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OVEN DRYING AND WATER EXTRACTION OF *CURCUMA XANTHORRHIZA* FOR HYGIENE IMPROVEMENT IN THE PRODUCTION OF *JAMU CEKOK*, A TRADITIONAL APPETITE STIMULANT HERBAL MEDICINE

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ABSTRACT

Toddlers (<5 years old) suffering from malnutrition have been a concern in Indonesia, and 53% of them are known to relate with appetite problems. *Jamu cekok* is a traditional appetite stimulant commonly applied by hand-squeezing the water out of herbal mixture directly into the throat of the children. Main ingredient of *jamu cekok* is the rhizome of *Curcuma xanthorrhiza* Roxb (*Temulawak* or Javanese turmeric) with curcumin and xanthorrhizol for its active compounds. Despite empirical evidence of the function and promising market potential, the common practice for the material preparation including sun-drying and hand squeezing has a higher risk for microbial contamination. For hygiene improvement, oven drying and water extraction can be applied to prepare *C. xanthorrhiza* water extract for material of *Jamu cekok* production. In this research, several drying temperatures (30 and 50 °C) as well as extraction temperatures (50, 75, and 100 °C) and solvents to mass ratio (10:5, 10:2, 10:1) were observed in the production of *Temulawak* water extract. Measurement of curcumin content and qualitative determination of xanthorrhizol to evaluate the effectiveness of water extraction, while microbial growth is observed to evaluate the improvement of hygiene conditions. Solvent to mass ratio 10:2 was shown to have the highest curcumin content. Higher extraction temperatures are shown to give higher curcumin content but less xanthorrhizol content. The oven drying and water extraction is shown to successfully improve the sanitation condition shown with significantly lower microbial growth.

Keywords: curcumin; jamu cekok; microbial growth; temulawak; xanthorrhizol

ABSTRAK

Balita usia di bawah 5 tahun dengan kondisi malnutrisi merupakan permasalahan yang banyak ditemukan Indonesia, dan sekitar 53% diantaranya disebabkan oleh rendahnya nafsu makan. Jamu cekok adalah obat tradisional Indonesia yang umumnya digunakan untuk meningkatkan nafsu makan untuk anak-anak. Jamu cekok biasanya diberikan kepada anak dengan cara meremas campuran herbal dengan tangan dan langsung dimasukan kedalam mulut anak supaya cairan yang dihasilkan langsung masuk ke dalam tenggorokan anak. Bahan utama jamu cekok adalah rimpang *Curcuma xanthorrhiza* Roxb (Temulawak) dengan bahan aktif kurkumin dan xantorizol. Walaupun fungsi secara empiris dan potensi pasar sudah cukup menjanjikan, tetapi umumnya metode yang digunakan untuk mengeringkan bahan baku dengan sinar matahari dan proses memeras herbal memiliki potensi kontaminasi mikroba yang sangat besar. Perubahan proses pengeringan menggunakan oven dan ekstraksi menggunakan air dapat diaplikasikan untuk meningkatkan sanitasi dari jamu cekok. Pada penelitian ini, dilakukan ekstraksi temulawak menggunakan air dengan dilakukan beberapa perbedaan diantaranya kondisi suhu pengeringan (30°C dan 50°C), suhu ekstraksi (50°C, 75°C, dan 100°C), serta rasio berat dari pelarut dan bahan baku (10:5, 10:2, 10:1). Estimasi kandungan kurkumin dan penentuan xantorizol secara kualitatif digunakan untuk menentukan efektivitas dari proses ekstraksi menggunakan air, sedangkan peningkatan sanitasi dapat dilihat dari jumlah pertumbuhan bakteri. Kandungan kurkumin paling tinggi dihasilkan dari rasio pelarut terhadap bahan baku 10:2. Suhu ekstraksi paling tinggi menghasilkan kandungan kurkumin yang paling tinggi, tetapi sebaliknya memiliki kandungan xantorizol yang paling rendah. Pengeringan menggunakan oven dan ekstraksi menggunakan air

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menunjukan peningkatan sanitasi yang terlihat dari penurunan jumlah bakteri yang sangat signifikan.

