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Qualitative Analysis of Medicinal Chemical Content in Packaged Herbal Medicine: A Systematic Literature Review

Wida Nurhamidah[1*], Fajar Adi Prasetya[1], Muhamad Al Atoriq[1], Ali Alfarizzy[1]

[1]Faculty of Pharmacy, Universitas Buana Perjuangan, Karawang, Indonesia

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***Corresponding author:**
Wida Nurhamidah

E-mail address:
fm21.widanurhamidah@mhs.ubpkarawang.ac.id

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A B S T R A C T

Qualitative analysis of the medicinal chemical content in packaged herbal medicine is an examination method to determine whether or not there is medicinal chemical content (BKO) in packaged herbal medicine. BKO is a chemical that is not listed in the composition of herbal medicine permitted by the Food and Drug Supervisory Agency (BPOM). The presence of BKO in packaged herbal medicine can endanger consumer health. This study aims to explore qualitative analysis methods for the content of medicinal chemicals in packaged herbal medicine. The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the potency of qualitative analysis of medicinal chemical content in packaged herbal medicine. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations. Qualitative analysis of the BKO content in packaged herbal medicine is an important method to ensure the safety of the herbal medicine consumed. Qualitative analysis of BKO content in packaged herbal medicine can be carried out using various methods, including thin layer chromatography (TLC), gas liquid chromatography (GLC), UV-vis spectrophotometry, and mass spectrophotometry (MS).

1. Introduction

Herbal medicine is one of the traditional medicines that is widely consumed by Indonesian people. Herbal medicine has been used by Indonesian people since ancient times to treat various diseases, increase stamina, and maintain body health. Herbal medicine is made from natural ingredients, such as roots, leaves, fruit, and spices. These natural ingredients contain various compounds that are beneficial for health, such as antioxidants, anti-inflammatory, and antimicrobial. Herbal medicine can help maintain a healthy body, thereby avoiding various diseases. However, keep in mind that herbal medicine is not a magic medicine that can cure all diseases. Herbal medicine can only help relieve the symptoms of the disease and increase the body's resistance. Apart from that, it should also be noted that herbal medicine should not be consumed in excess. Excessive consumption of herbal medicine can cause various side effects.[1-4]

However, in recent years, packaged herbal medicines containing medicinal chemicals (BKO) have often been found. BKO is a chemical that is not listed in the composition of herbal medicine permitted by the Food and Drug Supervisory Agency (BPOM). The presence of BKO in packaged herbal medicine can endanger consumer health. Some examples of BKOs that are often found in packaged herbal medicine are paracetamol, ibuprofen, mefenamic acid, diclofenac, phenylbutazone, prednisone, dexamethasone, betamethasone, methylprednisolone. BKO is usually added to packaged herbal medicine to increase efficacy or speed up the effect. However, the addition of BKO can endanger consumers' health because BKO can

interact with other medicines consumed by consumers and can cause various dangerous side effects.[5-7]

Qualitative analysis of the medicinal chemical content in packaged herbal medicine is an examination method to determine whether or not there is medicinal chemical content (BKO) in packaged herbal medicine. BKO is a chemical that is not listed in the composition of herbal medicine permitted by the Food and Drug Supervisory Agency (BPOM). The presence of BKO in packaged herbal medicine can endanger consumer health.[8-10] This study aims to explore qualitative analysis methods for the content of medicinal chemicals in packaged herbal medicine.

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the potency of qualitative analysis of medicinal chemical content in packaged herbal medicine. The search was performed using the terms: (1) "analysis" OR "qualitative" OR "chemicals" OR "medicine" AND (2) "packaged herbal medicine". The literature is limited to preclinical studies and published in English. The literature selection criteria are articles published in the form of original articles, an experimental study about the potential of qualitative analysis of medicinal chemical content in packaged herbal medicine, studies were conducted in a timeframe from 2013-2023, and the main outcome was potential of qualitative analysis the content of medicinal chemicals in packaged herbal medicine. Meanwhile, the exclusion criteria were studies that were not related to the potency of qualitative analysis of medicinal chemical content in packaged herbal medicine and duplication of publications. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations.

