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Determination of Mefenamic Acid and Dexamethasone in Instant Pegal Linu Herbal in Kediri by Using UV-Vis Spectro

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Abstract. Jamu pegal linu is one of the traditional medicinal products that are in great demand by the public, because it can relieve muscle and bone pain, improve blood circulation, strengthen body resistance, and relieve pain all over the body. However, some industry players have added medicinal medicine such as dexamethasone and mefenamic acid in herbal medicine. This study aims to determine the validity of the method in the analysis of dexamethasone and mefenamic acid by UV-Vis spectrophotometry on herbal medicine circulating in Indonesia several markets in Kediri-East Java. The sampling technique used in this study is a purposive sampling method so as to get 5 samples of herbal medicine (A,B,C,D,E). Research begins with determined of wavelength (nm) maximum of dexamethasone and mefenamic acid standard at 200-400 nm and determined of method validation to ensure the accuracy of the method in determining dexamethasone and mefenamic acid levels in the sample. The results of the research showed that the wavelength maximum of mefenamic acid and dexamethasone standard were 288 nm and 245 nm. The method validation showed that this method is good for detect the presence of mefenamic acid and dexamethasone in herbal medicine with the value of the validation parameters, such as linierity of calibration curve of mefenamic acid and dexamethasone weas 0.998, detection limit (LOD) 0.8779 µg/mL and 0.9677 µg/mL; quantification limit (LOQ) 2.9264 µg/mL and 2.2256 µg/mL; intraday and interday precision of mefenamic acid was expressed by the value of %RSD was 0.8905 % and 1.0781 %; intraday and interday precision of dexamethasone was expressed by the value % RSD was 0.6917 % and 0.8062 %. Respectively; as well as the accuracy expressed in mean % recovery were 101.547% for mefenamic acid, and 100.576% for dexamethasone. Results analysis of the sample using a validated method showed that only sample A was mefenamic acid positively with concentration was 7.6796 µg/mL. The other hand, sample C, D and E was dexamethasone positively with concentrations were 2.4978 µg/mL, 2.4112 µg/mL and 8.7748 µg/mL. This result proved that still many jamu pegal linu in Kediri which contained drug chemical (BKO). So, people have to aware and be careful when they consume jamu pegal linu.

Keywords : Dexamethasone, jamu pegal linu, mefenamic acid, traditional jamu

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Introduction

Indonesian traditional herbal medicine, better known as jamu have been used for long time to treat diseases, imboost immune systems improve health by the Indonesian population. Pegal linu herbal medicine is one of the traditional medicine that is widely consumed Indonesian society. Most of the Indonesian population has job by relying on physically, resulting in the emergence of aches and rheumatic pain in the body after work. Reduce these effects on society consuming herbal aches and pain [1][2].

The case of adding chemical drugs to jamu as herbal medicine is difficult to be elimated [3]. The chemical medicines indentified as being mixed in so many Jamu products was dominated by painkillers ad antirheumatic agents, such us Paracetamol, Mefanamic Acid, Phenylbutazone and Dexamethashone [4][5]. Based on Indonesian National Agency for drugs and Food Controls in , the trend of chemicals contamination in jamu led of jamu pegal linu. The two compounds that mostly found in jamu pegal linu were mefenamic acid and dexamethasone.

Dexamethasone is on the list of essential medicines of the World Organization (WHO) and a strong corticosteroid with immunosuppressant and anti-inflamatory properties used to treat various inflamantory condition [6][7]. Dexamethashone (9α-Fluoro-11β, 17α, 21-trihydroxy, 16α-methylpregna) which dosage is connected risk of adverse effects, like hypertension, glaucoma, osteoporosis, headache, obesity, diabetes mellitus, infection diabetes, osteoporosis, oedema, eye problem, skin problem, neuropsychological effects and many other side effects [5][8]. Beside dexamethashone, medical products that can be obtain in jamu is mefanamic acid . Mefanamic acid is drug Non-steroidal anti-inflamatory and analgesic (NSAID) used to treat treatment of osteoarthritis, rheumatism, and pain [9].