Kata kunci: jamu cekok; kurkumin; pertumbuhan bakteri; temulawak; xantorizol

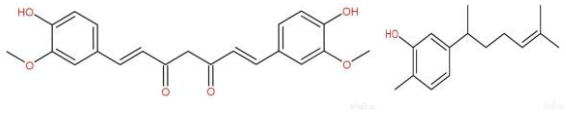
INTRODUCTION

Malnutrition remains to be one of the most common public problems occurring in Indonesia. The prevalence of toddlers (<5 years old) suffering from malnutrition due to appetite problems was up to 53% (Indonesia's Ministry of Health, 2012). To accommodate the appetite problems in children, *Jamu cekok* a traditional herbal mixture is commonly applied for treating appetite problems in children. *Cekok* means a method of giving the *herbal* mixture into the throat of the children by force (Figure 1a). In most applications, *Curcuma xanthorrhiza* Roxb (temulawak or Javanese ginger, Figure 1 (b)) is used as the main ingredient of *Jamu Cekok* as it is known to be effective for increasing appetite in children.

Figure 1. (a) Method of *jamu cekok* (b) Rhizome of *temulawak*

The active compounds in *C. xanthorrhiza*, such as curcumin, xanthorrhizol and essential oils contribute as the main factors of its benefit (Sidik et al., 1995). Curcumin (Figure 1a) is a polyphenol compound that is derived from a dietary spice, such as *C. longa* and *C. xanthorrhiza*, and has been studied for wide application including appetite stimulation (Agarwal *et al*, 2003). *Xanthorrhizol* (Figure 1b) is an active compound that majorly exists and has become a distinctive feature for *C. xanthorrhiza* to differentiate the plant from other Curcuma species (Halim *et.al*, 2012). Study by Choi *et.al* (2005), showed a wide health benefit potency of xanthorrhizol including those related to appetite stimulation. Besides, curcumin content from *temulawak* can increase bile secretion and elevate the activity of enzymatic activity in the digestive system, which results in increasing appetite levels *(Platel and Srinivasan, 2000)*.

While *jamu cekok* has empirical evidence for its efficacy and the demand is there, the commercial product is currently not available in the market. Besides, the preparation of *jamu cekok* is commonly done under an unhygienic method. Thus, there is the opportunity to develop a standard of *temulawak* utilization to produce hygienic *jamu cekok*. Water extraction could become a preferable alternative method for *jamu cekok* hygienic production if proven for their efficacy and hygienic improvement.



(A) (B)

Figure 2. (A) Chemical Structure of Curcumin (B) Chemical Structure of Xanthorrhizol

MATERIALS AND METHOD

Material

The materials that were used in this research are fresh temulawak (*C. xanthorrhiza*), which were obtained from Tangerang Traditional Market, distilled water, curcumin and xanthorrhizol standards from Nacalai Tesque Inc (Put city name, Japan), Plate Count Agar (Merck, city name, Germany), and HPLC-grade ethanol 99.5% (……).

Method

Temulawak extract preparation

The fresh temulawak was obtained from Tangerang traditional market. It was washed and cut into 2-cm-thick pieces. It was dried within two variations of oven drying temperature (30°C and 50°C) and milled. The fresh *temulawak* was separated into 2 batches and dried at 30°C and 50°C for 72 hours, separately. The dried temulawak were extracted using water at various temperatures (50°C, 75°C, 100°C) and various solvents to mass ratio (10:5, 10:2, 10:1). Optimum conditions for drying and extraction ratio were defined in correlation with the estimation for curcumin content.

Content of curcumin, to ensure the efficacy, and

the number of microbial growths in the extract, to ensure its hygienic standard of production. The evaluations are conducted triplo and the results were statistically evaluated for significance.

Determination of curcumin content (Rohman, 2012; Pawar et al., 2014)

The curcumin content was estimated by using UV-Vis spectrophotometry analysis at the wavelength of 420 – 430 nm, in which curcuminoids show the intensive absorption intensity in some organic solvents (Rohman, 2012). The crude extract is evaluated for its curcumin content estimation based on the standard curve made using curcuminoid standard (Pawar et al., 2014).

