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Determination of Standard Parameters and Phytochemical Screening of Ethanol Extract of Burdock Root (*Arctium lappa* L.)

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ABSTRACT

Gobo root (*Arctium* lappa L.) is one plant that is empirically used to lower blood sugar levels. The phytochemical content and standard parameters of Gobo root ethanol extract were investigated in this study. The maceration method was used to extract the samples using 70% ethanol solvent. The thick extract was obtained by evaporation. The percentage yield of gobo root extract (*Arctium* lappa L.) obtained was 46.24%. The results of organoleptic (macroscopic) examination produce blackish-brown extracts, thick, slightly sour taste, and a distinctive smell. Furthermore, phytochemical screening tests were carried out and determination of extract standard parameters which included water-soluble pollen, ethanol-soluble juice, drying shrinkage, water content, and total ash content. Obtained chemical compounds from gobo root extract, namely alkaloids, flavonoids, tannins, polyphenols, and triterpenoids. The results of determining the standard parameters of gobo root extract showed the value of water soluble juice content of 84.55% and ethanol soluble juice content of 27.8%.The drying shrinkage value is 25.52%, the moisture content is 5%, and the total ash content is 0.41%.

Keywords: *Arctium lappa* L., Extract standardization**,** Phytochemical screening, Maseration extraction

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1. Introduction

The burdock or gobo plant (Arctium lappa L.) is a plant that belongs to the Asteraceae family, growing in humid climates in Asia and Europe. This plant has brown fusiform roots. In traditional medicine the gobo plant is often used as a depurative, diuretic, lowers blood sugar levels, and for certain skin diseases (1). The benefits of gobo plant roots can be obtained because the roots contain active compounds. A phytochemical screening study by Oswari et al (2021), yielded the following results that the roots of the gobo plant (Arctium lappa L.) are rich in phenols, saponins, lignans, tannins and flavonoids (2).

The content of compounds in plant extracts can be determined through a variety of phytochemical screening techniques. Chemical screening tests are performed using reagents to detect groups of compounds such as flavonoids, alkaloids, tannins, saponins and terpenoids. The plant extract to be tested is mixed with detection reagents. The changes in the extract will determine the content of certain compounds in the plant extract (3).

To obtain a quality extract, the determination of extract standardization parameters can be done with two parameters, namely specific and non-specific parameters. Specific parameters include organoleptic (shape, smell, taste and color), water soluble extract, ethanol soluble extract and phytochemical compound content. Non-specific parameters include drying shrinkage, microbial contamination, total ash content, acid insoluble ash content, and heavy metal contamination of Pb and Cd. Specific parameters are aspects of qualitative and quantitative chemical analysis of active compound levels related to the pharmacological activity of an extract (4).

2. Method

2.1. Tools

In this study, several tools were used, namely stirring rods, vaporizer cups, petri dishes, silicate crates, desiccators, funnels (Pyrex), dropper pipettes, measuring cups, beakers, erlenmeyer flasks, spatulas, analytical scales (Mark M5-Ion), magnetic stirrer (Scigolex), overhead stirrer (IKA® RW 20 Digital), pH meter (Merk Mettler Toledo), brookfield viscometer (DV-I Prime), rotary evaporator (Merk R - 124), oven (UN 55), mesh 40, and digital water bath.

2.2. Materials

Gobo Root Extract (Arctium lappa L.), HPMC (Hydroxypropyl Methyl Cellulose Non-Ionic) (Alpha), PEG 400 (Madampari), Sucralose (Tutes), 70% Ethanol (Brataco), Whatman Paper No. 1, Silica Gel (GF254), Aquadest and Aqua DM.

2.3. Determination of Plants

Determination of gobo root plants (Arctium lappa L.) was carried out at Herbarium Jatinangor, Plant Taxonomy

Laboratory, Department of Biology, FMIPA UNPAD.

2.4. Preparation of Samples

Gobo root (Arctium lappa L.) as much as 9 kg was cleaned using running water to remove dirt. After that, a thin round shape was cut to facilitate the drying process. Drying of gobo root (Arctium lappa L.) is done using a simplisia oven with a temperature of 70℃. The dried gobo root (Arctium lappa L.) was pollinated and pulverized using mesh 40.

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2.5. Preparation of Gobo Root Extract (Arctium lappa L.)

A total of 700 g of gobo root (Arctium lappa L.) simplisia was extracted through maceration method using 70% ethanol solvent as much as 3.5 L stirring occasionally. The macerate was extracted for 3x24 hours, then the obtained macerate was concentrated with a rotary evaporator at 60 ℃ to obtain a thick but still pourable extract, after which the extract was concentrated using a water bath to obtain a concentrated thick extract. The concentrated thick extract obtained was weighed and the percentage yield was calculated.

