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# **The potential of the herbal plants of tourism (Curcuma Longa Linn) as a traditional medicine in preventing infections and Section caesarian wound healing**

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**Abstract**--Objective:. This literature review aims to determine herbal medicines in healing and preventing infection in Sectio Caesarea wounds. Method : a literature Review method that synthesizes literature studies by identifying, analyzing, and evaluating data from previous studies. Result: There were 27 indexed and reputable journals, including 17 international journals and nine national journals. The results of the analysis showed the presence of turmeric content that plays an active role in wound healing, namely alkaloids, saponins, tannins, and essential oils as anti-inflammatory, antibacterial, and antiproliferative. Conclusion : The content of metabolites that play an important role in the wound healing process are flavonoids, saponins, and essential oils because these metabolites play a role in anti-inflammatory effects on wounds.

**Keywords**---Turmeric, Wound Healing, Infection, Sectio Caesarea.

## **Introduction**

Labor is a physiological process with uterine contractions accompanied by the opening of the cervix or cervix. The delivery process can be done through the birth canal or through an incision in the abdominal wall known as Sectio Caesarea surgery. Labor can proceed normally, but there are some obstacles that labor cannot be carried out normally, so Sectio Caesarea surgery is necessary.<sup>[1]</sup>

Sectio Caesarea is a surgery to give birth to the fetus by making an incision in the abdominal wall and uterus. Sectio Caesarea action is caused by two indication factors, namely maternal factors and fetal factors. Maternal factors include narrow pelvis, mechanical dystocia, previous surgery on the uterus, history of CS, bleeding and toxemia gravidarum. Fetal factors include fetal distress, previous fetal defects or death, placental insufficiency, malpresentation, large fetus, rhesus incompatibility, postmortem caesarean and herpes virus infection..<sup>[2]</sup>

Post Sectio Caesarea wounds are scars that leave scars and are caused by Caesarean section when women cannot give birth normally. The presence of scars from sectio caesarea causes pain, so the mother tends to lie down, maintains the whole body stiff, causing joint stiffness, poor posture, muscle contractures, tenderness if not early mobilization.<sup>[3]</sup>

In labor with Sectio Caesarea, it is increasing with various risk factors, one of which is surgical wound infection or Surgical Site Infection (SSI). According to WHO the prevalence of nosocomial infections in the world in 2018 was 9%, while in Indonesia the prevalence of infection in 2011 was 7.1%. One of the causes of the high prevalence of nosocomial infections in Indonesia is caused by the increasing number of surgeries from 2011 as many as 140 million and in 2012 as many as 148 million patients.<sup>[4]</sup> Surgical wound infections are included in the nosocomial infection category. Staphylococcus aureus is the main cause of SSI. These bacteria are still effectively treated by mupirocin antibiotics with use according to the 5T principle (right patient, right time, right drug, right route, and right dose)..<sup>[5]</sup>

Infection in the surgical wound is a nosocomial infection that results in losses, especially for patients and health care providers. An increase in the number of days of hospitalization and patients can experience trauma due to the long wound healing process.<sup>[6]</sup>

Data from the WHO Global Survey on Maternal and Perinatal Health 2011 showed that 46.1% of all births through cesarean. A total of 3,509 cases of the cesarean section indicated 21% of the fetal pelvis disproportion, 14% of fetal distress, 11% of placenta previa, 10% of fetal position abnormalities, 7% of preeclampsia and hypertension. China is one of the countries where SC increased dramatically from 3.4% in 1988 to 39.3% in 2010<sup>[7]</sup>

According to the World Health Organization (WHO), the prevalence of Sectio Caesarea in the world in 2014, continued to experience a fairly large increase of around 24% - 30%, while in developed countries the Netherlands the percentage of Sectio Caesarea was 13%, in middle-income countries, namely Australia (32%), Brazil (54%), and Colombia (43%). The World Health Organization (WHO) sets the average standard for Sectio Caesarea in a country is around 5-15% per 1000 births worldwide. Government hospitals are approximately 11%, while private hospitals are >30%. According to WHO, the increase in deliveries by Caesarean section in all countries during 2007-2008 was 110,000 per birth throughout Asia [8]

In developing countries, Sectio Caesarea is the last option to save the mother and fetus during critical pregnancy and/or delivery. The maternal mortality rate due to Sectio Caesarea which occurs is 15.6% of 1,000 mothers and in Sectio Caesarea, it is 8.7% of 1,000 live births, while early neonatal death is 26.8% per 1,000 live births. [9]

The results of the Basic Health Research (RISKESDAS) in 2018, the number of deliveries using the SC method in women aged 10-54 years in Indonesia reached 17.6% of the total number of deliveries. There are several birth disorders/complications in women aged 10-54 years in Indonesia, reaching 23.2% with details of the transverse/breech position of the fetus at 3.1%, bleeding at 2.4%, seizures 0.2%, premature rupture of membranes by 5.6%, prolonged labor by 4.3%, umbilical cord entanglement by 2.9%, placenta previa by 0.7%, lagging placenta by 0.8%, hypertension by 2.7%, and others by 4.6%. [10]