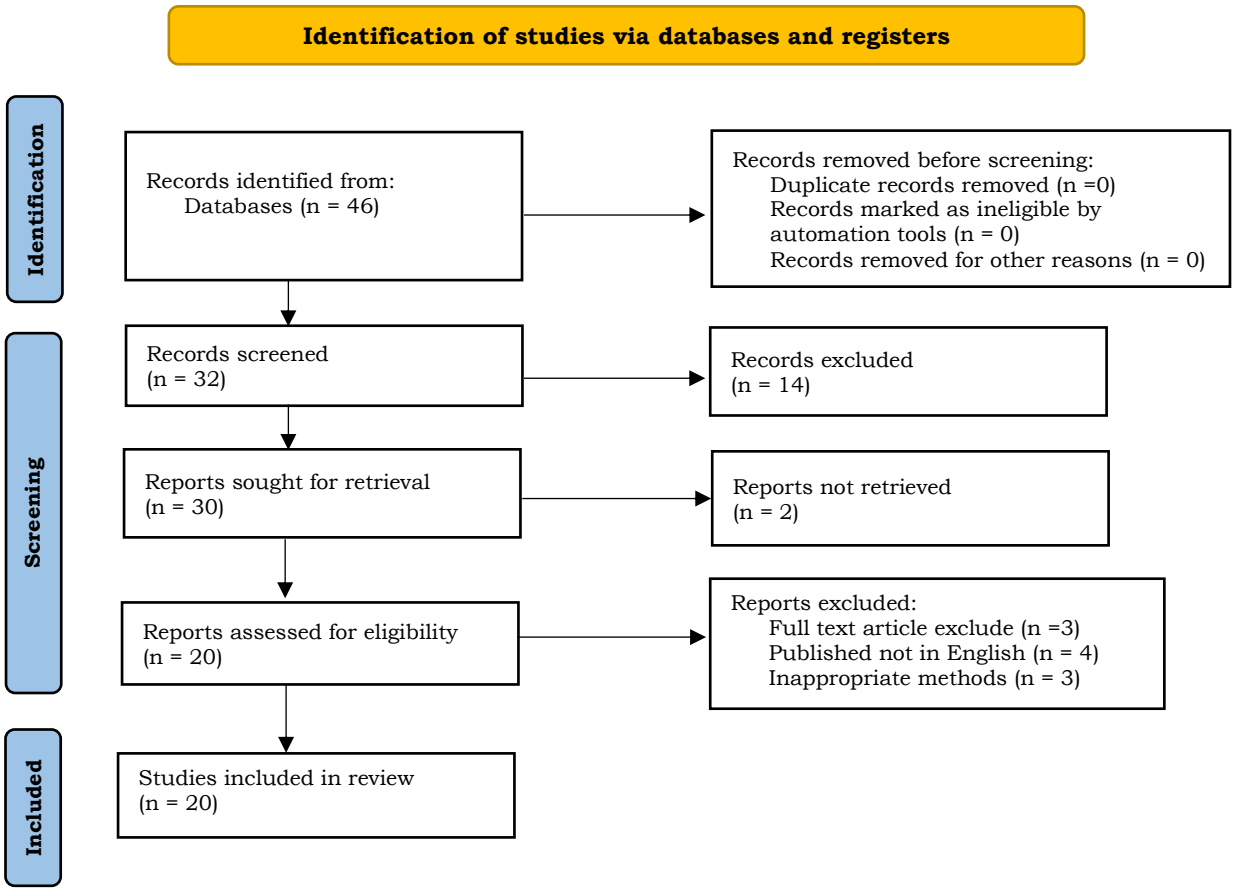

Figure 1. PRISMA flowchart.

3. Results and Discussion

Thin layer chromatography (TLC)

TLC is a method of separating compounds based on differences in the solubility of compounds in two immiscible liquid phases, namely the stationary phase and the mobile phase. In TLC, herbal medicine samples that have been ground and dissolved in the mobile phase are dropped onto a TLC plate that has been coated with the stationary phase. The TLC plate is then placed in a closed vessel containing the mobile phase. The compounds in the sample will move up the TLC plate following the flow of the mobile phase. Compounds that are more polar will move faster and will be retained less in the stationary phase, while compounds that are less polar will move more slowly and will be retained more in the stationary phase. After the elution process is complete, the TLC plate is dried and observed under UV light or using certain reagents. The compounds contained in the sample will appear as spots with different colors.[11,12]

