

## **Curcumin concentration in fresh and decoction of dried *Curcuma longa* L. (turmeric) rhizome as homemade jamu**

Ramdan Panigoro, Diah Dhianawaty D

Biochemistry Department Faculty of Medicine of Universitas Padjadjaran, Bandung,  
Indonesia

### **ABSTRACT**

*Curcuma longa* (turmeric) is the most popular plant in Indonesia, which was used as an ingredient in Indonesia cuisines, traditional medicine (jamu). The pharmacological effect of the rhizome had correlation with the dosage of curcumin. The objective of the research is to evaluate the curcumin concentrations in fresh and decoction of dried rhizome as homemade jamu. Fresh rhizome was scraped and was kneaded with 50 ml of boiled water and filtered. Dried rhizome was boiled in 50 ml water at 90<sup>0</sup>C during 30 minutes, volume to be kept at constant, was filtered. Both supernatant was evaporated on the water bath. Curcumin in both dried supernatants were isolated with 50 ml methanol. Concentrations of curcumin were measured with spectrophotometer at wavelength 418 nm. Result from 20 g fresh turmeric rhizome and 3.98 g decoction of dried turmeric rhizome could be isolated 30.35 mg and 25.5 mg curcumin respectively. In conclusion in the 20 g fresh turmeric rhizome and 3.98 g decoction of dried turmeric rhizome as homemade jamu contained 30.35 mg and 25.5 mg curcumin respectively.

**Keyword:** *Curcuma longa*, curcumin, jamu, traditional medicine, turmeric,

Corresponding author

Email : [ramdan.panigoro@unpad.ac.id](mailto:ramdan.panigoro@unpad.ac.id)

Contact: +62818210259

## INTRODUCTION

*Curcuma longa* (turmeric) is the most popular plant in Indonesia, which was used as an ingredient in Indonesia cuisines, in yellow rice for breakfast, begana rice at the birthday party. It has also been used in traditional Indonesia medicine (jamu, herb medicine) which in many cities is commonly sold on the street by hawkers as a fresh handmade jamu or at jamu stalls that sold as dried jamu, and the other forms.

Curcuminoids is one of the important active ingredients from turmeric and has number of medicinal uses such as anti-inflammatory, anti-HIV, antitumour, antiviral, anticancer, antifungal and antiparasitic. All of these activities had correlation with the dosage of curcumin.

Modern medicine has begun to recognize its importance, as indicated by the over 3000 publications dealing with turmeric that came out within the last 25 years. This review first discusses in vitro studies with turmeric, followed by animal studies, and finally studies carried out on humans; the safety and efficacy of turmeric are further addressed. More than 100 components have been isolated from turmeric. The main component of the root is a volatile oil, containing turmerone, and there are other coloring agents called curcuminoids in turmeric. Curcuminoids consist of curcumin demethoxycurcumin, 5'-methoxycurcumin, and dihydrocurcumin, which are found to be natural antioxidants. Volatile oils include d- $\alpha$ -phellandrene, d-sabinene, cinol, borneol, zingiberene, and sesquiterpenes. There are a variety of sesquiterpenes, like germacrone; termerone; ar-(+)-,  $\alpha$ -, and  $\beta$ -termerones;  $\beta$ -bisabolene;  $\alpha$ -curcumene; zingiberene;  $\beta$ -sesquiphellanderene; bisacurone; curcumenone; dehydrocurdione; procurcumadiol; bis-acumol; curcumenol; isoprocurcumenol; epiprocurcumenol; procurcumenol; zedoaronediol; and curlone, many of which are specific for a species. The components responsible for the aroma of turmeric are turmerone, arturmerone, and zingiberene. The rhizomes are also reported to contain four new polysaccharides-ukonans

along with stigmasterole,  $\beta$ -sitosterole, cholesterol, and 2-hydroxymethyl anthraquinone (Prasad et al., 2011).