The infection rate in Indonesia is one of the main causes of maternal mortality. The maternal mortality rate caused by post Sectio Caesarea (SC) infection in Indonesia in 2013 reached 7.3%. [11]. The main complications of cesarean delivery are organ damage such as the bladder and uterus during surgery, complications of anesthesia, bleeding, infection and thromboembolism. Maternal mortality is greater in cesarean delivery than vaginal delivery. [12]

The Indonesian Demographic and Health Survey (IDHS) in 2017 shows that the incidence of deliveries by cesarean section is 17% of the total number of births in health facilities. This proves that there is an increase in the number of cesarean deliveries with PROM indications by 13.6% due to other factors, including fetal position abnormalities, preeclampsia, and history of cesarean section. [10]

The management of cesarean section wound healing can be given through conventional therapy or with complementary therapies, one of which is the administration of turmeric. Complementary therapy is also known as traditional medicine or folk medicine. Practices known as traditional medicine include herbal, Ayurveda, Siddha, Unani, Muti, Ifa, African, and other pseudo-medical knowledge and practices throughout the world. [13]

In some Asian and African countries, up to 80% of the population depends on traditional medicine for their primary health care needs. Traditional medicine is often referred to as complementary and alternative medicine when applied outside traditional culture. Nearly four billion types of plants are used worldwide as

medicine, Patients using alternative medicine are between the ages of 30 and 49 years, and generally, women use them more often than men..<sup>[14]</sup>

Turmeric is an herbal plant that also has the active ingredient curcumin. In traditional medicine, turmeric is used as an anti-inflammatory, antiseptic, anti-irritant, and anorexic. Curcumin has a broad spectrum biological activity <sup>[15]</sup>. The use of drugs on wounds aims to speed up the healing process. The medicine used can be in the form of modern medicine or natural medicine made traditionally from plants and spices. One of the most widely used plants is turmeric. Turmeric (*Curcuma domestica*Val) contains curcumin compounds that can accelerate reepithelialization, cell proliferation, and collagen synthesis..<sup>[16]</sup>

There are two types of anti-inflammatory drugs: steroidal and non-steroidal. Non-steroidal anti-inflammatory drugs can cause gastric ulcers, bleeding, anemia, and kidney disorders while steroid anti-inflammatory drugs can cause peptic ulcers, osteoporosis, decreased immunity to infection, muscle atrophy, increased intra-ocular pressure and fatty tissue, and diabetic..<sup>[17]</sup>

According to Yunianto et al. (2017), from their research on the activity test of ointments with the active ingredient of turmeric that in vitro and in vivo, turmeric is antimicrobial that can kill and inhibit the growth of several types of fungi, bacteria and viruses. Curcumin compounds contained in turmeric rhizome are also toxic to several bacteria such as *Staphylococcus aureus*, *Micrococcus pyrogenes*..<sup>[18]</sup>

Curcuminoids (3.0-5.0%) and essential oils (2.5-6.0%) are the main compounds found in the turmeric rhizome. Other compounds found in turmeric are calcium, phosphorus, iron, starch, fat, protein, camphor, gum, resin, and resin..<sup>[19]</sup>

Curcumin is the active component of turmeric. Besides being able to protect the liver from damage, it can also function as a strong antioxidant (capturing free radicals that are harmful to body cells), able to resist the multiplication of cancer cells, can lower cholesterol, and as an anti-inflammatory. Recent research has proven that curcumin can also prevent colon cancer <sup>[20]</sup>

Based on the description above, the researcher can study "Turmeric as a traditional medicine in the healing and prevention of Sectio Caesarea wound infection" by reviewing and comparing research articles related to pharmacological activity in wound healing.

## **Method**

This research is a descriptive type of research that applies the Literature Review method, synthesizing literature studies by identifying, analyzing, and evaluating data from previous studies. The study of the Literature Review approach was carried out by examining the use of herbal plants, namely turmeric, as a traditional medicine for the wound healing process of Sectio Caesarea. Sources carried out in a literature review are by searching several relevant and reputable research articles on turmeric that can help the wound healing process of Sectio