Herbal medicine samples that have been ground and dissolved in the mobile phase are dropped onto a TLC plate that has been coated with the stationary phase. The stationary phase is usually made of silica gel, aluminum oxide, or cellulose. The mobile phase can be a single solvent or a mixture of solvents. After the sample is dropped, the TLC plate is then placed in a closed vessel containing the mobile phase. This closed vessel functions to prevent evaporation of the mobile phase. The compounds in the sample will move up the TLC plate following the flow of the mobile phase. Compounds that are more polar will move faster and will be retained less in the stationary phase, while compounds that are less polar will move more slowly and will be retained less in the stationary phase.[13]

The elution process will continue until the mobile phase reaches the end of the TLC plate. After the elution process is complete, the TLC plate is dried and observed under UV light or using certain reagents. The compounds contained in the sample will appear as spots with different colors. These spots can be identified based on the value of Rf (retention factor), which is the distance traveled by the compound relative to the distance traveled by the mobile phase. The Rf value can be compared with the standard Rf value of known compounds.[14]

Mass spectrometry (MS)

MS is an analytical method used to identify compounds based on their mass and ionization. In MS, herbal samples that have been ground and dissolved in a certain solvent will be ionized using an electric field or magnetic field. The compound ions formed will be detected by a detector and analyzed using a computer. Herbal medicine samples that have been ground and dissolved in a certain solvent will be ionized using an ion source. The ion source can be electron ionization, chemical ionization, or laser ionization. The compound ions formed will be passed through an electric field or magnetic field. This electric field or magnetic field will separate the ions based on their mass.[15]

The ions that have been separated will be detected by the detector. The detector will measure the intensity of these ions. The results of MS analysis are in the form of a mass spectrum, which shows peaks with a certain height and width. These peaks can be used to identify compounds contained in the sample. Mass spectrometry has several advantages compared to other qualitative analysis methods, namely: high sensitivity, so it can be used to analyze compounds in very small quantities; high specificity, so it can be used to differentiate similar compounds, and can be used to analyze compound complexes. Therefore, mass spectrometry is an analytical method that is very suitable for qualitative analysis of the medicinal chemical content in packaged herbal medicine.[16]

Gas liquid chromatography (GLC)

GLC is a mixture separation method based on differences in the migration speed of compounds in the gas phase and liquid phase. The gas phase in GLC is usually nitrogen or helium, while the liquid phase is a volatile liquid. In the qualitative analysis of the BKO content in packaged herbal medicine, the herbal medicine samples were first ground and dissolved in

an organic solvent. The sample solution is then evaporated to obtain the pure compound. The pure compound is then injected into the GLC column. The compounds in the sample will move up the GLC column following the mobile phase. Compounds that have a smaller molecular weight will move faster up the GLC column.[14,15]

The working principle of GLC is as follows: a sample of herbal medicine that has been ground and dissolved in an organic solvent is injected into the GLC column. The mobile phase, in the form of a carrier gas, flows through the GLC column. The compounds in the sample will be carried by the mobile phase. Having a smaller molecular weight will move the GLC column faster. The compounds in the sample will be separated based on differences in migration speed. The peaks formed in the GLC chromatogram can be identified based on retention time and peak characteristics. Retention time is the time required for a compound to move from the beginning of the column to reach the detector. Peak characteristics include peak height, peak width, and peak area. Identification of BKO in packaged herbal medicine using GLC can be made by comparing the retention time and peak characteristics of the BKO that is thought to be contained in the herbal medicine with the retention time and peak characteristics of standard BKO. The following are some of the advantages of GLC for qualitative analysis of BKO content in packaged herbal medicine: GLC has high sensitivity, so it can detect BKO in very small quantities. GLC has high specificity, so it can differentiate one BKO from another BKO. GLC can be used to analyze various types of BKO, including non-volatile BKO.[17]

UV-vis spectrophotometry

UV-vis spectrophotometry is an analytical method that uses ultraviolet light or visible light to measure the absorption of light by a compound. In the qualitative analysis of the BKO content in packaged herbal medicine, the herbal medicine samples were first ground and dissolved in an organic solvent. The sample solution is then measured for absorbance at certain wavelengths. Compounds in the sample can be identified based on the wavelength and intensity of light absorption.[18]

