

UTILIZATION OF ACTIVE COMPOUNDS IN TUMERIC (*Curcuma longa*) AS ANTIOXIDANT HERBAL

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ABSTRACT

Turmeric (*Curcuma longa*) is a plant that has many benefits. Most people use turmeric as a cooking spice, food coloring, or as traditional medicine. Traditional medicine is needed as an alternative method in medical world. At present, a lot of research has been done to develop the use of turmeric. The active compound in turmeric is diferuloylmethane (1,7-bis (4-hydroxy-3-methoxyphenyl) -1,6-heptadiene-3,5-dione) or often called curcumin. Curcumin is a compound that has many benefits. Curcumin can be used as an antioxidant, anti-inflammatory, antibacterial, and antiobesity. The purpose of this review journal is to discuss several studies related to the potential of the active component in turmeric. This journal discusses the benefits of active compounds in turmeric as an antioxidant, anti-inflammatory, antibacterial, and antiobesity.

Keyword: Curcumin, Compound, Traditional Medicine, Turmeric.

INTRODUCTION

Indonesia is one of the largest spice producing countries. Turmeric land in Indonesia in 2016 amounted to 50,203 hectares, increased in 2017 to 62,874 hectares, then increased again in 2018 to 75,148 hectares and continued to increase in 2019 to 81,003 hectares (BPS, 2019). Based on data obtained turmeric land in Indonesia continues to increase every year as well as abundant production from 2016 to 2018 increased from 107,783 tons/ha to 203,457 tons/ha (BPS, 2019). This indicates that turmeric has potential as a traditional medicinal plant that has high economic value.



Figure 1. Chart of Total Increase in Turmeric Production (BPS, 2019)

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Turmeric rhizomes can be used as a variety of traditional raw materials. In Indonesia, turmeric is widely cultivated by the community and is one of the raw materials of traditional medicine (Sulasiyah et al., 2018). Indians use turmeric as a food raw material for dyes and flavor enhancers (Gupta et al., 2013). Turmeric can also be used in social and religious ceremonies and traditional medicine for the treatment of diseases such as gastric, liver, gynecological and infectious diseases (Hasan and Mahmud, 2014). Consuming herbs such as turmeric will prevent various diseases such as cancer, inflammation, and cardiovascular (Hossain et al., 2008). Turmeric has many benefits for human life.

One of the important active compounds contained in turmeric is curcumin. According to Mutiah (2015), curcumin is a flavonoid compound that can not be dissolved in water but can be dissolved in ethanol, dimethylsulfoxide, or acetone. Kocaadam and Nevin (2015) added that the most active component of turmeric is curcumin. Therefore, curcumin has an important role as an active component in turmeric. The purpose of this review journal is to discuss the potential of the active component in turmeric. This journal discusses the benefits of active compounds in turmeric as antioxidants, anti-inflammatories, antibacterials, and antiobesity.

RESEARCH METHODS

One of the important parts of a study is literature studies. According to (Nazir 2013; Sugiyono, 2012) literature and research studies are inseparable from scientific literature, books, notes, or research-related reports. This literature is part of a review of the use of turmeric as traditional medicine. The methods used are review through articles, organizational websites, published research results, and national statistical data. Keywords in articles searched from databases such as Elsevier Science Direct, Springerlink, and Google Scholar. The source is then selected according to the criteria for scientific research, research articles, nationally and internationally recognized publications either published in Bahasa or English. The result is then categorized in several categories of the use of turmeric as a traditional medicinal ingredient.

RESULTS AND DISCUSSION

The use of traditional medicine in maintaining public health is often recommended by those with the trend of "back to nature". One of the spices that can be utilized is turmeric. Turmeric has a variety of functions, especially for human health. Turmeric belongs to the spice group that is used as a natural treatment ingredient with low side effects (Asnia, et al., 2019). Arisonya et al., (2014) state that turmeric has main uses such as traditional medicinal ingredients, herbal medicine, and cosmetic industry raw materials, cooking seasoning ingredients. Other benefits that turmeric has are antioxidants, antitumor, anticancer, antimicrobial, and anti-poisoning (Wulandari et al., 2018). Based on table 1 can be seen there are various active compounds in turmeric that are beneficial for living things such as antioxidants, anti-inflammatories, antibacterials, and so on.