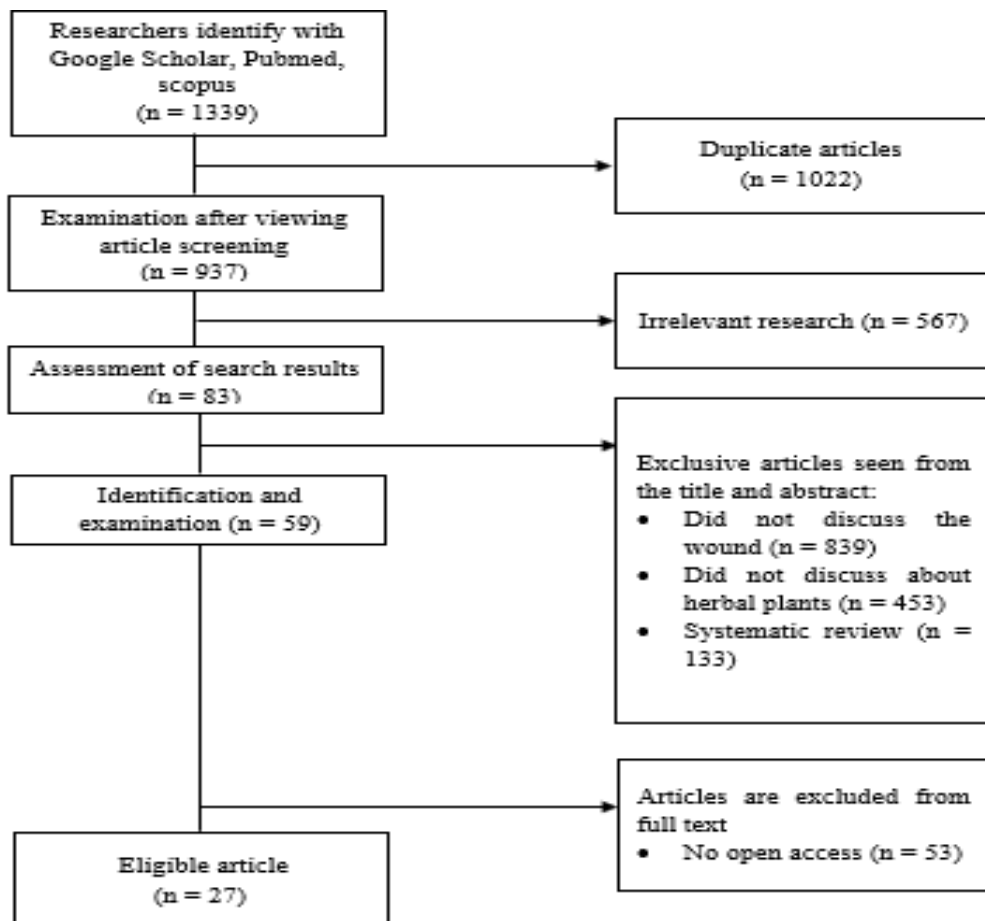
Caesarea. The strategy for finding articles is to use the PICOS framework, with the following criteria:

1. Inclusion Criteria:

- a. Keyword “Turmeric, Wound Healing, Sectio Caesarea, Herbal Medicine”.
- b. Journal published year between 2010-2022.
- c. Experimental research method.

2. Kriteria Eksklusi :

- a. Nonfull text
- b. Duplicate journal.
- c. Not-relevant.