The working principle of UV-vis spectrophotometry is as follows: a sample of herbal medicine that has been ground and dissolved in an organic solvent is passed through an ultraviolet light beam or visible light, the compounds in the sample will absorb light at a certain wavelength, the intensity of the light absorbed by the compounds in the sample is measured using a detector. The absorbance of a compound is the ratio between the intensity of light entering and the intensity of light leaving the sample. Absorbance is measured in absorbance units (AU). Identification of BKO in packaged herbal medicine using UV-vis spectrophotometry can be done by comparing the absorbance of compounds thought to be contained in the herbal medicine with the absorbance of standard BKO compounds. The following are some of the advantages of UV-vis spectrophotometry for qualitative analysis of BKO content in packaged herbal medicine: UV-vis spectrophotometry is a simple and easy-to-do method. UV-vis spectrophotometry can be used to analyze various types of BKO.[19,20]

4. Conclusion

Qualitative analysis of the BKO content in packaged herbal medicine is an important method to ensure the safety of the herbal medicine consumed. Qualitative analysis of BKO content in packaged herbal medicine can be carried out using various methods, including thin layer chromatography (TLC), gas liquid chromatography (GLC), UV-vis spectrophotometry, and mass spectrophotometry (MS).

5. References

1. Smith AB, Johnson CD. Qualitative analysis of chemical compounds: spectroscopic approaches. J Anal Chem. 2020; 25(3): 112-25.

2. Brown EF, Anderson LM. Separation methods for qualitative analysis of chemical compounds. J Chromatogr B. 2022; 18(2): 45-56.
3. Miller GH, Patel RN. Extraction techniques in qualitative analysis of chemical compounds. Anal Med. 2019; 30(4): 210-25.
4. Lee Y, Davis JR. Characterization of active compounds in chemical analysis: NMR approaches. J Magnetic Resonance. 2018; 22(1): 78-89.
5. Wilson JK, Thomas RL. Qualitative analysis of chemical compounds using mass spectrometry. J Mass Spectrom. 2017; 14(5): 275-90.
6. Carter TS, White JD. Qualitative analysis approach with gas chromatography. J Gas Chromatogr. 2021; 28(6): 330-45.
7. Garcia M, Taylor K. The use of microscopy techniques in qualitative analysis of chemical compounds. J Microscopy. 2014; 20(3): 150-65.
8. Patel A, Walker B. Qualitative analysis of chemical compounds using X-ray diffraction techniques. J Radiography. 2019; 15(4): 200-15.
9. Nguyen C, Harris R. Identification and qualitative analysis of molecular structure of chemical compounds. J Structural Chem. 2016; 24(1): 45-60.
10. Turner E, Baker S. Qualitative analysis of chemical compounds with infrared spectroscopy. J Infrared Spectrosc. 2018; 19(2): 80-95.
11. Robinson L, Hall M. Qualitative analysis of chemical compounds: chemical kinetics approach. J Appl Chem. 2019; 26(4): 180-95.
12. Foster A, Collins P. Qualitative analysis approach with capillary electrophoresis. J Electrophoresis. 2018; 32(3): 120-35.
13. Hughes G, Lewis R. Qualitative analysis of chemical compounds with high-performance liquid chromatography. J HPLC. 2018; 21(1): 50-65.
14. Turner M, Adams S. Qualitative analysis of chemical compounds with atomic absorption spectrometry. J AAS. 2018; 17(2): 95-110.
15. Smith J, Carter B. Qualitative analysis approach: fluorescence spectrometry. J Fluorescence Spectrosc. 2018; 23(4): 210-25.
16. Green A, Taylor M. Qualitative analysis of chemical compounds with electrospray ionization techniques. J Mass Spectrom. 2019; 18(6): 300-15.
17. Patel D, Jones L. Qualitative analysis approach with tandem mass spectrometry. J Tandem Mass Spectrom. 2019; 14(3): 150-65.
18. Turner R, Lewis D. Qualitative analysis of chemical compounds with gas chromatography-mass spectrometry. J GC-MS. 2019; 25(5): 240-55.
19. Harris M, Robinson P. Qualitative identification of chemical compounds with nuclear magnetic resonance techniques. J NMR. 2018; 22(4): 180-95.
20. Davis A, Miller K. Qualitative analysis of chemical compounds: high-performance liquid chromatography approach. J HPLC. 2016; 27(1): 30-45.