The aqueous *Curcuma longa* extract has activity against endodontic pathogen. From 500 gms *Curcuma longa* was produced 19.5 gms of the semi-solid aqueous extract. Four different concentrations: 1; 0.75; 0.5 and 0.25 g/ml that prepared in DMSO (dimethyl sulfoxide) had been tested. 0.75% concentration showed the greatest zone inhibition of 13 mm against *Staphylococcus aureus* and the 50% concentration showed the best zone of inhibition of 15.66 mm against *Candida albicans* and mild activity with a zone inhibition of 9 mm against *Enterococcus faecalis* (Hegde et al., 2012). The studied of the anti-oxidant and glucose lowering effects of bisdemethoxycurcumin analog (BDMCA) and curcumin in vitro, BDMCA at the dosage 10 and 20 mg/kg bw of rat, curcumin at the dosage 10 and 20 mg/kg bw of rat, had inhibitory effect on intestinal glucose absorption:  $9.54\pm 0.72$ ;  $7.23\pm 0.55$ ;  $14.59\pm 1.11$  and  $11.34\pm 0.86$ , respectively. BDMCA at the dosage 25 and 50 ng/mL, curcumin at the dosage 25 and 50 ng/mL, had antioxidant activity on inhibition of iron-ascorbate induced lipid peroxidation in liver homogenate,  $0.17\pm 0.014$ ;  $0.08\pm 0.008$ ;  $0.16\pm 0.008$ ; and  $0.07\pm 0.081$  respectively (Sivabalan et al., 2012).

In rat, 200 mg curcuminoid /kg bw of rat by oral route of administration showed after 2 hour and 3 hour inhibited 70% and 80% edema respectively which was caused by carrageenan injection (Patil et al., 2011). In mice, curcumin inhibited edema at doses between 50-200 mg/kg. A 50-percent reduction in edema was achieved with a dose of 48 mg/kg body weight, with curcumin nearly as effective as cortisone and phenylbutazone at similar dosages. In rats, a lower dose of 20-80 mg/kg decreased paw edema and inflammation. Curcumin also inhibited formaldehyde induced arthritis in rats at a dose of 40 mg/kg, had a lower ulcerogenic index (0.60) than phenylbutazone (1.70) (an anti-inflammatory drug often used to treat arthritis and gout), and demonstrated no acute toxicity at doses up to 2 g/kg body

weight. Intraperitoneal injection of an extract containing 4 mg total curcuminoids/kg/day for four days prior to arthritis induction significantly inhibited (Julie et al., 2009). At 400 mg/rats (2 g/KgBW) single dose once a week, oral curcumin significantly reduces atrophy of soleus muscle in rats immobilized for 2 weeks (Soebadi et al., 2008). The investigation of the effect of curcumin (0.02%, wt/wt) for 6 weeks on male diabetic mice type 2 showed curcumin significantly lowered blood glucose and HbA 1c levels, and it suppressed body weight loss, and significant reduction in lipid peroxidation (Seo et al., 2008). Curcumin in a dose of 400 mg/kg bw daily is more effective in decreasing total cholesterol level, LDL-cholesterol, number of F2-isoprostan and the formation of foam cell (Fikriah, 2007). Curcumin at 10  $\mu$ M prevents protein glycosylation and lipid peroxidation caused by high glucose levels using an erythrocyte cell model (Jain et al., 2006).

Akazawa investigated the effects of curcumin ingestion and aerobic exercise training on flow-mediated dilation as an indicator endothelial function in postmenopausal women. The curcumin used in the study was describe as a highly absorptive curcumin dispersed with colloidal nanoparticle. A daily dose of 25 mg was provided. The study lasted for eight weeks. The results indicated that curcumin ingestion and aerobic exercise training can increase flow-mediated dilation in postmenopausal women, suggesting that both can potentially improve the age-related decline in endothelial function (Akazawa et al., 20012). At the dosage 6 g *C. longa* had no significant effect on the glucose response. The change in insulin was significantly higher 30 min ( $P = 0.03$ ) and 60 min ( $P = 0.041$ ) after the oral glucose tolerance test (OGTT) including *C. longa*. The insulin areas under the curves AUCs were also significantly higher after the ingestion of *C. longa*, 15 ( $P = 0.048$ ), 30 ( $P = 0.035$ ), 90 ( $P = 0.03$ ), and 120 ( $P = 0.02$ ) minutes after the OGTT (Wickenberg et al., 2010). Soni and Kuttan examined the effect of curcuminadministration in reducing the serum levels of cholesterol and lipid peroxides in 10 healthy humanvolunteers receiving 500 mg of curcumin per day for

7 days [112]. A significant decrease in the level of serum lipid peroxides (33%), an increase in high-density lipoproteins (HDL) cholesterol(29%), and a decrease in total serum cholesterol (12%) were noted. The result of the examination of anticancer potential of curcumin liposomal formulation on mice by the Dalton's lymphoma cells, at concentration 1 mg/animal, all animals survived 30 days, and only two of the animals developed tumors and died before 60 days (Aggarwal et al., 2005).