*Figure 1. Search Strategy Flowchart*

Table 1. Relevant Studies

No	Article Title	Author	Country	Purpose	Method	Conclusion
1	The Use of Honey and Curcumin for Episiotomy Pain Relief and Wound Healing: A Three-Group Double-Blind Randomized Clinical Trial. (Nikpour et al.)	Maryam Nikpour, et.al/2019.	Iran	This study aimed to compare the effects of honey and curcumin on episiotomy pain and wound healing.	As a double-blind three-group randomized controlled trial, this study was done from October 2014 to May 2016.	Curcumin and honey creams have almost the same effects on episiotomy wound healing and pain intensity. <sup>[24]</sup>
2	The Impact of Turmeric Cream on Healing of Caesarean Scar.	G Mahmudi, et.al/2015.	Iran.	The aim of this study was to assess the impact of turmeric cream on the healing of Caesarean wound.	This study was done as a randomized double blind trial in three groups of women who had a Caesarean operation. The redness, oedema, ecchymosis, drainage, approximation (REEDA) scale was used to evaluate the wound healing process. The $\chi^2$ , analysis of variance (ANOVA) and Tukey tests were used for statistical analysis	Turmeric was effective in faster healing of wounds of Caesarean operation. The use of turmeric is suggested to reduce the complications of the wounds from Caesarean section. <sup>[22]</sup>
3	Nanotechnology in Wound Healing; Semisolid Dosage Forms Containing Curcumin-Ampicillin Solid Lipid	Solmaz Ghaffari, et.al/2018.	Iran.	In this study semi solid formulations containing curcumin and ampicillin solid lipid nanoparticles (SLNs)	Curcumin as an anti-inflammatory and antibacterial agent and ampicillin as an antibiotic was applied. In-vitro and in-vivo evaluations were carried out. Particle size, loading efficiency, release profile, morphology and antibacterial efficacy of desired nanoparticles were	It seems that using nanotechnology could shorten wound healing process to reduce treatment costs and increase compliance of patients. <sup>[23]</sup>
	Nanoparticles, in-Vitro, Ex-Vivo and in-Vivo Characteristics.			were prepared to evaluate as burn wound healing agent.	evaluated at first. Then the remaining of the antibacterial effect in semi solid preparations was studied. Animal studies for both toxicology using rabbits and skin burn model using rats were designed. Pathology studies after applying of formulations was done too.	
4	Wound Healing Activity by Turmeric Rhizome Ethyl Acetate Fraction Gel in Hyperglycemic Mice.	Ietje Wientarsih, et.al/ 2012.	Indonesia	To determine the wound healing effect of Curcuma longa ethyl acetate fraction gel on hyperglycemic mice.	Extraction of turmeric rhizome simplicia was carried out by maceration method for 72 hours with 96% ethanol as solvent.	Turmeric rhizome ethyl acetate fraction gel has activity in the wound healing process because it can reduce inflammation (anti-inflammatory), accelerate reepithelialization, and connective tissue. <sup>[24]</sup>
5	Comparison of the Effectiveness of Giving Turmeric Rhizome Extract (Curcuma Domestica Val) and Gentamicin Ointment on Healing of Mice (Mus Musculus) Skin Cuts.	Josef Satrida Yustino Maan, et.al/ 2020.	Indonesia.	The purpose of this study was to compare the effectiveness of giving turmeric (Curcuma domestica Val) rhizome extract and gentamicin ointment to the healing of mice (Mus musculus) skin cuts.	Experimental laboratory with a "true experimental design post test only control group design".	Comparison of the effectiveness of giving turmeric rhizome extract (Curcuma domestica Val) and gentamicin ointment on the healing of skin incisions in mice (Mus musculus) there was no significant difference in wound healing between the 3 treatment groups, namely the group that was given aquades, the group that was given turmeric rhizome extract and the group that was given turmeric rhizome extract. given gentamicin ointment. <sup>[25]</sup>
6	The Effectiveness of Snakehead Fish Extract (Channa striata) and Turmeric Extract (Curcuma domestica) on Incision Wound Healing in White Rats (Rattus norvegicus).	Ratna Widyawati, et.al/ 2020.	Indonesia.	The purpose of this study was to determine the effect of snakehead fish extract (Channa striata) and turmeric extract (Curcuma domestica) on wound healing in white rats (Rattus norvegicus).	This type of experimental research. This study used a completely randomized design (CRD) with a random sampling technique with 4 treatments and 6 replications for each treatment and questionnaire method..	The conclusion of this study showed that the administration of povidone iodine, snakehead fish extract and turmeric extract had an effect on the healing of incision wounds in white rats (Rattus norvegicus). <sup>[26]</sup>

7	Effectiveness of Combination of Ethanol Extracts of Turmeric ( <i>Curcuma Longa</i> Linn.) And Chocolate ( <i>Theobroma Cacao</i> ) As Antidepressant Candidates in White Rats ( <i>Rattus Norvegicus</i> ) Wistar strain.	Farach Khanifah, ET.AL/2020.	Indonesia.	To determine the effectiveness of turmeric ethanol extract, cocoa ethanol extract and a combination of turmeric and cocoa ethanol extract as antidepressants in <i>Rattus norvegicus</i> wistar rats.	This research is an experimental study with a post test control group design using 25 rats and divided into 5 groups, namely positive control group, negative control group, turmeric ethanol extract, cocoa ethanol extract and a combination of turmeric and cocoa ethanol extract. Antidepressant testing is determined based on immobility time using the Swim Forced Test method.	Turmeric ethanol extract at a dose of 560 mg/kgBW and cocoa ethanol extract at a dose of 0.392mg/20gBW had antidepressant effects. The antidepressant effect of the combination of turmeric and cocoa ethanol extract is more significant than the single preparation. <sup>[27]</sup>
8	The Effect of Consumption of Turmeric Acid Drink on the Length of Unity of Perineal Wounds in Postpartum Mothers.	Dewi Susanti/2018.	Indonesia.	The purpose of this study was to determine the effect of consuming sour turmeric drink on the duration of union of perineal wounds and the number of bacteria in the perineum of postpartum mothers	This research is a true experimental research with Posttest Control Trial design. The sample consisted of 28 postpartum mothers with perineal wounds.	Postpartum mothers with perineal wounds to consume sour turmeric drink for 7 days accelerate the union of perineal wounds. <sup>[28]</sup>
8	Wound healing by marigold ( <i>Calendula officinalis</i> ) and turmeric ( <i>Curcuma longa</i> ) paste: A comparative approach.	Sattwikesh Paul, et.al/2017.	Bangladesh	Wound healing was assessed by observing some morphological characters as well as histopathological changes of the wounded area.	Experimental. The body weight and age of the animal was ranged from (18-20) Kg and (1-3) years respectively. All of the experimental goats were dewormed with ivermectin (0.2 mg/kg body weight, SC; Inj. Vermic®, Techno Drugs, Bangladesh) before starting the experiment.	This study could patronize veterinarians to consider the use of herbal plants, especially turmeric as a great wound healer. It will also reduce toxicities created by haphazard use and applications of pharmaceutical products. The findings of this very experiment will not only prevent the skin degradation but also help to maintain the good health status of animals
9	Activity of Turmeric Rhizome Extract Ointment	Wiwini Winarsih, et.al/2012.	Indonesia.	The purpose of this study was to determine the effectiveness of	Experimental research using the masserari method with 96% ethanol	Administration of ethyl acetate fraction ointment and turmeric rhizome hexane can accelerate the wound healing process in mice