2.6. Phytochemical Screening

A total of 3 grams of gobo root extract (Arctium lappa L.) was dissolved with 100 ml of water on a water bath, then the filtrate was filtered. The filtrate obtained was used for saponin, flavonoid, tannin and polyphenol tests. For the alkaloid test using acidic juice from gobo root extract as much as 0.1 ram was put into the mortar, then added dilute ammonia and CHCl3 (chloroform), crushed until homogeneous. The filtrate is filtered and 2N HCl is added, shaken and allowed to stand until two layers are formed, the HCl part of the filtrate is pipetted. For steroid and triterpenoid tests, 0.1 gram of gobo root extract was put into a mortar and then added ether, after the ether evaporated, the extract was tested with Lieberman Burchard reagent for steroid and triterpenoid testing.

2.7. Examination of Extract Quality Parameters

2.7.1. Organoleptic Examination Parameters

Organoleptic examination is carried out by describing the shape, colour, smell, and taste using the five senses.

2.7.2. Determination of Total Ash Content

Gobo root extract (Arctium lappa L.) was weighed as much as 1 g and put into a crucible that had been incinerated and tared, then incinerate the crucible containing the extract slowly using a furnace at a temperature of 600 ± 25 ℃ until the organic compounds evaporate and leave mineral elements and inorganic compounds. After that, the krus that has been incinerated is cooled in a desiccator and then weighed. Total ash content is calculated against the weight of the test material, expressed as % w/w (5).

2.7.3. Determination of Drying Shrinkage

A total of 1 g of gobo root extract was put into a crucible that had previously been heated at 105 ℃ for 30 minutes and had been calibrated. Then the krus in the open krus lid state is put into the oven, dry the krus containing the extract at 105 ℃ for 30 minutes to a fixed weight, cool in a desiccator with the krus closed. The fixed weight obtained was recorded and then calculate the percentage of drying shrinkage (5).

2.7.4. Determination of Water Content

The moisture content of gobo root extract (Arctium lappa L.) was determined by the toluene distillation method. A total of 200 mL of toluene was put into a round bottom flask that already contained 2 boiling stones to prevent sudden turbulence when boiling, the toluene was saturated with 2 mL of water. Put 2 g of gobo root extract (Arctium lappa L.) into a round bottom flask containing saturated toluene. Heat the toluene until it boils, then set the distillation at a speed of 2 drops per second and then increase it to 4 drops per second. After all the water is distilled, cool the flask and then the volume of water is calculated after the water and toluene are completely separated[5].

2.7.5. Water Soluble Juice Content

Weigh 5 g of extract, put it into an erlenmeyer and then close it using a stopper, add 100 ml of distilled water that Shake for 6 hours using an orbital shaker, then leave for 18 hours. The filtrate was filtered and then put into a calibrated vapour cup. After that, the filtrate was evaporated to dryness and the residue was heated at 105° to a fixed weight[7]. Calculate the content in % water soluble essence with the following formula: Water Soluble content

$$= \frac{\text{Weight of water essence (g)}}{\text{Weight of extract (g)}} \; x \; \frac{100}{20} x \; 100\%$$

2.7.6. Ethanol Soluble Juice Content

Weigh 5 g of the extract, put it into an erlenmeyer and close it using a stopper, add 100 ml of ethanol P. Shake for 6 hours using an
orbital shaker, then leave for 18 hours. The filtrate was filtered and then put into a calibrated vapour cup. Afterwards, the filtrate was evaporated to dryness and the residue was heated at 105° to a fixed weight. Calculate the content in % ethanol soluble juice.

Ethanol Soluble Content

$$= \frac{\text{Weight of ethanol soluble juice (g)}}{\text{Weight of extract (g)}} \text{ x } \frac{100}{20} \text{ x } 100\%$$

3. Result

3.1 Gobo Root Extraction (Arctium lappa L.)

The weight of the thick, thick extract produced from the extraction of 700 g of gobo root simplicia (*Arctium lappa* L.) is 323.69 g. The percentage yield of the thick extract obtained was calculated. The percentage yield of gobo root extract (*Arctium lappa* L.) obtained was 46.24%.

3.2. Phytochemical Screening

Table 1. Results of Phytochemical Screening of Gobo Root Extract

Golongan	Result
Tannin	+
Polyphenols	+
Saponins	-
Alkaloids	+
Flavonoids	+
Steroids	-
Triterpenoids	+

3.3. Organoleptic Examination of Extract

Table 2. Results of Organoleptic Examination of Gobo Root Extract

Observation	Result
Texture	Thick
color	Blackish brown
smell	Typical aomatic
flavor	Slightly sour

3.4. Extract Quality Parameter Check

Table 3. Test Results for Total Ash Content and Drying Loss

	rate (%)			
Test Parameters	**I**	**II**	**III**	**average (%) ± SD**
Ash content	0,45%	0,39%	0,39%	0,41% ± 0.0003
Drying shrinkage	27,43%	23,01%	26,11%	25,52% ± 0.0227

3.2. Phytochemical Screening

Table 1. Results of Phytochemical Screening of Gobo Root Extract

Test Parameters	rate (%)
Water content	5%
Ethanol soluble essence content	27,8%
Water soluble essence content	84,55%