Indonesian National Agency for drugs and Food Controls warns the public do not consume jamu that contain drug chemicals. Because, included in the category of substances that are harmful to the body. Drug chemical (BKO) in jamu, come in the category of hard drugs. Hard drugs have a dose or dose in use. I used without paying attention to the dosage, it can have a negative impact on health. If eople consume Jamu or herbs containing BKO will experience the risk of serious health problems, especially in stomach, heart, kodney, and liver. In fact, it can lead to death. So, traditional jamu or herbal medicine have to zero contain BKO.

There are various methods of analysis adulateration in herbal preparations for example by TLC, densitometry, high pressure liquid chromatography (HPLC), Gas Chromatography and spectrophotometry [10][11]. Ultraviolet-visible (UV-Vis) spectroscopy provides a rapid and sensitive detection based on light-absorbing properties of chemical adulterants in the UV-Vis region. Lack of specificity due to spectral interferences can be resolved by multivariate techniques [12][13].

Based on this, a research analysis of the content of medical chemicals was carried out Dexamethashone and Mefanamic Acid in several Jamu Pegal Linu marketed in Kediri East Java using UV-Vis spectrophotometry, so that it can be used as a reference for the public about safety of several herbal aches and pains in Kediri.

Experimental

Materials

The tools used in this research are beaker (Iwaki Pyrex), pipette, vortex mixer (Stuart), volumetric flask (Iwaki Pyrex), micro pipette, dropper, stirbas, spatula, analytical balance (Precisa), and filler UV-Vis Spectrophotometer (JASCO, model V650, Japan) with 1.00 cm quartz cells. The ingredients used are 3 samples of herbal medicine obtained from take herbal medicine in Kediri city, Dexamethashone and Mefanamic Acid standard, methanol pro-analyst (Merck), and aquadest.

Sampling

This research is the random sampling. Sampling begins with making observation in Kediri market. Sampling in this research based on the consideration of herbs that are most in demand by consumers and incomplete information on the packing such as the name of the manufacturer, efficiacy, content and distrubation permit in the form of herbal medicine notification number. The amount of sample were 5 with initial A, B, C, D, E.

Making Mefenamic Acid Standard Curve

a) *Preparation of Mefenamic Acid Standard Solu-*

tion 1000 µg/mL. Mefenamic acid standard was weighed 100 mg, methanol was added to 100 mL.

b) *Preparation of Mefenamic Acid Standard Solution 50 µg/mL*. Take 2.5 mL of standard Mefenamic Acid 1000 µg/mL, added methanol to 50 mL.

c) *Determination of the Maximum Wavelength of Mefenamic Acid*. Take 2.5 mL of standard Mefenamic Acid 50 µg/mL, add methanol to 50 mL. The maximum absorption was measured at the wavelength 200-400 nm using methanol as a blank.

Making Dexamethasone Standard Curve

a) *Preparation of Dexamethasone Standard Solution 1000 µg/mL*. Dexamethashone standard was weighed 100 mg, methanol was added to 100 mL and homogenized.

b) *Preparation of Dexamethasone Standard Solution 50 µg/mL*. Take 2.5 mL of standard Dexamethasone 1000 µg/mL added methanol to 50 mL.

c) *Determination of the Maximum Wavelength of Dexamethasone*. Take 2.5 mL of standard Dexamethasone 50 µg/mL, add methanol to 50 mL. The maximum absorption was measured at the length wave 200-400 nm using methanol as a blank.

Validation Method (ICH, 1994)

a) *Linierity*

This linearity parameter was done by making a calibration curve of mefenemic acid and dexamethasone. Calibration curve can be used as a guideline or reference to the sample on observation.

b) *Precision*

Precision parameter was expressed by a percentage of Relative Standard Deviation (% RSD) in intraday and interday. The measurement of absorbance was used 20 µg/mL with 7 times repetitive.

c) *Accuracy*

Accuracy parameter was expressed by % recovery. The measurement was used concentration 10 µg/mL for 80%, 100%, and 120% with 3 times repetitive and used standard addition method.

d) Limit of Detection (LOD) and Limit of Quantification (LOQ)

Detection limits and quantitation limits were calculated using statistical tests with linear regression equation (Eq. 1 and 2) of the standard curve and deviation standard.

$$LOD = \frac{3\ X\ SD}{S} \qquad (1)$$

$$LOQ = \frac{10\ X\ SD}{S} \qquad (2)$$

Where S was slope from calibration curve of mefenamic acid and dexamethasone.