Xanthorrhizol quantitative determination (Choi et al., 2017)

The crude extract was chromatographed on a C18 reversed-phase column using ethanol containing 0.1% phosphoric acid. Xanthorrhizol standard with known concentration is used to calculate the amount of xanthorrhizol content in the sample. Sample only, sample with xanthorrhizol standard, and xanthorrhizol standard only were injected into the HPLC system and calculated using an embedded software program to calculate the amount of xanthorrhizol content in the sample.

Total microbial growth (AOAC, 1990)

Total plate count method was used to analyze the hygiene quality of the sample. Each extract was taken using separate sterile pipettes, and diluted to 10^{-2}, 10^{-3}, and 10^{-4}. From each dilution 1 ml of extract sample was pipetted into a petri dish, poured with 12-15 ml plate count agar (cooled to 45 ± 1°C), and mixed immediately by alternate rotation and back-and-forth motion of plates on flat level surface. After the agar solidified, the petri dishes were placed inversely and incubated for 48 h at 35°C. Microbial growth was counted and was calculated for its microbial concentration within serial dilution.

Statistical analysis

The result from the research was analysed statistically by using ANOVA and a post hoc test using Tukey HSD. Differences at $p < 0.05$ are considered statistically significant with 95% confidence level (Kopjar *et al.*, 2009).

RESULTS AND DISCUSSION

Selection of drying temperature and extraction ratio

Sun-drying remains the common practice in preparing dried temulawak prior to consumption or further processing in Indonesia. In this study temperatures of 30°C and 50°C are selected as the minimum and maximum temperatures in Indonesian climates and oven drying is selected as a method due to its simplicity and high processing unit availability. Following the oven-drying, the dried *C. xanthorriza* was extracted with several variations of temperature and ratio solvent to mass.

Table 1. Curcumin Content on Dried Temulawak with Different Temperature of Drying and Water Extraction Process

Drying Temperature	Extraction Temperature	Solvent to Mass Rasio	Curcumin (mg)
30°C	50°C	10:5	21.038 ± 0.52[a]
		10:2	19.308 ± 0.57[a]
		10:1	22.467 ± 0.40[a]
	75°C	10:5	27.996 ± 0.24[b]
		10:2	47.415 ± 1.83[c]
		10:1	70.584 ±1.60[d]
	100°C	10:5	66.972 ± 0.29[e]
		10:2	112.721 ± 0.33[f]
		10:1	87.589 ± 0.67[g]
50°C	50°C	10:5	38.60 ± 0.20[a]
		10:2	47.01 ± 0.40[b]
		10:1	21.13 ± 0.80[c]
	75°C	10:5	52.05 ± 0.60[d]
		10:2	66.89 ± 0.15[e]
		10:1	43.94± 0.50[b]
	100°C	10:5	189.27 ± 0.60[f]
		10:2	417.75 ± 2.33[g]
		10:1	351.04 ± 2.66[h]

The content of curcumin from each sample were shown in Table 1. The evaluation showed that extracts resulting from dried temulawak which was dried at 50 °C, has higher estimated content of curcumin in comparison to those dried at 30 °C. The result was in agreement with prior study of Halder *et. al* (2010), showing that higher drying temperatures cause the difference in moisture ability to diffuse in the cells of biological material

and may increase yield of the following extraction up to three times higher compared to those that were dried at low temperatures. It is interesting to note that higher estimated content of curcumin was shown in the extract resulting from ratio extraction of 10:2 solvent to mass (Table 1). Higher solvent ratio will increase extraction yield as it facilitates conditions that favors good mass transfer from the solid matters to their solvent (Sayyar et al., 2009). However, in this study, it is shown that the optimum extraction ratio was not the highest ratio of solvent to mass. This is probably due to the limit of solvent capacity. According to the evaluation of estimated content of curcumin, 50 °C is selected as the drying temperature and extraction at ratio solvent to mass 10:2 are selected as extraction conditions.

Impact of extraction temperature to curcumin and xanthorrhizol content and microbial growth

*C. xanthorrhiza e*xtract resulting from extraction at higher temperatures have higher estimated content of curcumin in comparison to those coming from lower temperatures extractions (Table 1). In contrast, the highest content of xanthorrhizol was shown in extract resulting from extraction at lower temperature (Table 2). Xanthorrhizol is known to have less stability in temperatures above 50 °C and was not able to maintain its stability at higher temperatures (Yulianti, 2010).

