

# Analysis of Chemical Ingredients in Jamu Pegal Linu Released in Siwa, Pitumpanua District, Wajo Regency

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Received: 17 June 2025 / Accepted: 19 September 2025 / Published: 30 October 2025

**ABSTRACT:** Jamu is an indigenous Indonesian traditional herbal medicine commonly prepared in the form of brews, powders, liquids, pills, or capsules. However, some manufacturers irresponsibly add pharmaceutical chemicals (Bahan Kimia Obat, BKO) to enhance the therapeutic effects of these products. One of the most frequently detected adulterants in *jamu pegal linu*—a herbal remedy used to relieve muscle and joint pain—is diclofenac sodium, a nonsteroidal anti-inflammatory drug (NSAID). This study aimed to identify and quantify the presence of diclofenac sodium in *jamu pegal linu* samples circulating in Siwa, Pitumpanua Sub-district, Wajo District, Indonesia. Six samples were analyzed using thin-layer chromatography (TLC) and UV-Visible spectrophotometry. The qualitative TLC analysis utilized silica gel GF254 as the stationary phase and an ethyl acetate–n-hexane (7:3) mixture as the mobile phase. All samples exhibited  $R_f$  values of 0.8, corresponding to the diclofenac sodium standard, confirming the presence of this compound. Quantitative analysis using a UV-Vis spectrophotometer at a wavelength of 276 nm revealed the average diclofenac sodium contents as follows: sample A = 17.911%, B = 20.691%, C = 21.016%, D = 20.902%, E = 23.350%, and F = 23.772%. These findings indicate that all analyzed *jamu pegal linu* preparations contained diclofenac sodium as a medicinal chemical adulterant (BKO). This study underscores the urgent need for stricter regulation, quality control, and consumer awareness to ensure the safety and authenticity of traditional herbal medicines in Indonesia.

**KEYWORDS:** Diclofenac sodium; jamu; traditional; TLC; UV-Vis spectrophotometry.

## 1. INTRODUCTION

Indonesia has a long-standing tradition of utilizing natural remedies that have been passed down through generations. These traditional medicines are widely perceived as safer and milder than modern pharmaceuticals, as well as being more affordable and practical for daily use. Among these, herbal medicine (*jamu*) is one of the most commonly consumed forms, leading to the proliferation of producers ranging from large-scale manufacturers to small home industries. According to the Indonesian National Agency of Drug and Food Control (BPOM, 2019), herbal medicines are preparations derived from natural materials—plants, animals, or minerals—either individually or in combination, that have been traditionally used for therapeutic purposes and are accepted by community norms.

Jamu, a traditional Indonesian herbal formulation, is typically available in various forms such as decoctions, powders, liquids, pills, or capsules (Jayanti et al., 2015). The increasing popularity and market demand for herbal medicines have encouraged the herbal industry to improve the efficacy of their products. However, in pursuit of faster or stronger therapeutic effects, some manufacturers have resorted to illegally adding pharmaceutical chemicals (Bahan Kimia Obat, BKO) to herbal formulations (Kamar et al., 2021). Such adulteration violates the Regulation of the Minister of Health of the Republic of Indonesia No. 246/Menkes/Per/V/1990, which clearly states that traditional medicines must not contain synthetic chemicals or isolated pharmaceutical substances (Permenkes, 1990).

One of the most frequently adulterated herbal preparations is *jamu pegal linu*, a formulation traditionally used to relieve fatigue, muscle and joint pain, enhance blood circulation, and improve physical endurance (Tahir et al., 2018). Investigations have revealed that several *jamu pegal linu* products contain pharmaceutical adulterants such as paracetamol, mefenamic acid, prednisone, and diclofenac sodium—nonsteroidal anti-inflammatory drugs (NSAIDs) that provide rapid pain relief but carry potential health risks when consumed without medical supervision (Rusmalina et al., 2020; Pratama et al., 2022).

Previous studies have reported the presence of diclofenac sodium in *jamu pegal linu* samples across various regions in Indonesia. Tahir et al. (2018) detected the compound in 3 out of 8 samples analyzed in Makassar; Setyowati et al. (2022) found it in 6 out of 14 samples from Pekalongan; Rosyada et al. (2019) reported it in 3 out of 10 samples from Mataram; and Padanun and Minarsih (2021) identified it in 3 out of 5 samples from Semarang. These findings suggest a widespread issue of pharmaceutical adulteration in traditional herbal products.