4. Discussion

The purpose of extraction is to obtain the chemical compounds present in the sample. In this study, gobo root (*Arctium lappa* L.) was extracted using the maceration method, which is a type of cold extraction. Maceration involves soaking the simplisia in a suitable solvent for 3x24 hours with occasional stirring, and then storing it at room temperature (6). This method was chosen because gobo root simplicia cannot tolerate heat. The solvent used to obtain the extract is 70% ethanol because more active compounds are attracted than other solvents, besides that 70% ethanol is a polar solvent and its polarity is higher than 96% ethanol so that polar flavonoid compounds can be attracted by ethanol 70% (7). The yield of thick extract was calculated by comparing the weight of extract obtained with the weight of simplicia used (6).

Phytochemical screening aims to identify the presence of chemical compounds in plants. Several classes of compounds tested include tannins, polyphenols, saponins, alkaloids, flavonoids and steroids. The phytochemical screening results indicate that the gobo root extract contains tannins, polyphenols, alkaloids, flavonoids, and triterpenoids. Table 1 shows the results of the phytochemical screening of gobo root extract.

The organoleptic examination of the extract of Arctium lappa (*Arctium lappa* L.) aimed at the initial recognition of the extract through the description of the shape, color, smell and taste using the five senses (6). Table 2 shows the results of the organoleptic examination of the extract of gobo root (*Arctium lappa* L.).

The total ash parameter aims to provide an overview of the mineral content both externally and internally present from the initial process to extract formation (6). The total ash parameter testing is carried out to determine how much inorganic or mineral components are contained in a sample (8). The mineral content in a material increases as the total ash content in an extract increases. In a material there is mineral content in the form of organic salts from acetate, oxalate, pectate, malic acid and inorganic salts from alkali metals, chlorides, carbonates, phosphates and sulfate nitrates. Mineral content can also come from complex salts that are organic (9).

The total ash content in gobo root extract (*Arctium lappa* L.) is 0.41% can be seen in Table 3. The ash content of gobo root extract is quite low in mineral content. The total ash content test results have met the requirements, namely ≤ 16.7% (10).

The drying loss parameter is expressed as a percentage value and is measured by determining the residual substance after drying at a temperature of 105℃ for 30 minutes until a constant weight is achieved. The purpose of the drying loss parameter is to establish an upper limit on the quantity of compounds that are lost during the drying process (6). The drying loss value of the gobo root extract was 25.52%. This is shown in Table 3.

The determination of water content is a parameter for the measurement of the amount of water present in the thick extract of gobo root (*Arctium lappa* L.). For this purpose, the distillation method is used. The purpose of this water content test is to establish a minimum limit for the amount of water content in the extract after the thickening process (6). The required quality for water content in the form of a thick extract is 5-30% (11). were 5%, which met the quality requirements. Gobo root thick extract was found to meet quality requirements with a water content of 5%. A large percentage of water content in a material can cause the extract to experience damage and decay more easily due to microbial growth. Apart from that, it can also cause decomposition of the active compounds contained in the extract due to enzymatic reaction activity, so that the water content really determines the quality and stability of an extract (12). Table 4 demonstrates the result of moisture content of gobo root extract has been measured.

The concentration of water-soluble and ethanol-soluble essence is used to estimate the amount of active ingredients of the extract dissolved in either water or ethane, taking into account their polarities (polar, non-polar or semi-polar). This determination uses the working principle of dissolving the extract with a solvent such as water or ethanol, so that the amount of compound content can be determined using the gravimetric method. The method is based on the measurement of the mass of the extracted sediments. The results of measuring water soluble essences 85.55% and ethanol 27.8% are shown in Table 4. This proves that the compounds contained in the gobo root are more soluble in water compared to ethanol. Therefore, in gobo roots there are more polar compounds compared to non-polar.

The solubility of compounds in water and ethanol is influenced by the bonding properties of the solvent. Water is a universal solvent whose bonding properties are more polar than ethanol. In water there are hydroxyl groups which can form hydrogen bonds so that the bond srength is greater. Compounds that have the same bonding properties as water will bond more strongly with water. Therefore, these compounds will be better absorbed in water solvents. Meanwhile, compounds that dissolve in ethanol are due to the nature of the ethanol bond which can filter out active compounds that have different polarities.

This is because in the ethanol bond structure there is a hydroxyl group (-OH) which is polar so it can dissolve polar compounds. Apart from that, ethanol has a side group in the from of ethyl (CH3-CH2-) which is nonpolar so it can dissolve nonpolar compounds (13).

5. Conclusion

Based on the research done, it can be concluded that gobo root extract is a thick, black-brown extract with a characteristic smell and a slightly sour taste. Phytochemical screening tests indicate that gobo root contains flavonoids, alkaloids, tannins, polyphenols, and triterpenoids. The gobo root extract obtained meets the specific and nonspecific parameters, except for drying shrinkage, making it compliant with pharmaceutical product standards.

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