Table 2. Xanthorrhizol Content from Various Extraction Temperature

Temperature	Xanthorrhizol Content (mg/L)
50°C	1966.81
75°C	406.81
100°C	306.06

Note: Used best ratio (1:20) and optimum drying temperature(50°C)

C. xanthorrhiza is known to have anti-microbial activity from xanthorrhizol content, however heat treatment is also known to inhibit microbial growth. Evaluation of total microbial count in *C. xanthorrhiza e*xtract from extraction at higher temperatures has lower microbial count (Table 3). This has shown that high temperature treatments have more impact than xanthorrhizol content in the inhibition of microbial growth from *C. xanthorrhiza e*xtract. Nevertheless all extract tested has met the hygiene standard of traditional herbal medicine production of $<10^4$ CFU/ml (Kepmenkes, 1994). Study by Shohlichah (2012) showed that *Jamu* with traditional preparation can have as high as 4.8 x 10^6 CFU/ml. Therefore, oven drying and water extraction of *C. xanthorrhiza* is shown to successfully improve the hygiene level in the preparation of *Jamu cekok* ingredients.

Table 3. Microbial Growth in The Sample

Temperature (°C)	Number of Bacteria (CFU/ml)
50	25.7 x 10^3
75	10.8 x 10^3
100	4.3 x 10^3

CONCLUSION

In the effort of hygiene improvement for the preparation of *jamu cekok*, oven-drying and water extraction were applied in replacement of sun drying and hand-squeezing. In concern to the processing efficiency and resulted extract efficacy, oven drying at 50°C followed by extraction in ratio solve is shown to yield better curcumin content in the resulting extract. Extraction temperature showed a contrast effect in the curcumin and xanthorrhizol content. Highest curcumin content is shown in extract resulting from highest extraction temperature while highest xanthorrhizol content is shown in extract resulting from lowest extraction temperature. Nevertheless, all extracts met the microbial growth requirements in hygiene standard of traditional herbal medicine production and improvement in the preparation of *jamu cekok* ingredients.

REFERENCES

Association of Official Analytical Chemists. 1990. Official Methods of Analysis, 15th ed. AOAC, Arlington, VA.

Choi, S., Kim, M., Kim, C., Hwang, J.K. and Kang, W., 2017. Quantitative determination of xanthorrhizol in rat plasma by HPLC–MS/MS

and its application to a pharmacokinetic study. *Journal of pharmaceutical and biomedical analysis, 132, pp.56-59*.

Halder *et.al.* 2010. 'Water transport in cellular tissues during thermal processing', *AIChE Journal, vol. 57, no. 9, pp. 2574-2588*

Kopjar *et.al*.2011. Influence of Different Extracts Addition on Total Phenols, Anthocyanin Content and Antioxidant Activity of Blackberry Juice During Storage. Croatian Journal of Food Science and Technology, 3(1), pp.9–15

Pawar, H., Karde, M., Mundle, N., Jadhav, P. and Mehra, K., 2014. Phytochemical evaluation and curcumin content determination of turmeric rhizomes collected from Bhandara District of Maharashtra (India). *Med. Chem, 4*(8), pp.588-591.

Platel, K. and Srinivasan, K. 2000. Influence of dietary spices and their active principles on pancreatic digestive enzymes in albino rats. *Nahrung*. 44, 42–46

Sayyar et. al. 2009. Extraction of Oil from Jatropha Seeds-Optimization and Kinetics. *American Journal of Applied Sciences. vol. 6, no. 7, pp. 1390-1395*

Sidik, Mulyono WM, Mutadi A. 1995. Temulawak (*Curcuma xanthorrhiza* Roxb). Jakarta: *Phyto Medika*.

Yulianti, Novi Puspita. 2010. Pengaruh Nisbah Bahan Baku – Pelarut Dan Suhu Ekstraksi Terhadap Kandungan Xanthorrhizol. Dalam Oleoresin Temulawak. *Repository IPB*

Zukhrufa, Clarisha. 2016. The Extraction, Characterization, And Stability of Anthocyanin from Langsat Burung (*Aglaiaforbesii King*) Fruit. *Swiss German University*