Turmeric as Antioxidant

Antioxidants are bioactive compounds that are useful as a deterrent to free radicals. The antioxidant is a molecule that can produce free radicals by inhibiting molecular oxidation (Rajnarayana et al., 2011). Antioxidants are very diverse in type. Antioxidants are divided into two types based on their source, namely natural antioxidants and synthetic antioxidants (Junaidi, 2015). One of the compounds that can be used as an antioxidant is curcumin. Curcumin is a potential compound as an antioxidant substance because it contains the active substance of phenolic compounds (Sugiharto et al., 2012). According to Tanvir et al., (2018) turmeric from Bangladesh is a natural source of antioxidants indicated by the high content of polyphenols, flavonoids, tannins, and ascorbic acid as well as the antiviral activity of free radicals obtained from the extraction of turmeric insoluble substances and ethanol extraction. Wahyuningtyas et al., (2017) revealed that curcumin produced from turmeric extract with ethanol solvents is antioxidant in

inhibiting free radicals. Based on the results of Alisi et al., (2018) testing of antioxidant activity in curcumin conducted with DPPH test showed that the presence of high antioxidant activity in curcumin compounds. Similarly, the results reported by Septiana et al., (2015) that ethyl acetate extract of turmeric rhizomes has the best antioxidant activity with IC50 with substrate oxidation inhibitory mechanism. Sulasiyah et al., (2018) reported that fermentation of turmeric using *Aspergillus oryzae* can increase antioxidant activity in turmeric because the more phenolics are free, the higher its antioxidant activity (Liang et al., 2012). In addition to humans, curcumin can be used as an antioxidant for animals because according to Al-Samarrai et al., (2015) turmeric contains Curcumin, Demethoxy curcumin, Curcumol, Isocurcumin, and Germacrone which are isolated in vivo conditions have antioxidant properties that significantly increase serum levels of reduced glutathione, glutathione peroxide, and uric acid in rabbits.

Table 1. Active Compounds In Turmeric and Its Utilization

Utilization	Active Compounds	Methods	References
Antioxidant	Curcumin	<ul style="list-style-type: none"> • Antioxidant capacity measured using the DPPH method • Antiochistic activity and tested using Thiobarbituric acid (TBA) method • Total phenolic measurement Total phenolic is measured after obtaining Supernatant from the TBA process. 	Mulyani <i>et al.</i> , 2014
	Curcumin	<ul style="list-style-type: none"> • DPPH 	Riaminanti <i>et al.</i> , 2016
Antiinflammatory	Essential Oil	<ul style="list-style-type: none"> • Acute Toxicity Test Administration of essential oils in mice animals at a dose of 100-800 mg/kg. • Teratogenik Test Administration of HCG and PMSG hormones in mated female mice 	Muniroh <i>et al.</i> , 2010

		<ul style="list-style-type: none"> • Blood urea concentration test and TNF-α <p>Measurement of blood urea concentration using a strip test of easy touch GU fast monitoring system Tnf-α detection using Elisa human-TNF-α bendermed system</p>	
	Curcumin	<ul style="list-style-type: none"> • Rhizome extraction using maceration method for 72 hours • Security test is done by the patch test method • Induction of hioerglikema in animals using Streptozotocin • Histopathological observations using Chen et al methods, 2005 and Winarsih et al., 2007 • Research model using quasi-experiments • Pain level measured using the Numeric Rating Scale (1-10). • A sample is missive with Purposive sampling method • Bivariate analysis with t test p=0.05. 	Wientarsih et al., 2012
Antibacterial	Curcumin dan fenilprepanoid	<ul style="list-style-type: none"> • Provision of heating temperature using the water bath 	Fitoni et al., 2013
	Curcumin	<ul style="list-style-type: none"> • Data processing with ANOVA one-way and if there are real differences between treatments conducted with Post Hoc Test (1%) 	Ramadhani et al., 2017
	Curcumin dan essential oil	<ul style="list-style-type: none"> • Phytochemical testing performed using saponin test • Examination of steroids, triterpenoids, and glycosides was carried out with the Liebermann-Burchard reaction. 	Kumara, el al., 2019.
Anticancer	Curcumin	<ul style="list-style-type: none"> • □ Cell calculation using Trypan Blue Exclusion Method 	Sianipar el al., 2018