Determination of mefenamic acid and dexamethasone in sample jamu

Samples (A, B, C, D, E) were indentified the profile absorbance in 200-400 nm. The quantity of samples were measured 25 mg, add methanol 50 mL. Then, put 500 µL and add with methanol until 10 mL. The absorbance was measured with using wavelength based on profile absorbance before. The concentration was measured from linear regression.

Results and Discussion

Determination of the Maximum Wavelength of Mefenamic Acid

The maximum wavelength of mefenamic acid was determined the highest absorbance by using Uv-Vis spectrometer at 200-400 nm. The result was showed that the maximum wavelength in 288 nm (Figure 1).

Determination of the Maximum Wavelength of Dexamethasone

The maximum wavelength of dexamethasone was determined the highest absorbance by using Uv-Vis spectrometer at 200-400 nm. The result was showed that the maximum wavelength in 245 nm (Figure 2).

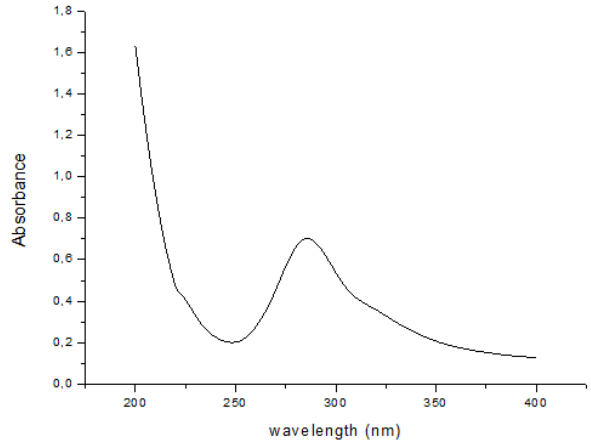

Figure 1. The wavelength of mefenamic acid standar

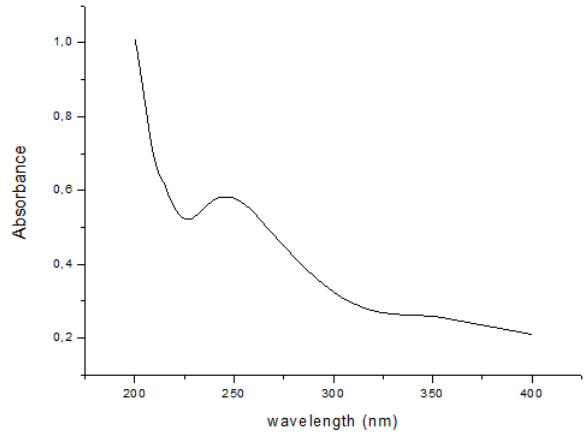

Figure 2. The wavelength of dexamethasone standar

Linearity

This linearity parameter was done by making a calibration curve of mefenemic acid and dexamethasone. Calibration curve can be used as a guideline or reference to the sample on observation. The concentrations was made 5 µg/mL, 10 µg/mL, 15 µg/mL, 20 µg/mL, 25 µg/mL, 30 µg/mL and 35 µg/mL. The absorption is measured at the wavelength maximum and used methanol as a blank as a blank. The results were showed in Figure 3 and 4.

Calibration curve equation is the relationship between the x-axis and the y-axis where x-axis expressed by the concentraion obtained while the y-axis is the absorbance or obsorption obtained from the measurement result so that linear regression equation of curve the calibration obtained is coefficient correlation r value, 0.998 for mefenamic acids standard and 0.9986 for dexamethasone standard. The value of coefficient correlation (r) close to 1 express a linear relationship between concentration with high absorption generated, in other words an increase analyte absorbance value is directly proportional with increasing concentration according to acceptance correlation coeffient (r) s good is according International Conference of Harmonisation [14] r≥ 0.995. This linierities were good because the value almost 1.