Curcumin is extracted from the dried root of the rhizome *Curcuma longa*. The process of extraction requires the raw material to be ground into powder, and washed with a suitable solvent that selectively extracts coloring matter. The selection of solvents is done with care to meet extractability and regulatory criteria. The following solvents are considered suitable:

isopropanol, in the curcumin manufacturing process isopropyl alcohol is used as a processing aid for purifying curcumin. Ethyl acetate, with a restriction placed on the use of chlorinated solvents, such as dichloroethane, it is found that ethyl acetate, owing to its polarity, is a reasonable replacement providing acceptable quality of product and commercially viable yields. Acetone, this is used as a solvent in the curcumin manufacturing process. Carbon dioxide, this is not currently used in commercial production. However, it is listed in EC Directive 95/45/EC and has potential as a substitute for chlorinated solvents. Methanol, this solvent is used occasionally as a processing aid for purification. Ethanol, this solvent is used sparingly because curcumin is completely soluble in ethanol Hexane (Stankovic, 2004).

## **METHOD**

### **Material:**

*Curcuma longa* L. (turmeric), it was identified at School of Life Sciences and Technology Institute Technology of Bandung, cultivated at Wonogiri (Central Java), was harvested in

October, 2012. Its rhizome has length 7.5 – 9.0 cm; diameter 3.5 – 4.5 cm; fresh (wet) weight = 1,460.6 g; dried weight = 279.27 g.

Curcumin for synthesis: 8203540010 (E.Merck)

Equipment : Spectrophotometer Jenway 6305 UV-Vis single beam.

### **Experimental Details:**

#### 1. Standard curve

Curcumin for synthesis was dissolved in methanol at concentrations: 0.500; 0.250; 0.200; 0.125; 0.100; 0.050 mg/50ml. The absorbance was measured at wavelength 418 nm.

#### 2. Dosage in traditional medicine (Dalimartha, 2008).

Fresh and dried turmeric rhizome were used: 6 – 20 g and 3 – 10 g respectively

In this experiment was used 20 g fresh turmeric rhizome which is equivalent with 3.98 g dried turmeric

#### 3. Isolation of curcumin from fresh and decoction of dried turmeric rhizome with methanol.

10 g of fresh rhizome was scraped and was kneaded with 50 ml of boiled water. Then was pressed and was filtered, supernatant was evaporated on the water bath. After dried, curcumin was isolated with methanol. Methanol was added until the total volume of solution was 50 ml.

The decoction was prepared by boiling: 3.98 g of dried rhizome was boiled in 50 ml water at 90°C during 30 minutes, volume to be kept at constant. Then was filtered and supernatant was evaporated on the water bath. After dried, curcumin was isolated with methanol. Methanol was added until the total volume of solution was 50 ml.

#### 4. The calculation of samples curcumin concentration

1 ml of curcumin from above solutions were taken and were diluted until 50 ml solutions.

Curcumin concentration were measured at wavelength 418 nm by Spectrophotometer

Jenway 6305 UV-Vis single beam, and then the results were calculated by linier regression from standard curve.

## RESULT AND DISCUSSION

Table 1: Standard curve of curcumin at wavelength 418 nm

No.	Concentration of curcumin mg/ 50 ml	Absorbance
1	0.500	1.323
2	0.250	0.669
3	0.200	0.552
4	0.125	0.327
5	0.100	0.256
6	0.050	0.127

The linier regression is  $y = 2.663 x - 0.001$

Note : Y is absorbance and X is sample concentration

Table 2: Curcumin concentration from fresh and decoction of dried turmeric rhizome were measured at wavelength 418 nm

No Samples	Absorbance	
	turmeric	
	Fresh	Dried
1	1.616	1.359
2	1.618	1.356
3	1.619	1.356
Average	1.617	1.357
Concentration of curcumin	30.35 mg	25.5 mg

Concentration of curcumin was calculated with the linier regression,  $y = 2.663 x - 0.001$

From 20 g fresh turmeric rhizome and 3.98 g decoction of dried turmeric rhizome homemade could be isolated 30.35 mg and 25.5 mg curcumin respectively.

## CONCLUSION

In 20 g fresh turmeric rhizome and 3.98 g decoction of dried turmeric rhizome as homemade jamu contained 30.35 mg and 25.5 mg curcumin respectively.

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