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Nutraceuticals from Bushland: Determination of Medicinal Value of Malaysian Wild Herbs for Proposed Hygienic Travel Soap

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ABSTRACT

Medicinal plants have been used in traditional medicine for centuries due to their phytochemical components and medicinal properties. In this study, wild herbs *Oldenlandia corymbosa* (Lidah Ular), *Striga asiatica* (Jarum Mas) and *Phyllanthus niruri* (Dukung Anak) were collected from Universiti Sains Islam Malaysia, dried, and grounded. The powdered samples were extracted using hot water, ethyl acetate and ethanol for 48 hours. Phytochemical analysis revealed antioxidants such as flavonoids and phenolics in all extracts, while resins were present only in the ethanolic extracts, and steroids were absent. ATR-FTIR analysis identified key functional groups, including hydroxyls, lipids, alkanes, amino acids, benzoic compounds and phenols. Additionally, the study aimed to develop a portable, easy-to-use travel soap to promote frequent handwashing. Since liquid soap and bar soap each have their own limitations, this travel soap was invented to make it easier for users. Oils from *Oldenlandia corymbosa*, *Striga asiatica* and *Phyllanthus niruri* were used to replace palm oil in the saponification process. The soap, shaped like a ball, allows for easier use than traditional soap and can be rolled between the fingers to effectively clean all parts of the hands and remove germs.

1. Introduction

Universiti Sains Islam Malaysia (USIM) is a university located in Negeri Sembilan, Malaysia. Its specific campus location is located on a piece of land in Nilai, Negeri Sembilan Malaysia. The green area around USIM is estimated at about 40 % of the total campus area. This green area covers the lake near PERMATA Insan College, the secondary forest area near the Faculty of Science and Technology, the garden area and around the water catchment pond, the secondary forest area around the water tank near the staff housing.

Oldenlandia corymbose (Lidah Ular), *Striga asiatica* (Jarum Mas) and *Phyllantus niruri* (Dukung Anak) are the wild herbs which can be found around the green area of USIM and has been used in

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this study. Hence, this study is focusing to investigate the organic compounds of those wild herbs' trough out a few methods.

Plant extracts are extremely potent and can be utilized for a wide range of applications. Around 80 % of the world's population relies on traditional medicine for health care, and most therapies rely on plant extracts and active chemicals [1], implying that two-thirds of all plant species have medicinal potential [2]. Most therapeutic herbs have antioxidant capabilities, according to previous reported by the research of Saeed *et al.,* [3]. Natural antioxidants are being employed in cosmetics, foods and medicinal goods due to their ability to scavenge free radicals. Reactive oxygen species (ROS) are produced in response to pollution, food xenobiotics and radiation exposure, and these ROS cause oxidative stress [4]. Antioxidants prevent the development of ROS, neutralize them and repair the harm they cause [5].

There are several methods for identifying phytochemical substances in plant extracts. Qualitative analysis is a preliminary study and essential to identify the phytochemicals constituent present in medicinal plants [6]. Fourier-transform infrared spectroscopy (FTIR), for example, uses infrared light beams to identify functional groups in gaseous, liquid and solid materials [7].

The single-use travel soap made from Lidah Ular (*Oldenlandia corymbosa*), Jarum Mas (*Striga asiatica*) and Dukung Anak (*Phyllanthus niruri*) is a hygienic travel soap that exhibits antimicrobial properties, which will help in the prevention of disease spread. This research also aimed to create portable and user-friendly soap to promote the culture of frequent handwashing. The use of *Oldenlandia corymbosa* (Lidah Ular), *Striga asiatica* (Jarum Mas) and *Phyllanthus niruri* (Dukung Anak) oil in the development of the travel small ball soap is also intended to replace palm oil in the saponification process. The travel small ball soap is designed to improve the coverage area during handwashing compared to the previously invented paper-thin soap. The travel soap is easier to use as it can be rolled between fingers to ensure more effective handwashing, covering all surface areas of the hands to kill microorganisms.

The objectives of this study were to extract bioactive compounds from various wild herbs collected from the USIM green area through the solid-liquid extraction process. The crude extract solutions obtained were then screened through qualitative phytochemical analysis to examine the phytochemical compounds. Further investigation was carried out to determine the functional groups present in the wild herbs' extracts. However, there is a gap in current research regarding the use of local wild herbs in the formulation of travel soap with antimicrobial properties.