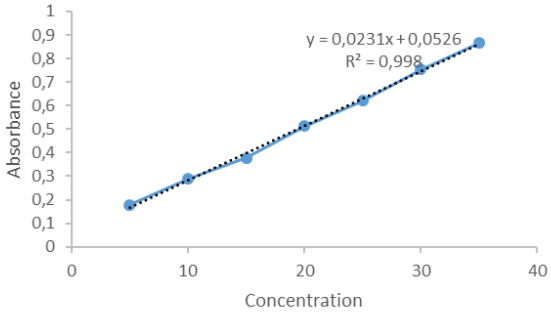

Figure 3. Calibration curve of mefenamic acid standard

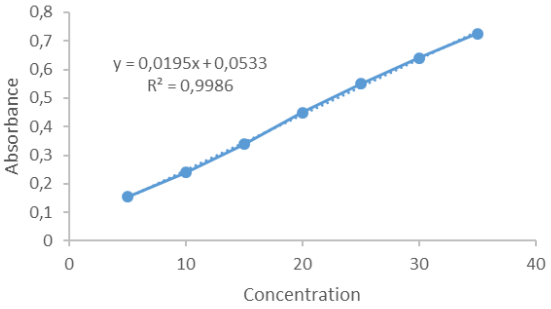

Figure 4. Calibration curve of dexamethasone standard

Limit of detection (LOD) and limit of quantification (LOQ)

The result of statistical calculation obtained Mefanamic Acid LOD value of 0.878 µg/mL and LOQ value of 2.926 µg/mL. The LOD value shows that at a concentration of 0.878 µg/mL is the lowest concentration of Mefanamic Acid standard solution that cn still be detected by UV-Vid Spectrophotometry while the LOQ value shows that at concentration of 2.926 µg/mL is the higest concentration of Mefanamic Acid solution which can still be quantified through the regression equation.

The result of statistical calculation obtained Dexamethasone LOD value of 0.878 µg/mL and LOQ value of 2.926 µg/mL. The LOD value

shows that at a concentration of 0.968 µg/mL is the lowest concentration of Dexamethasone standard solution that can still be detected by UV-Vid Spectrophotometry while the LOQ value shows that at concentration of 3.266 µg/mL is the higest concentration of Dexamethasone solution which can still be quantified through the regression equation.

Table 1. The result of LOD and LOQ analysis

Standard	LOD (µg/mL)	LOQ (µg/mL)
Mefenamic acid	0.878	2.926
Dexamethasone	0.968	3.226

Precision and Accuracy

The precision results was showed in Table 2. Accuracy parameter was expressed by % recovery. The result was showed in Table 3. This test requirement is said to be valid and fulfils the validation test requirements if it has an RSD value of less than 2% [15]. In this study, based on the data on the recovery value of the samle solution, the RSD value were 1.086 % for Mefanamic Acid and 0.806 % for Dexamethasone.

Determination of mefenamic acid and dexamethasone in sample jamu

Samples (A, B, C, D, E) were indentified the profile absorbance in 200-400 nm. Only absorbance profile of sample A was similar with mefenamic acid standard absorbance profile, and absorbance profiles of sample C, D, E were similar with dexamethasone profile. The results was showed in Table 4.