Despite these reports, there has been no prior investigation on the presence of BKO, particularly diclofenac sodium, in *jamu pegal linu* distributed in Siwa, Pitumpanua Sub-district, Wajo District. Therefore, this study aims to analyze *jamu pegal linu* products circulating in Siwa using UV-Visible spectrophotometry to detect and quantify diclofenac sodium



content. The results are expected to serve as a scientific reference and raise public awareness regarding the safety and authenticity of herbal medicines available in the market.

## 2. EXPERIMENTAL SECTION

### 2.1. Sample Collection and Processing

A total of 6 samples of jamu pegal linu circulating in Siwa, Pitumpanua sub-district, Wajo Regency were taken using purposive sampling technique with consideration of herbs that are in great demand and in powder or capsule form (Rosyada *et al.*, 2019). Samples of jamu pegal linu were weighed as much as 1 gram, then extracted by maceration method using 96% ethanol solvent as much as 50 mL. The extraction results were filtered with filter paper and evaporated at room temperature to form a thick extract. The dried extract was then added with 10 mL of 96% ethanol and filtered again using filter paper (Rosyada *et al.*, 2019).

### 2.2. Qualitative Test Using Thin Layer Chromatography

Samples and diclofenac sodium were photographed on a TLC plate. Then put into a developer vessel containing a mixed mobile phase, namely ethyl acetate: n-hexane (7:3). The TLC plate that has reached the upper limit is removed from the developer vessel and let the mobile phase evaporate first. Observe the spots on each plate using an ultra violet (UV) light lamp 254 nm and calculate the *Retardation factor* (Rf) value. The Rf value of the sample was compared with the Rf value of the diclofenac sodium standard solution (Rosyada *et al.*, 2019).

### 2.3. Quantitative Test Using UV-Vis Spectrophotometer

#### 2.3.1 Preparation of Reference Standard

Standard diclofenac sodium was weighed 10 mg, put in a beaker and 10 ml of 96% ethanol after dissolving then put into a 10 ml volumetric flask until the limit mark so that a 1000 ppm diclofenac sodium solution is formed. This solution was then diluted by taking 1 mL, then put into a 10 mL volumetric flask and added 96% ethanol to the limit mark. This 100 ppm diclofenac sodium solution is used as a stock solution (Rosyada *et al.*, 2019).

#### 2.3.2 Determination of Maximum Absorption Wavelength

The stock solution was taken as much as 2 mL and put into a 10 mL volumetric flask, then add ethanol to the limit mark to form a 20 ppm diclofenac sodium solution. This solution was measured at a wavelength of 260-290 nm to determine the maximum wavelength (Rosyada *et al.*, 2019).

#### 2.3.3 Preparation of Standard Curve

Stock solutions were taken 0.4; 0.5; 0.6; 0.7 and 0.8 mL then the solution was put into a 5 mL volumetric flask and added ethanol to the limit mark. The solutions formed were read for absorption at the maximum wavelength and the regression line equation and correlation coefficient were calculated (Rosyada *et al.*, 2019).

#### 2.3.4 Determination of sample content

Determination of the sample jamu pegal linu weighed as much as 5 mg, then the sample was dissolved in 96% ethanol to 5 mL (1000 ppm level). The 1000 ppm sample solution was taken 0.25 mL then the solution was put into a 5 mL volumetric flask and added 96% ethanol until the limit mark. The sample solution was measured absorbance on UV-Vis spectrophotometer in accordance with the maximum wavelength has been determined. The absorbance data obtained was entered into the standard curve equation to obtain the diclofenac sodium content in the sample (Rosyada *et al.*, 2019).