2. Methodology

2.1 Sample Collection

Based on Figure 1, this research was conducted around USIM with coordinate of 2.48° N, 101.78 ° E. Wild herbs were collected around this university green area and the leaves of the collected herbs were washed and measured the weight. Then, the leaves were dried in oven at temperature 60℃ for 24 hours. The dried sample were grounded to obtain the powdered by using a grinder. The grounded samples were weighted, sorted and kept in a Schott Duran bottle for further used.

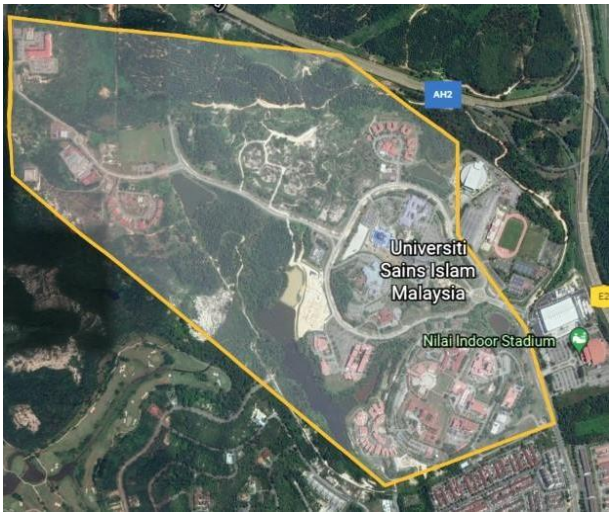


Fig. 1. USIM campus with surrounded by green area

2.2 Solid-Liquid Extraction Process

i. Hot Water Extraction

Approximately, 3 g of each sample powder were placed in 500 ml beaker and 300 ml of distilled water was added into that beaker. Extraction process started by putting all beakers onto the stirring hotplate machine. The samples were heated at temperature 80℃ for 2 hours. The samples were filtered using filter paper to separate the solute and the solution of the samples [8]. The extract solution of the samples was used for phytochemical screening.

ii. Ethyl Acetate Extraction

Ten grams of each sample was extracted with 100 ml of ethyl acetate solution at room temperature for 48 hours. The solution from each sample was separated using the pipette and then a rotary evaporator was used to evaporate ethyl acetate solution at temperature 50℃. So, the concentrated extract solution was produced and used for Fourier- Transform Infrared Spectroscopy (FTIR).

iii. Ethanol Extraction

Fifteen grams of each sample powders was extracted with the ethanol using Soxhlet apparatus at temperature 120℃ for 24 hours. The sample extract was filtered to separate the solute and get the solution. The rotary evaporator was used to produce concentrated extraction of each sample powders. Hence, the concentrated extract solution was used for FTIR and phytochemical screening.

2.3 Phytochemical Screening

This method was conducted using two type of extracts which are hot water extracts and ethanol extracts. Hot water extracts were produced from the extraction process can be continuously used for phytochemical screening without any additional method. Meanwhile, the extracts were produced by ethyl acetate and ethanol extraction must be added a few drops of ethanol before using for phytochemical screening.

i. Detection of Flavonoid

1 ml of each extract was added into test tubes. 1 ml of 10 % sodium nitrate was added to each test tubes. The presence of Flavonoid was indicated by a yellow colour [14].

ii. Detection of Phenolic

1 ml of each extract was dropped on a blue litmus paper. The presence of phenolic compounds was identified when the blue litmus paper turned red [13].

iii. Detection of Resins

1 ml of each extract was added into each test tubes. 1 ml of hydrochloric acid solution was added to each test tubes. The presence of Resins was indicated by the appearance of turbidity [14].

iv. Detection of Steroid

1 ml of each extract was added into each test tubes. 1 ml of sulphuric acid was added to each test tubes. The presence of steroid was indicated by a red precipitate [14].

2.4 Fourier- Transform Infrared Spectroscopy (FTIR)

This method was used to identify the presence of the functional group of each wild herb samples. This method was used to identify the presence of the functional group of each wild herb samples. The sample can be in solid or liquid condition because the result will be same. The powders and concentrated extracts of various wild herbs were characterized using FTIR analysis, and the frequency range are measured as wave numbers in the range of 4000 – 650 cm^{-1}. Briefly, the samples were placed on the clean window of Agilent Cary 630 equipped with diamond ATR (Attenuated Total Reflectance). Then, the pressure clamp was closed until a click was heard and analyzed using a real-time Micro-Lab software.