Antivirus	Curcumin	<ul style="list-style-type: none"> • Propagansi virus sel C636 • Evaluasi aktivitas antivirus dengan sek veri (African green monkey kidney) • Deteksi antigen dengan RT-PCR 	Marbawati dan Umniyati (2016)
	Curcumin	<ul style="list-style-type: none"> • HPLC 	Chen et al., 2010

Turmeric As Antiinflammatory

Inflammation is a response due to damage to tissues. According to Ramadhani and Sri (2016), inflammation is the response caused by damage to tissues caused by various traumas. Inflammation has an important role in the healing of diseases. Inflammation is a complex biological reaction of blood vessel tissue to harmful action (Setia and Ami, 2016). Drugs that can be used for anti-inflammatories are AIS (Anti-Inflammatory Steroids) or AINS (Non-Steroidal Anti-Inflammatory) (Huassaana and Suparmi, 2012). According to Widiyantoro et al., (2012) inflammatory healing can be done by various methods such as anti-inflammatory steroids and nonsteroids, but the use of such ingredients can lead to side effects. Another alternative that can be used as an anti-inflammatory drug is the use of herbal remedies.

One of the natural ingredients that can be used as medicine is turmeric. Turmeric is a plant that can be used as traditional medicine (Astuti and Sih, 2019). From various studies mention that the active compound of turmeric that is efficacious as an anti-inflammatory is curcumin. Based on research (Swanson et al., 2010) extracts from turmeric can modulate inflammatory responses. Similarly, according to Gonçalves et al., (2014), curcumin can prevent skin tumors and wrinkle formation. According to Khotimah and Ahmad (2016) turmeric ethanol extract has the potential as an anti-inflammatory because curcumin can suppress the activity of the enzyme cyclooxygenase and inhibit the formation of prostaglandins. Similarly, the results of Abelira's research (2020) stated that inflammation can be inhibited by the active compound of turmeric, namely curcumin with nf-kB suppression mechanism, limiting various NF-kB activators, and also regulating the activity of enzymes and cytokines by inhibition of COX-1 and COX 2. Other studies mention

that inflammation can cause joint pain in people with gout and one of the treatments is by utilizing turmeric as a medicine.

Fahryl and Novita's research (2019) mentioned that turmeric can be used as an anti-inflammatory agent in uric acid disease. The administration of the active compound curcumin in turmeric in the long term remains safe. According to Chandran and Ajay (2012), curcumin administration for more than 8 weeks remains safe to consume. Research on the effects of turmeric as an anti-inflammatory was also conducted in animals such as mice, such as research conducted by Meilina and Rasmadi (2018) on the anti-inflammatory effect of turmeric ethanol extract in white mice reported that the administration of turmeric ethanol extract at a dose of 600 mg/kg gave an optimal anti-inflammatory effect.

Turmeric As Antibacterial

Bacteria are living things that do not have cell nucleus membranes. There are two types of bacteria, namely gram-positive and negative bacteria. The presence of bacteria in the body can be prevented from using drugs. One of the medicinal plants that people often use is turmeric (*Curcuma longa*) rhizome part. The main content of turmeric is curcuminoid which includes phenolic compounds acting as anti-microbes (Ramadhani et al., 2017). The mechanism of curcumin as an antibacterial is by inhibiting the metabolism of bacteria where the cytoplasm membrane will be damaged and the cell proteins will be denatured so that the nutrients from the cells will leak and the bacterial cells will die or their growth will be inhibited (Madigan, 2005). Based on Bisht et al., (2010) turmeric extract in *Bacillus* sp. can inhibit the growth of bacteria *Bacillus* sp. in the weak category by denaturing and damaging the cell membrane so that the metabolic process is disrupted and the oil in the dry extract of turmeric can inhibit the growth of bacteria by damaging the process of forming cell membranes so that cell membranes do not form or occur imperfect cell formation.