## 2.4. Data Analysis

Data analysis used in this research is qualitatively using TLC and quantitatively using UV-Vis Spectrophotometer. Analyzed data in the form of:

1. Qualitative analysis by comparing the retardation time (Rt) value of the herbal medicine sample and the *Retardation Time* (Rt) value of the reference.
2. Quantitative analysis of diclofenac sodium levels in the herbal medicine samples. Diclofenac sodium levels from herbal medicine samples are known based on the standard curve equation  $y = bx + a$ , where y is the absorbance value and x is the measured level. To find out the percentage of diclofenac sodium content, namely:

$$\%Content = (Concentration \times volume \times FP) / (Sample \text{ weight}) \times 100\%$$

### 3. RESULTS AND DISCUSSION

The study began by qualitatively analyzing the content of diclofenac sodium in 6 samples of jamu pegal sciatica in Siwa, Pitumpanua sub-district, Wajo district. Qualitative analysis was conducted using thin layer chromatography method. TLC was used as a qualitative test because of its simple use and high level of accuracy. In addition, this method is able to produce a perfect separation of the compounds contained in the sample (Maharani *et al.*, 2023). The test was carried out using a mobile phase in the form of *ethyl acetate: n-hexane* (7:3) and stationary phase in the form of silica gel GF 254 (Figure 1).

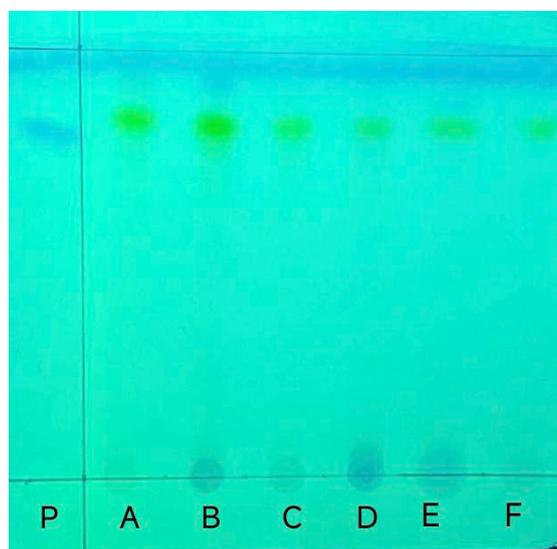


Figure 1: UV light 254 nm TLC results

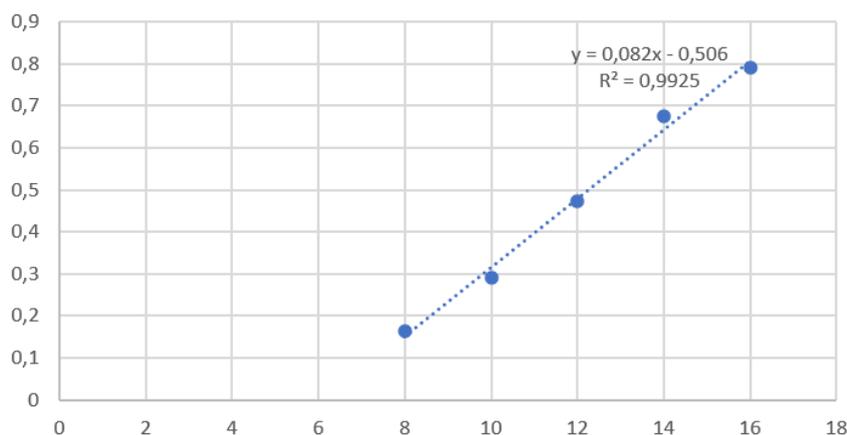
(Note: P: Diclofenac sodium comparator; A: Herbal medicine sample A; B: Herbal medicine sample B; C: Herbal medicine sample C; D: Sample of herbal medicine D; E: Sample of herbal medicine E; F: Sample of herbal medicine F)

The results of qualitative analysis on the samples in the form of Rf values have similarities with diclofenac sodium standards (Table 1). The Rf value is used to compare the relative comparison value between samples. Compounds that have a larger Rf have low polarity. Vice versa (Sopiah *et al.*, 2019). The test results show that all samples have similar Rf values to the diclofenac sodium standard.