3. Results

3.1 Wild Herbs Collection

Table 1
Wild herbs collected from USIM green bush area

Scientific Name	Local Name
Oldenlandia corymbosa	Lidah Ular
Striga asiatica	Jarum Mas
Phyllantus niruri	Dukung Anak

Fig. 2. *Oldenlandia corymbosa* (Lidah Ular)

Fig. 3. *Striga asiatica* (Jarum Mas)

Fig. 4. *Phyllanthus niruri* (Dukung Anak)

3.2 Sample Preparation

Fig. 5. The sample of wild herbs were grounded and kept in a bottle

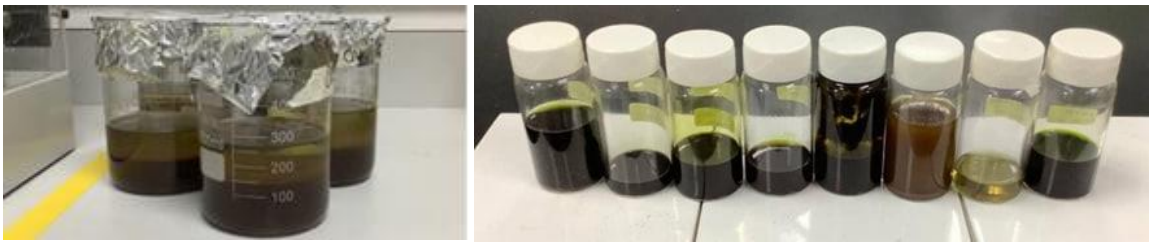
3.3 Extraction Process

i. Hot Water Extraction

(a) (b)

Fig. 6. (a) Filtered samples (b) Extract storage

ii. Ethyl Acetate Extraction



(a) (b)

Fig. 7. (a) The sample powders were extracted in ethyl acetate (b) The concentrated extracts were kept in the covered bottles

iii. Ethanol Extraction

(a) (b)

Fig. 8. (a) The sample powders were extracted in ethyl acetate (b) The concentrated extracts were kept in the covered bottles

3.4 Phytochemical Screening

Table 2 showed the observations after testing the species of wild herbs' extracts.

Table 2
Phytochemical screening of various wild herbs from USIM

Species		Organic Compound			
		Flavonoid	Phenolic	Resins	Steroid
Oldenlandia corymbosa	Hot water	+	+	-	-
	Ethanol	+	+	+	-
Striga asiatica	Hot water	+	+	-	-
	Ethanol	+	+	+	-
Phyllantus niruri	Hot water	+	+	-	-
	Ethanol	+	+	+	-

3.5 Fourier- Transform Infrared Spectroscopy (FTIR)

The functional groups of each species were identified in this method. Figure 9 until Figure 11 and Tables 3 to 5 below summarises the results and identify the organic compound in each herbs' samples.

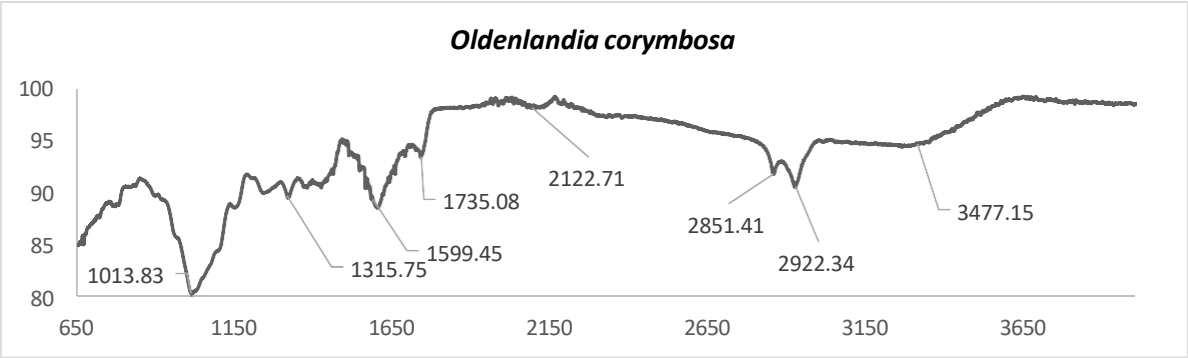


Fig. 9. *Oldenlandia corymbosa* (Lidah Ular)