	in Wound Healing Process in Diabetes Induced Mice.			turmeric rhizome ethanol extract ointment in the wound healing process in mice induced by diabetes with streptozotocin.	solvent was used to extract the turmeric rhizome.	induced by diabetes. The administration of ethyl acetate and hexane fractions can reduce the inflammatory process, accelerate the formation of new blood vessels (neovascularization), reepithelialization and connective tissue.. <sup>[29]</sup>
10	Clinical evaluation of ethanolic extract of curcumin ( <i>Curcuma longa</i> ) on wound healing in Black Bengal goats.	Md Abu Haris Miah, et.al/ 2017.	Bangladesh	This study was aimed at clinical evaluation of surgical wound healing in goats treated with ethanolic extract of turmeric ( <i>Curcuma longa</i> ) rhizomes through topical route.	The experimental. Goats were divided into three groups consisting of three animals in each group: Test group (Group 1): Ethanolic extract of turmeric ointment was applied daily on surgical wounds. Standard group (Group 2): PVI cream was applied daily on surgical wounds. Control group (Group 3): No medicine was applied on surgical wounds. Only normal saline was used to wash the wound	Ethanol treated turmeric enhances wound healing process in goats. This result could help the veterinarian and the researchers to consider herbal product especially ethanolic extract of turmeric for the treatment and better healing of surgical wounds with minimal complications. <sup>[30]</sup>
11	Effectiveness of Turmeric Ethanol Extract Cream Preparation ( <i>Curcuma Longa</i> ) in Speeding up Wound Healing in Male Wistar Rats.	Wang Ling, et.al/2022.	Indonesia.	This study aims to find out the effect of turmeric extract ( <i>Curcuma longa</i> ) on wound healing in white rats.	This type of research is experimental with the approach of Pre-test and Post-test group only control design, conducted November to December 2020. The samples used were turmeric rhizomes ( <i>Curcuma Longa</i> ) and male white rats. Determination of the size of the sample according to Frederer's formula, so that the number of samples as many as 25 mice, the division of 4 treatment groups and 1 control group.	The creamy preparation of turmeric ethanol extract ( <i>Curcuma Longa</i> ) has an ability that is close to Bioplacenton® in healing wounds in mice. <sup>[31]</sup>
12	Topical Curcumin for the Healing of Carbon Dioxide Laser Skin Wounds in Mice.	Pia Lo'pez-Jornet, et.al/2011.	Spainol.	The purpose of this study was to evaluate the effect of topical curcumin on the healing of skin wounds produced by the CO2 laser in an animal model.	A prospective, randomized, experimental design involving three groups of mice was used to compare CO2 laser induced skin wound progression with topical curcumin or application of its vehicle.	This study shows that topical curcumin applied to CO2 laser-induced skin wounds may be useful, because improved reepithelialization is observed after 7 days. <sup>[32]</sup>

13	Low Density Lipoprotein Levels and Liver Histopathological Features in Type 1 Diabetes Mellitus Model Rats with Curcuma Longa L Ethanol Extract	Herlina Pratiwi, et.al/2015.	Indonesia	To determine LDL levels and liver damage in rats ( <i>Rattus et al norvegicus</i> ) model of type 1 diabetes mellitus induced by streptozotocin (STZ) with ethanol extract turmeric therapy ( <i>Curcuma Longa L</i> ).	Experiment Group DM 1 rats treated with turmeric ethanol extract at a dose of 1.2 g/kg, group DM 1 rats treated with ethanol turmeric extract therapy at a dose of 1.8 g/kg, and a group of DM 1 rats with turmeric ethanol extract therapeutic dose of 2.7 g/kg.	Turmeric ethanol extract contains antioxidants that can lower LDL levels and reduce severity fatty liver in type 1 diabetes mellitus. <sup>[33]</sup>
14	Evaluation of Aqueous Creams Containing Ethanol Extract of Curcuma longa (Turmeric) as Bioactive Ingredient for the Management of Wounds	Kenneth Chinedu Ugoeze, et.al/2021.	Nigeria	This study aimed to formulate aqueous creams containing concentrations of ethanolic extract of turmeric (EET) as bioactive ingredients, evaluate their stability and wound healing activities in male Wistar rats using hydroxyproline (HXP) as a biochemical marker.	Experiment. The stability of the creams was evaluated and their wound healing effects were studied using distilled water, dimethyl sulphoxide (DMSO) and cholesterol as controls in male Wistar rats.	The crude EET has been confirmed to possess wound healing properties with an optimal effective concentration for wound healing in male Wistar rats determined as 1.5 % w/v which when incorporated as a bioactive ingredient in an aqueous cream retained its efficacy in wound healing and could therefore be beneficial in the treatment of body injuries. <sup>[34]</sup>
15	Ethosomal Curcumin Promoted Wound Healing and Reduced Bacterial Flora in Second Degree Burn in Rat.	A. Partoazar, et.al/2016.	Iran	To formulate a topical preparation of turmeric as a wound healing drug	In this study, we prepared Ethosomal curcumin (Etho-cur) formulation for wound healing and bacterial flora assessments in treated rats which were subjected to second degree burn under a standard procedure.	Regarding the results, ethosomal curcumin efficiently fights against wound infection and promotes wound repair in burn injuries in rats. <sup>[35]</sup>
16	The effects of topical treatment with curcumin on	Mustafa Kulac, et.al/2012.	Turkey	The present study was designed to determine the	The thirty-six healthy Wistar albino rats were randomly allotted into one of three experimental groups	Cur treated wounds were found to heal much faster as indicated by improved rates of inflammation cells, collagen deposition, angiogenesis, granulation tissue formation and