Table 1. Results of qualitative analysis of diclofenac sodium in jamu pegal sciatica by Thin Layer Chromatography

No	Sample Name	Rf (Retardation factor) Value
1	Diclofenac sodium standard	0.8
2	A	0.81
3	B	0.81
4	C	0.8
5	D	0.8
6	E	0.8
7	F	0.8

Samples that are known to contain diclofenac sodium are then quantitatively tested using a UV-Vis spectrophotometer. This method is used because diclofenac sodium has a chromophore group or conjugated double bond so that it can absorb UV light. So that the UV-Vis spectrophotometer can detect diclofenac sodium in the sample (Rosyada *et al.*, 2019). The first step in quantitative analysis is to determine the maximum wavelength ( $\lambda$  max). The maximum wavelength is important to obtain absorbance that has high sensitivity so that good accuracy is obtained (Rosyada *et al.*, 2019). In determining the standard curve of diclofenac sodium, the value of  $r = 0.9925$  and the linear line equation  $y = 0.082x - 0.506$  were obtained (Figure 2). The value of  $r$  is said to be good if it is close to 0.99. (Wahyuningsih *et al.*, 2021).



**Figure 2.** Standard curve graph of diclofenac sodium

Determination of diclofenac sodium levels in herbal medicine samples was carried out by making a 50 ppm concentration sample solution. Then measured using the results of determining the maximum wavelength of 276 nm. The average absorbance value was calculated from three replicates. Then entered in the linear regression equation  $y = 0.082x - 0.506$  to obtain diclofenac sodium content in the sample. The calculation results listed in table 3 show that Sample F has the highest percentage content of 23.772% and sample A has the lowest percentage of diclofenac sodium content of 17.911% (**Table 2**).

**Table 2.** Calculation results of diclofenac sodium content in herbal medicine samples

Sample	Replication	Weighed sample weight (mg)	Absorbance	Diclofenac sodium concentration (ppm)	Diclofenac sodium content in sample (%)
A	1	5	0.208	8.707	17.415
	2	5	0.236	9.049	18.098
	3	5	0.241	9.110	18.220
Average					<b>17.911</b>
B	1	5	0.32	10.073	20.146
	2	5	0.317	10.037	20.073
	3	5	0.39	10.927	21.854
Average					<b>20.691</b>
C	1	5	0.378	10.780	21.561
	2	5	0.336	10.268	20.537
	3	5	0.353	10.476	20.951
Average					<b>21.016</b>
D	1	5	0.353	10.476	20.951
	2	5	0.333	10.232	20.463
	3	5	0.367	10.646	21.293
Average					<b>20.902</b>
E	1	5	0.456	11.732	23.463
	2	5	0.464	11.829	23.659
	3	5	0.434	11.463	22.927
Average					<b>23.350</b>
F	1	5	0.455	11.720	23.439
	2	5	0.463	11.817	23.634
	3	5	0.488	12.122	24.244
Average					<b>23.772</b>

These results show that herbal medicine has violated Permenkes No. 7 of 2012 concerning Traditional Medicine Registration, one of the requirements for traditional medicine must not contain medicinal chemicals or isolated products that have medicinal properties. Therefore, the herbal medicine sample has violated the regulation as a condition for a traditional medicine distribution permit because it contains BKO in the form of diclofenac sodium which has the potential to cause side effects for people who consume herbal medicine products.

#### 4. CONCLUSION

The findings of this study indicate that all six *jamu pegal linu* samples circulating in Siwa, Pitumpanua Sub-district, Wajo District, were found to contain or are suspected of containing diclofenac sodium, confirming the presence of a medicinal chemical adulterant (BKO) in these traditional herbal preparations. Quantitative analysis using UV-Vis spectrophotometry revealed that the percentage of diclofenac sodium in each sample was 17.911% (sample A), 20.691% (sample B), 21.016% (sample C), 20.902% (sample D), 23.350% (sample E), and 23.772% (sample F). These results demonstrate that *jamu pegal linu* products sold in the Siwa region have been adulterated with synthetic medicinal compounds that may pose potential health risks to consumers. Therefore, stricter supervision, regulation, and quality control are urgently required to ensure the safety, efficacy, and authenticity of traditional herbal medicines circulating in Indonesia.

**Acknowledgments:** The authors are grateful to The Head of Pharmaceutical Chemistry Laboratory, Universitas Muslim Indonesia. The authors are thankful to The Dean of Faculty of Pharmacy Universitas Muslim Indonesia for the space to do this research.

**Author contributions:** All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

**Conflict of interest:** The authors declared no conflict of interest.

**Ethical Approval:** Not applicable

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