Table 3
FTIR results for *Oldenlandia corymbosa*

Functional Group assignment	Wavenumber cm^{-1}	Wavenumber cm^{-1} [9]	Predicted Compound
OH stretch	3477.15	3200-3550	Alcohol
-C-H_2 stretch	2922.34	~2900	Alkanes
C-H stretch	2851.41	2800-2900	Alkanes
C=C stretch	2122.71	2100-2250	Alkynes
C=O stretch	1735.08	1720-1740	Aldehydes
C=C stretch	1599.45	1440-1625	Aromatic
NO_2 stretch	1315.75	1300-1390	Nitro

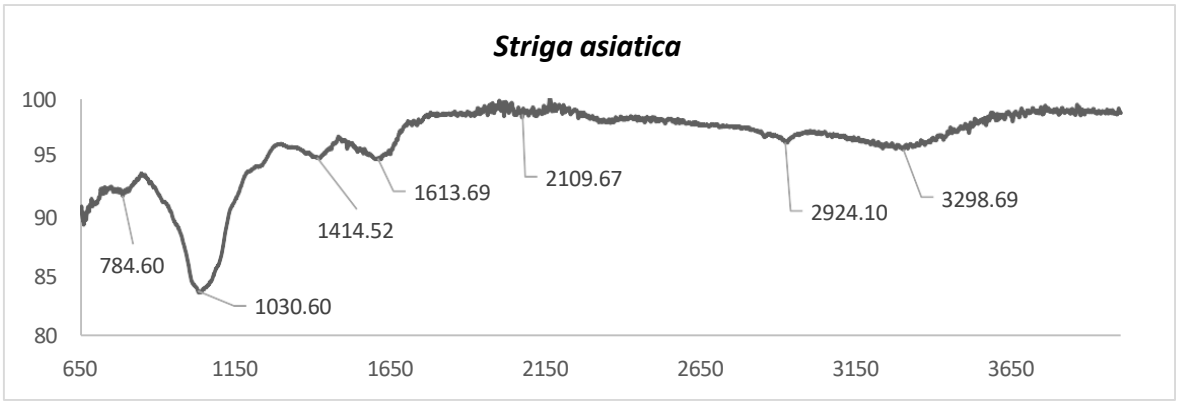


Fig. 10. *Striga asiatica* (Jarum Mas)

Table 4
FTIR results for *Striga asiatica*

Functional Group assignment	Wavenumber cm^{-1}	Wavenumber cm^{-1} [9]	Predicted Compound
OH stretch	3298.69	3200-3550	Alcohol
-C-H_2 stretch	2924.10	~2900	Alkanes
C=C stretch	2109.67	2100-2250	Alkynes
C=C stretch	1613.69	1440-1625	Aromatic
NO_2 stretch	1414.52	1300-1400	Nitro
C-F stretch	1030.60	1000-1400	Alkyl
C-Cl stretch	784.60	600-840	Alkyl

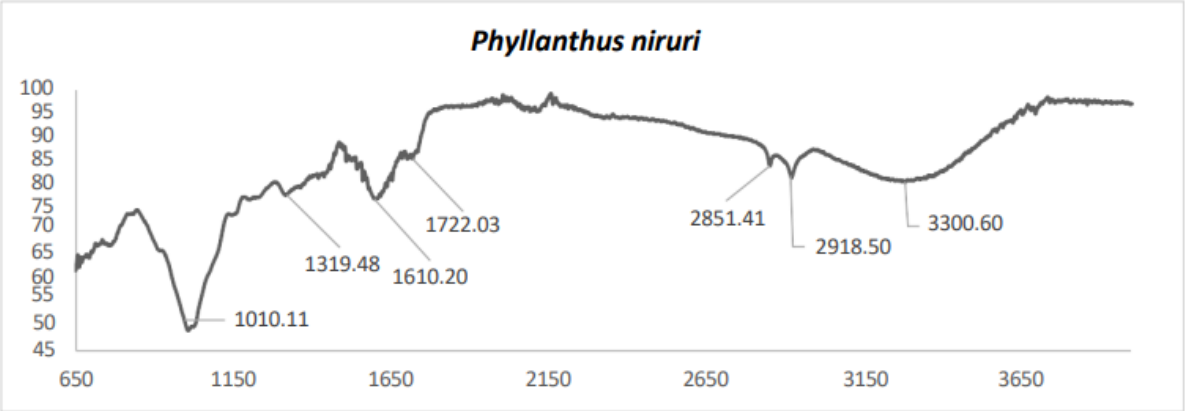


Fig. 4. *Phylanthus niruri* (Dukung Anak)

