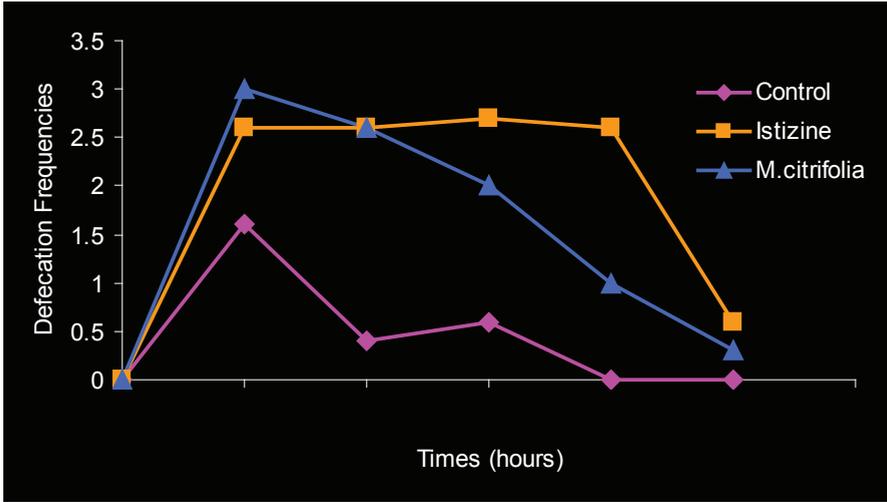


Figure 3. Average of Defecation Frequency of Male Mice after Treatment with 20% *Morinda citrifolia* L. leaves Decoction (25 ml/kg BW) and Istizin (12.5 mg/kg BW)

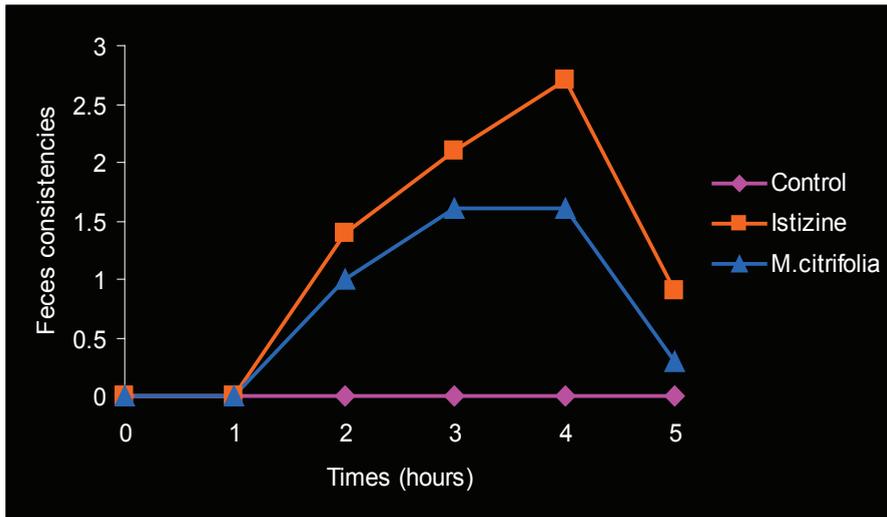


Figure 4. Average Feces Consistency of Male Mice after Treatment with 20% *Morinda citrifolia* L. Leaves Decoction (25 ml/kg BW) and Istizin (12.5 mg/kgBW)

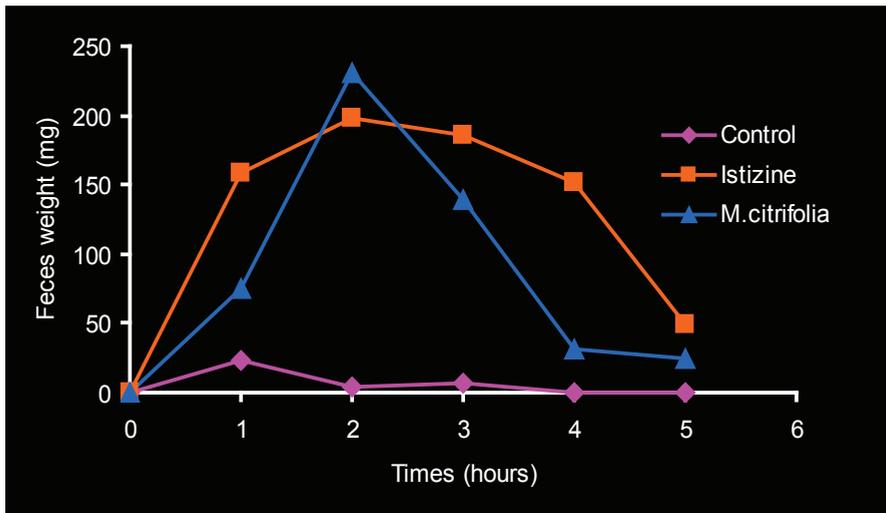


Figure 5. Average of Feces Weight of Male Mice after Treatment with 20% *Morinda citrifolia L.* leaves Decoction (25 ml/kg BW) and Istizine (12.5 mg/kgBW)

Figures 3, 4 and 5 above show frequency of defecation, consistency and feces weight parameters respectively. One can observe the more significant degree and latency effect of Istizine and of the tested plant on defecation of male mice as the laxative effect on frequency defecation, consistency and weight feces. These three parameters correspond to the clinical effect of a laxative drug.

Anthelmintic and laxative actions of *Morinda citrifolia L.* leaves were effective for the treatment of worm infection, firstly, by paralyzing the worms by their anthelmintic effect and, secondly, by quickly removing the worms from the intestine by their laxative effect.

Conclusion

The two methods that were used for determining the anthelmintic and laxative activity tests were valid methods because they validated using two reference drugs, piperazine citrate as an anthelmintic and Istizine as a laxative drug.

A decoction (20%) of “Mengkudu” (*Morinda citrifolia L.*) leaves showed anthelmintic activity that could paralyze worms of *Ascaris suum in vitro* and laxative activity at a dose of 25 ml/kg body weight of mice (equivalent with 5 g leaves simplex/kg bw).

This result supports the traditional use of “mengkudu” or *Morinda citrifolia* L. leaves in worm parasitic infection therapy; 20 % “mengkudu” leaves decoction at a dose of 25 ml or 5 g leaves simplex/kg body weight of mice is equal to a dose of \pm 38,79 g leaves or 194 ml as 20% *Morinda citrifolia* leaves decoction for adult (70 kg).

This double action of *Morinda citrifolia* L. leaves decoction is effective for worm parasitic infection medication. It showed two effects in one herb for use in one therapy. This is a traditional herbal medicine concept.

Suggestion

The characteristics and quality of *Morinda citrifolia* L. leaves decoction and its safety should be determined.

From this research it is suggested to isolate the active compound(s) in *Morinda citrifolia* L. leaves which have activity as anthelmintic or/and laxative.

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