The content of essential oil in dried turmeric extract can inhibit the growth of bacteria *E. coli* and *Bacillus subtilis* by utilizing interactions with bacterial cell walls that are then reabsorbed and penetration into cells to cause deposition and denaturation of proteins while antibacterial activity in curcumin using the inhibition of bacterial cell proliferation (Yuliati, 2016). Similarly, the results of research (Gupta et al., 2015) on the evaluation of the microbial activity of turmeric rhizome extract against *S. aureus* reported that the effects of turmeric extract in different fractions such as petroleum ether, chloroform, benzene, and methanol with turmeric powder obtained from the market.

Similarly, Niamsa's research (2009) on the antimicrobial activity of turmeric in Aquos extract showed the results that the presence of antimicrobial activity against *E. coli*, *S. aureus*, *K. pneumonia*, and *S. epidermidis*. According to research by Pangemanan et al., (2016) turmeric rhizome extract has antimicrobial activity because the active substance (curcuminoid) in turmeric rhizome extract can inhibit bacterial growth. In addition to being antibacterial for humans, turmeric can also be used as an antibacterial in fish. According to Karmila et al., (2017) reported that turmeric extract can be used as an alternative medicine for starch infected with *A. hydrophila* because the active compound in turmeric can treat Motile Aeromonas Septicemia (MAS) disease caused by bacteria *A. hydrophila* by denaturing proteins so that inhibited the work of enzymes that cause inhibition of the metabolic process of eating growth and development of bacteria is hampered.

Turmeric As Antiobesity

Obesity is a chronic condition that occurs in the body as a result of a very high build-up of fat. According to Ali and Yolanda (2017), obesity is a condition where there is an accumulation of fat that exceeds the normal limits needed by the body. There are various kinds of drugs that

can be used as antiobesity one of which is natural ingredients. Natural ingredients have a function as an antiobesity because their content is safe and non-toxic. Plant extracts that can be used as antiobesity are plants with high anti-lipase activity 75%-100%, moderate anti lipase activity (50%-70%), low anti lipase activity (25-50%), and absence of anti-lipase activity (less than 25%) (Etoundi et al., 2010). Fatty acids are produced by hydrolysis of triglycerides derived from lipase hydrolysis (Choi et al., 2003).

Inhibition of the synthesis of cholesterol and triglycerides as anti adipogenesis becomes an important role as an antiobestic agent. Natural ingredients that have potential as antiobesity are known to have metabolic stimulant activity (Rayalam et al., 2008). Based on the results of research Meydiani et al., (2010) curcumin has anti-obesity properties by inhibition of preadipocyte differentiation, suppression of lipogenesis, promotion of oxidation of fatty acids, and reduction of inflammation in adipose tissue. According to Budiman et al.'s research, (2015) turmeric and curcumin extracts can potentially be antiobesity by inhibiting the synthesis of triglycerides and cholesterol in the formation of HepG2 cells. Pierro et al., (2015) reported that curcumin can lose weight in overweight people by relieving inflammation of adipose tissue and insulin repression. Jayarathne et al., (2017) state that curcumin provides antiobesity and anti-inflammatory effects by reducing adiposity, lipid storage, and increased lipid oxidation.

CONCLUSION AND SUGGESTIONS

Turmeric has various benefits for humans, one of which is as herbal medicine. Turmeric contains the active compound curcumin. The active compound curcumin has many important roles in health such as an antidote to free radicals as an antioxidant, inhibitors of inflammation as an anti-inflammatory, inhibition of bacterial growth as an antibacterial, and also an inhibitor of

cholesterol synthesis as an antiobesity. Curcumin content in turmeric is very beneficial for humans in addition to its properties, curcumin is also a drug that is easy to obtain at affordable prices and low side effects for long-term consumers.

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