	burn wound healing in rats.			role of topical treatment with curcumin (Cur) on burn wound healing in rats.		epithelialization which were also confirmed by histopathological and biochemical examinations. Our data also indicate that there is a rise in the expression of. <sup>[36]</sup>
17	Differential efficacies of marigold leaves and turmeric paste on the healing of the incised wound in sheep.	Md. Tuhinur Rahman, et.al/2020.	Bangladesh	This study was undertaken to compare the curative efficacy of marigold leaf paste and turmeric paste on healing the incised wound in sheep. The study also determined the antimicrobial effects and histopathological changes in a wound's healing process treated with these medicinal herbs.	Surgical wounds (n = 18) were created aseptically in the skin of the flank region of six healthy sheep dividing them into three experimental groups. Follow-up data were taken up to day 21. Samples were collected on days 1, 2, and 3 to test the antimicrobial effects and on days 1, 3, and 7 for histopathological studies.	Marigold leaf paste showed less tissue reaction and healed the wounds effectively. Thus, this paste could be used for the treatment of superficial wounds in sheep. <sup>[37]</sup>
18	Evaluation of propylene glycol nanoliposomes containing curcumin on burn wound model in rat: biocompatibility, wound healing, and antibacterial effects.	Nooshin Kianvash, et.al/2017.	Iran.	Identification of bacteria in burns rats with curcumin propylene glycol nanoliposomes.	Experiment design.	The result showed no detectable cytotoxicity, but considerable cytotoxicity was observed in higher concentration of 1.5 and 3 mg/ml of free and PgL forms of curcumin. Eight days of application of Cur-PgL on burned rats resulted in a significant ( $P < 0.001$ ) compared to the other groups. The antibacterial activity of the Cur-PgL formulation was found to be similar to the silver sulfadiazine (SSD) cream 1% regarding the inhibition of the bacterial growth. In conclusion, the low dose of curcumin nanoliposomal formulation efficiently improved injuries and infections of burn wounds and it can be considered in burn therapy. <sup>[38]</sup>
19	Evaluation of Antibacterial Potential of Raw	Iqra Sarwar, et.al/2021.	Pakistan.	Current study was planned to check	Experiment design. Wound samples (n=150) were collected from different animals.	The study concluded that higher prevalence of multiple drug resistant <i>S. aureus</i> and <i>E. coli</i> were found from wound infections of different