From Table 4 can conclude that several jamu pegal linu in Kediri still contain mefenamic acid and dexamethasone. This conditions was pro-

Table 2. The results of precision analysis

Standard	Repetition	Intra-day	%RSD	Inter-day	%RSD
Mefenamic acid	1	0.517	0.89051	0.51	1.078104
	2	0.508		0.524	
	3	0.506		0.521	
	4	0.502		0.521	
	5	0.507		0.523	
	6	0.508		0.528	
	7	0.509		0.524	
Dexamethasone	1	0.421	0.691776	0.45	0.806234
	2	0.417		0.451	
	3	0.423		0.449	
	4	0.42		0.448	
	5	0.426		0.459	
	6	0.419		0.452	
	7	0.42		0.45	

Tabel 3. The results of accuracy

Standard	Concentration	Abs	% Recovery
Mefenamic acid	80%	0.2242	101.0899
	100%	0.2389	102.0158
	120%	0.2722	101.5375
Mean			101.5477
Dexamethasone	80%	0.2242	99.7634
	100%	0.2389	101.5049
	120%	0.2722	100.4615
Mean			100.5766

Table 4. Determination mefenamic acid and dexamethasone in sample

Sample	ABS		Concentration
	288 nm	245 nm	(ppm)
A	0.23	0	7.6797
B	0	0	0
C		0.111	2.4978
D		0.109	2.4113
E		0.256	8.7749

hibited. Length measurement result the maximum waveform of the dexamethasone standard solution obtained is equal to the wavelength of the existing literature is 245 nm [16]. Length measurement result the maximum waveform of the mefenamic acid standard solution obtained is equal to the wavelength of the existing literature is 288 nm [17].

Conclusion

Based on the results of method validation and analysis of dexamethasone and mefenamic acid on several samples herbal medicine circulating in Kediri City, it can be concluded that the spectrophotometric method UV-Vis analysis for dexamethasone and mefenamic acid, obtained linierity of calibration curve of mefenamic acid and dexamethasone weas 0.998, detection limit (LOD) 0.8779 µg/mL and 0.9677 µg/mL; quantification limit (LOQ) 2.9264 µg/mL and 2.2256 µg/mL; intraday and interday precision of mefenamic acid was expressed by the value of % standard deviation relative (%RSD) was 0.8905 % and 1.0781 %; intraday and interday precision of dexamethasone was expressed by the value of % standard deviation relative (%RSD) was 0.6917 % and 0.8062 %. Respectively; as well as the accuracy expressed in mean % recovery were 101.547 % for mefenamic acid, and 100.576% for dexamethasone. Results analysis of the sample using a validated method showed that only sample A was mefenamic acid positively with concentration was 7.6796 µg/mL. The other hand, sample C,D and E was dexamethashone positively with concentrations were 2.4978 µg/mL, 2.4112 µg/mL and 8.7748 µg/mL. This result proved that still many jamu pegal linu in Kediri which contained BKO. So, the people have to aware and be careful when consume jamu pegal linu.

References

[1] M. Tahir, S. Maryam, and A. Wahdania, "Analisis Bahan Kimia Obat Natrium Diklofenak Pada Sediaan Jamu Pegal Linu Yang Beredar Di Makassar," J. Kesehat., vol. 1, no. 4, pp. 311–317, 2018, DOI: 10.33368/woh.v1i4.101

[2] E. Kumalasari, L. F. Wahyuni, and R. Alfian, "Analisis Kualitatif Kandungan Ibuprofen Dalam Jamu Pegal Linu Yang Beredar di Pasar Baru Permai Banjarmasin," J. Pharmascience, vol. 5, no. 1, pp. 32–38, 2018, doi: 10.20527/jps.v5i1.5783.

[3] S. Rusmalina, K. Khasanah, and D. K. Nugroho, "Deteksi Asam Mefenamat pada Jamu Pegel Linu yang beredar di Wilayah Pekalongan," Pharmacon J. Farm. Indones., pp. 51–60, 2020, doi: 10.23917/pharmacon.v0i0.10111.

[4] T. Sentat, H. Nurhasnawati, and Y. R. Dwinand, "Development of Paper-Based Color Test-Strip for Paracetamol Detection in Jamu," J. Ilmu Kesehat., vol. 7, no. 2, pp. 137–142, 2020, doi: 10.30650/jik.v7i2.1231.

[5] A. Nugroho and F. D. Ritonga, "Rapid Analysis of Adulterated Dexamethasone in Joint-Pain Killer Traditional Herbal Medicine (THM) Using Infrared Spectroscopy," EKSAKTA J. Sci. Data Anal., vol. 18, pp. 137–145, 2018, doi: 10.20885/eksakta.vol18.iss2.art5.