Table 5
FTIR results for *Phylanthus niruri*

Functional Group assignment	Wavenumber cm^{-1}	Wavenumber cm^{-1} [9]	Predicted Compound
OH stretch	3300.60	3200-3550	Alcohol
-C-H_2 stretch	2918.50	~2900	Alkanes
C-H stretch	2851.41	2800-2900	Alkanes
C=O stretch	1722.03	1720-1740	Aldehydes
C=C stretch	1610.20	1440-1625	Aromatic
NO_2 stretch	1319.48	1300-1390	Nitro
C-F stretch	1010.11	1000-1400	Alkyl

4. Discussions

Phytochemicals are secondary metabolites that have a variety of health advantages and have colour, fragrance and flavour in plants. Alkaloids, flavonoids, tannins, phenolics, saponin, steroids, glycosides, terpenes and other compounds are all found in plants [16]. They help to protect plants from illness and contribute to the colour, scent and flavour of the plants. Furthermore, when their food intake is significant, they have a function in human health protection. In this study, the phytochemical compound contained in the extract of various wild herbs from USIM were screened and shown in Table 2. All tested wild herbs were found to have organic compounds such as flavonoid, phenolic and resins. From the results, it was found that flavonoid and phenolics compound were detected in hot water and ethanol extracts for all tested wild herbs. However, resins were only detected in ethanol extracts of the wild herbs. Steroid was not detected in all extracts.

Flavonoids are class of polyphenolic secondary metabolites found in plants, and thus commonly consumed in the diets of humans. Phytonutrients like flavonoid have beneficial anti-inflammatory effects and it can protect human cells from oxidative damage that can lead to diseases [15]. The dietary containing flavonoids play a role as antioxidants which can prevent the development of cardiovascular diseases, diabetes, cancer and cognitive diseases [13]. Phenolics are aromatic benzene ring compounds with one or more hydroxyl groups produce by plants mainly for protection against stress. Phenolics can act as antioxidants where the antioxidant capacity of phenolic compounds is also attributed to their ability to chelate metals involved in the production of free radicals [3]. The presence of flavonoid, phenolics and resins in *Oldenlandia corymbosa*, *Striga asiatica* and *Phyllantus niruri* extracts indicates all these wild herbs as a source of antioxidants.

The chemicals bonds or functional groups present in the wild herbs' extracts were furthered predicted using FTIR. The bonds were determined by interpreting the infrared absorption spectra.

Figure 7-14 shows the spectrum of the wild herbs extracts and the interpretation of the functional groups detected in the extracts. These results demonstrated the present of hydroxyl group (alcohol), alkanes, benzoid compounds (aromatic), aldehydes, alkyl, amides, carboxylic acid and esters.

Flavonoids are polyphenols characterised by two benzene rings joined by a linear carbon chain [11]. The identification of benzenoid compounds *via* FTIR spectrophotometry supported the findings from the phytochemical screening, which detected the presence of phenols and flavonoids. The amides alkanes and phenols present were considered the major functional groups of bioactive compounds [7].

4. Conclusions

The phytochemicals compounds present in the hot water, and ethanol extracts were flavonoid and phenolics. The major functional groups identified were hydroxyl group (alcohol), alkanes, benzoid compounds (aromatic), aldehydes, alkyl, amides, carboxylic acid and esters. Further studies will focus on the biological activities such as antibacterial and antioxidant analysis from these wild herbs.

The findings of this study have significant practical applications in product development, particularly in the creation of antimicrobial travel soap. By utilizing bioactive compounds from local wild herbs like Lidah Ular (*Oldenlandia corymbosa*), Jarum Mas (*Striga asiatica*) and Dukung Anak (*Phyllanthus niruri*), the research provides an eco-friendly alternative to traditional soaps, replacing palm oil with sustainable herbal ingredients. This could lead to a marketable product that not only promotes hygiene by preventing disease spread but also appeals to environmentally conscious consumers. Future research could expand on these findings by investigating the long-term efficacy and safety of the soap, exploring additional wild herbs with antimicrobial properties and optimizing the formulation for better stability. Furthermore, studies on consumer acceptance, market potential and the environmental impact of the soap could help refine the product and maximize its success in the personal care market. Additionally, the potential of these herbs in other personal care products, such as shampoos or lotions, could be explored to further enhance their practical uses.

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