19	Evaluation of Antibacterial Potential of Raw Turmeric, Nano-Turmeric, and NSAIDs against Multiple Drug Resistant Staphylococcus aureus and E. coli Isolated from Animal Wounds	Iqra Sarwar, et.al/2021.	Pakistan.	Current study was planned to check antibacterial potential of raw turmeric, nano-turmeric, and Non-steroidal anti-inflammatory drugs against multiple drug resistant (MDR) Staphylococcus aureus and E. coli isolated from animal wounds.	Experiment design. Wound samples (n=150) were collected from different animals.	The study concluded that higher prevalence of multiple drug resistant S. aureus and E. coli were found from wound infections of different animal species. The study found higher sensitivity of ciprofloxacin, trimethoprim-sulphamethoxazole and amikacin against MDR S. aureus and E. coli with higher resistance to ampicillin, amoxicillin, oxytetracycline and vancomycin. Non-steroidal anti-inflammatory drugs (NSAIDs) in combination with antibiotics showed higher antibacterial potential as compared to their alone effects. Nano curcumin exhibited higher antibacterial activity as compared to raw curcumin. The study found promising antibacterial potential of NSAIDs, raw curcumin and nano curcumin against highly pathogenic MDR S. aureus and E. coli. <sup>[39]</sup>
20	Comparative effect of turmeric (Curcuma longa) and durba (Cynodon dactylon) on the healing of surgical wounds in cattle (Bos indicus).	Mohammad Abdullah-Al Mamun, et.al/2018.	Bangladesh	Was carried out to exploit turmeric (Curcuma longa) and durba (Cynodon dactylon) pastes in the treatment of surgical wounds in cattle and to study their healing effect on wound sutured with horizontal mattress using nylon.	Experiment design. A total of thirty six surgical wounds were made on the skin of six cattle. Cattle were divided into three groups with two animals in each group	Tr. Benzoin seal caused marked tissue reaction in wounds in comparison to turmeric and durba paste. Turmeric paste showed splendid results in healing the wounds produced in cattle. Durba paste also has wound healing activity but less effective than that of turmeric. <sup>[40]</sup>
21	Postnatal treatment using curcumin supplements to amend the damage in VPA-induced	Maha Al-Askar, ET.AL/2017.	Saudi Arabia.	To assess the benefits of curcumin supplementation were investigated using an animal model of VPA-induced autism.	Eksperiment design. The study was performed using a rodent model of autism by exposing rat fetuses to valproic acid (VPA) on the 12.5th day of gestation. At 7 days from their birth, the animals were supplemented with a specific dose of	Curcumin plays a significant therapeutic role in attenuating brain damage that has been induced by prenatal VPA exposure in rats; however, its therapeutic role as a dietary supplement still must be certified for use in humans. <sup>[41]</sup>
	rodent models of autism.				curcumin. Forty neonatal male Western Albino rats were divided into four groups. Rats in group I received only phosphate-buffered saline, rats in group II were the prenatal VPA exposure newborns, rats in group III underwent prenatal VPA exposure supplemented with postnatal curcumin, and rats in group IV were given only postnatal curcumin supplements.	
22	Study Of Formulation, Characterisation And Wound Healing Potential Of Transdermal Patches Of Curcumin	Radhika Gadekar, Et.AL/2012.	India.	The aim of this study was to investigate the feasibility of Curcumin patches formulation (CPF) as a transdermal therapeutic system for wound healing potential.	The healthy albino rats of either sex (200-250 g) with no prior drug treatment were selected to carry out all the present in vivo studies. The animal was used after an acclimatization period of 10 days to laboratory environment. The protocol of the study was approved by the Local Ethical Committee for animal experimentation. For excision wound model, 18 animals of either sex weighed between 200-250 g were divided into three groups in each groups consisting of 6 animals as follows. Group I is (untreated) control group, group II is (viccoturmeric cream) standard group, group III (CPF-1F Formulation) treated group.	The results showed that wound healing and repair is accelerated by applying an organized epidermis's CPF-1 formulation of the wound area. Study on animal models showed enhanced rate of wound contraction and drastic reduction in healing time than control, which might be due to enhanced epithelialization. The animals treated with Vicco-turmeric Cream and CPF-1 Formulation showed significant (* p< 0.01) wound healing results when compared with control groups. The treated wound after nine days itself exhibit marked dryness of wound margins with tissue regeneration. Group treated with CPF-1 formulation showed better wound closure compared to control group. Histopathological studies of Curcumin patches showed well-organized collagen fibers, increased in fibroblast cells and new blood vessels formation as compared to control group. <sup>[42]</sup>
23	Effectivity of zinc oxide-turmeric extract dressing in stimulating the reepithelization	Asti Meizarin, et.al/2020.	Indonesia.	Zinc This study aimed to determine the effect of a wound dressing consisting of zinc oxide and turmeric	his research was a post-test only control group design study.	A wound dressing consisting of zinc oxide and turmeric extract can help accelerate reepithelization in the wound healing process. <sup>[43]</sup>

	phase of wound healing.			extract on wound reepithelialization by assessing the expression of cytokeratin 14 (CK14), epidermal growth factor receptor (EGFR), and epithelial cadherin (E-cadherin).		
24	The effect of combined photobiomodulation and curcumin on skin wound healing in type I diabetes in rats.	Hasan Soleimani, et.al/2018.	Iran.	To analyze the effects of combined pulsed wave Photobiomodulation (PW PBM) and Curcumin on the microbial flora; in addition, the tensiometrical wounds properties for type one diabetes mellitus (TIDM) in an experimental animal model.	Thirty Wistar male adult rats, 4 months old weighed 290~ g were used. The animals were divided into five groups with 6 rats in each group. The primary group was considered as the control group without any treatment. The secondary group (placebo) received sesame oil by gastric gavage plus PWPBM in which the laser was turned off. The third group received PWPBM (0.2 J/cm <sup>2</sup> ). The fourth group received curcumin (40 mg/kg, which was dissolved in sesame oil) by gastric gavage. Eventually, the fifth group received PW PBM + curcumin. data was analyzed by statistical tests.	It was concluded that PW PBM significantly accelerated the wound healing process in the STZ-induced TIDM in an experimental rat model. PW PBM, curcumin, and PWPBM + curcumin significantly decreased colony forming units compared to the control and the placebo groups. The cellular and molecular mechanisms regarding the effect of PW PBM on healing of wounds in the TIDM rats should be elucidated by further scientific studies. Consequently, further experiments regarding the PWPBM on the wound healing in animal with TIDM are strongly suggested. <sup>[44]</sup>
25	Effectiveness of Anti-Inflammatory Formulation of Turmeric (Curcuma Longa), Binahong Leaf (Anredera Cordifolia) and Sambilotto Leaf (Andrographis	Kh Endah Widhi Astuti, Sih Rini Handajani/2019.	Indonesia.	Effectiveness of Anti-Inflammatory Formulation of Turmeric (Curcuma Longa), Binahong Leaf (Anredera Cordifolia) and Sambilotto Leaf (Andrographis Paniculata) Against Cuts in Rabbits.	This study uses a quantitative method with the type of pure treatment research in the form of a pre-post test design. The sample in this study was 10 rabbits per group 5 groups.	The formula of turmeric, binahong leaves, bitter leaves (F1, F2 and F3) in incisions in rabbits can improve the wound healing process. <sup>[45]</sup>