[6] A. G. Maria de et al., "Anti-inflammatory effect of dexamethasone tablets orally administered in dogs determined by the tissue chamber model," J. Microbiol. Exp., vol. 6, no. 3, 2018, doi: 10.15406/jmen.2018.06.00209.

[7] R. Asra, Zulharmita, and N. Yuliatim, "Determination of Dexamethasone in Unregistered Herbal Weight Gain Using HPTLC-Densitometry," Indones. J. Pharm. Clin. Res., vol. 1, no. 2, pp. 21–28, 2018, doi: 10.32734/idjpcr.v1i2.331.

[8] A. D. Ananto, L. U. Y. M. G, and L. S. W. F. A, "Analysis of BKO Content (Antalgin and Dexamethasone) in Herbal Medicine Using Iodimetry Titration and HPLC Method," Elkawnie, vol. 6, no. 1, p. 57, 2020, doi: 10.22373/ekw.v6i1.5428.

[9] S. Harimurti, S. Ulandari, H. Widada, and V. L. Damarwati, "Identifikasi Parasetamol dan Asam Mefenamat pada Jamu Pegel Linu dan Asam Urat yang Beredar di Daerah Istimewa

Yogyakarta," JPSCR J. Pharm. Sci. Clin. Res., vol. 5, no. 2, p. 179, 2020, doi: 10.20961/jpscr.v5i2.41929.

[10] M. Handoyo Sahumena, R. Ruslin, A. Asriyanti, and E. Nurrohwinta Djuwarno, "Identifikasi Jamu Yang Beredar Di Kota Kendari Menggunakan Metode Spektrofotometri Uv-Vis," J. Syifa Sci. Clin. Res., vol. 2, no. 2, pp. 65–72, 2020, doi: 10.37311/jsscr.v2i2.6977.

[11] E. S. Simaremare et al., "Analysis of acetaminophen, mefenamic acid, sibutramine hydrochloride, and sildenafil citrate," J. Appl. Pharm. Sci., vol. 8, no. 11, pp. 48–56, 2018, doi: 10.7324/JAPS.2018.81107.

[12] R. Dion, "Analisis Cemaran Kapang dan Khamir pada Jamu Serbuk Instan Jahe Merah dan Temulawak," Berk. Bioteknol., vol. 3, no. 2, 2020, available online: https://ejournal2.undip.ac.id

[13] A. Y. Puspitasari, H. D. Pranowo, R. T. Swasono, and T. R. Nuringtyas, "1H NMR Fingerprinting of Medicinal Herbs Contain Chemical Drug Material Allopurinol," Maj. Obat Tradis., vol. 23, no. 3, p. 137, 2018, doi: 10.22146/mot.42300.

[14] I. Conference et al., "Requirements Registration of Pharmaceuticals for Human Humanized Tripartite Guideline Validation o analytical procedures : Parent Guideline : Text on Validation of Analytical Procedures," vol. 1994, no. October 1994, 2005.

[15] S. Musiam and R. Alfiian, "Validasi metode spektrofotometri UV pada analisis penetapan kadar asam mefenamat dalam sediaan tablet generik," J. Ilm. Ibnu Sina, vol. 1, no. 2, pp. 31–43, 2017, DOI: 10.36387/jiis.v2i1.78

[16] B. Aqnes and ulfa faza muhamad barik, "Analisis Bahan Kimia Obat Deksametason Dalam Jamu Pegal Linu Menggunakan Kromatografi Cair Kinerja Tinggi," deksametason, jamu pegal linu, KCKT, vol. 18, pp. 1–6, 2015, DOI: 10.3194/ce.v3i1.2136

[17] N. Nerdy, "Validation of Ultraviolet Spectrophotometry Method for Determination of Mefenamic Acid Level in Suspension Dosage Forms," J. Nat., vol. 17, no. 1, p. 17, 2017, doi: 10.24815/jn.v17i1.6540.