	Paniculata) Against Cuts in Rabbits.					
26	Comparison of the Effectiveness of Giving Turmeric Rhizome Extract (Curcuma Domestica Val) and Gentamicin Ointment on Healing of Mice (Mus Musculus) Skin Cuts.	Josef Satrida Yustino Maan, et.al/2020.	Indonesia.	This study aimed to compare the effectiveness of giving turmeric rhizome extract (Curcuma domestica Val) and gentamicin ointment on the healing of skin incisions in mice (Mus musculus).	Laboratory experimental research with "true experimental design post test only control group design". The test animals used were mice which were treated with cuts on the back with a wound length of 2 cm and a depth of up to the dermis. Animals were divided into 3 groups.	The formula of turmeric, binahong leaves, bitter leaves (F1, F2 and F3) in incisions in rabbits can improve the wound healing process. <sup>[46]</sup>

## Result

Based on the analysis of several articles above, in this study, we can determine the content of turmeric, which plays an active role in wound healing, namely alkaloids, saponins, tannins, and essential oils as anti-inflammatory, antibacterial, and antiproliferative. Turmeric is proven to be able to heal perineal wounds, cuts, diabetic wounds, and Sectio Caesarea wounds.

## Discussion

The purpose of this article is to present up-to-date information with a comprehensive review of the literature. Researchers have reviewed several journal articles related to accelerating wound healing. Based on the information found in the article it was found that the protective response caused by tissue damage due to physical trauma, microbiological substances or chemical substances is damaged by reducing the activity of enzymes such as cyclooxygenase, lipoxygenase, nitric acid synthase, and inhibiting the production of tumor necrosis factor  $\alpha$  (Fig. TNF- $\alpha$ ) and interleukin (IL).

Comparison of the average reepithelialization, epithelial thickness and crust creation in the wound showed that cell regeneration was 5–10 days faster in skin that was given turmeric topically compared to that which was not given turmeric. Nano-particles of PLGA (Poly Lactide Glucolid Acid) encapsulating turmeric can accelerate wound healing.

Briefly, the wound healing process is divided into 3 phases. The first phase is the inflammatory phase or the initial phase (lag phase), which lasts from the time the wound occurs until the fifth day. In this phase bleeding occurs, then clotting/cessation of bleeding due to smooth muscle contraction of injured blood vessel walls and blood clots by thrombin and fibrin come out, as well as the body's defenses in the form of leukocyte cells and antibodies. This occurs in vasodilation of blood vessels, edema.

Changes in the skin are the frequency of epidermal cells, inflammatory response to injury, sensory perception, mechanical protection, and skin barrier function. The speed of cell repair is in line with the growth or maturity of age. During the wound healing process, nutrients are needed by the body because the physiological process of wound healing depends on the availability of protein, vitamins, and minerals in the body.

Turmeric rhizome contains secondary metabolites of flavonoids, quinones, and polyphenols. In addition to curcumin compounds, turmeric also contains sesquiterpene compounds contained in turmeric essential oil which is a derivative of terpene compounds such as alcohol which is bactericidal by destroying the tertiary structure of bacterial proteins or denaturing proteins. In comparison, curcumin is a phenolic compound. This phenol derivative will interact with the bacterial cell wall, then be absorbed and penetrate into the bacterial cell, causing protein denaturation, which in turn will lyse the bacterial cell membrane. While the antibacterial activity of curcumin by inhibiting the proliferation of bacterial

cells [20]. Turmeric (*Curcuma domestica* Val.) contains curcumin compounds that can accelerate reepithelialization, cell proliferation, and collagen synthesis. [16]

## Conclusion

The content metabolites that play an important role in the wound healing process are flavonoids, saponins, and essential oils because these metabolites play a role in anti-inflammatory effects on wounds. The method of administering turmeric extract as inflammation was carried out in vivo. Surgical wound healing is also influenced by pain, to reduce pain, turmeric extract ointment is given, which can be used as a multimodal analgesic treatment after Sectio Caesarea surgery, and it is not recommended to use a single analgesic treatment.

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