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Phytochemical Content and Antioxidant Potential of Leaf Extract *Berchermia discolour* (Munie Tree) For Goats in The Limpopo Province, South Africa

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Abstract: The study aims to investigate the phytochemical content and antioxidant potential of leaf extract *Berchermia discolour* (Munie tree) for goats. Plant leaves were ground, and their powder was mixed with reagents and chemicals to attain the concentration level of phytochemicals and other bioactive compounds found in these plant's properties. Most of the phytoconstituents were present (shown by the change of colour), and the phenolic content, tannins, and flavonoid content of *B. discolour* were significantly different across the treatments ($p<0.05$). Acetone extractant had the highest phenolic content (1.089±0.06 mg/g), while water had the lowest (0.081±0.06 mg/g). From the solvents used to extract active components from *B.* discolour leaves, DCM had the highest mass of extractants, whereas acetone had a low one. Antioxidant activity was the highest quantity in the acetone extract compared to hexane, which had the lowest quantitative activity. Under FRAP, dichloromethane extract had high quantitative antioxidant activity with water, methanol and hexane in the same low level of quantity. These results suggested that the leaves could be utilized as a feed with stronger antioxidant properties. Similarly, it was found that these bioactive compounds have effects on the health and growth performance of goats. Therefore, these phytochemicals and antioxidants protect cells from oxidative damage and enhance immune function and longevity. In conclusion, *B. discolour* is beneficial to the goats as it enhances efficiency and potentially yields economic gains for farmers.

Keywords: Phyto-Constituents, Bioactive Compounds, Oxidative Stress, Phenolics

Introduction

In goat diets, antioxidants protect cells from oxidative damage, enhancing immune function and reproductive performance. They're commonly added to feeds, contributing to overall health and longevity. Phytochemicals, also known as Phyto-nutrients, are plant-produced compounds with beneficial health effects (Abbas *et al*., 2015). Phytochemicals, also known as antioxidants, occur naturally and are among the most promising ingredients found in animal diets in a variety of ways (James *et al*., 2007). In animal feeds, they come from the plants in the feed. While some improve health and digestion, others, like tannins, can pose challenges by binding to proteins. Consideration of plant types and diet composition is essential for assessing the phytochemical impact on goats.

Utilizing phytochemicals and antioxidants in animal diets can have a positive impact on economic feasibility (Lee *et al*., 2016). On the contrary, oxidative stress impairs animal performance, health and productivity, which has a detrimental impact on the viability of the economy. Therefore, by maintaining and improving the oxidative status of animals, these substances enhance the overall health and efficiency of livestock, potentially yielding economic gains for farmers. According to Cardozo *et al*. (2013), nutritional therapy is a significant approach for managing and/or preventing a variety of illnesses and improving the welfare of individuals due to the availability of materials and the relatively low cost of utilizing feedstuff with little toxicity.

Researchers have done commendable studies on determining the phytochemicals and antioxidants found in traditional trees: Moringa *olifera* (Makkar *et al*., 2007; Yang *et al*., 2006), *Bulbine abyssinica* (Idamokoro *et al*., 2020), Vachellia karroo (Idamokoro *et al*., 2017) and Acacia types (Osuga *et al*., 2007). However, when it comes to *Berchemia* discolours, its antioxidant properties and phytochemical contents are still unknown. Therefore, scientific studies on animal nutrition need to focus on

attaining the concentration level of phytochemicals and other bioactive compounds found in this plant. Therefore, this study aims to investigate the antioxidant potential and phytochemical content of leaf extract of *Berchermia discolour*.

Materials and Methods

Study site

The research was carried out at Thulamela Local Municipality (Limpopo), where the tree leaves were harvested by hand before defoliation from two communal areas (Makuya and Lamvi S 22 39’49.85” and E 30°45’21.88) situated in Vhembe district. The areas are situated 40-50 km from Kruger National Park. According to S.A.W.S (2020), the areas are known to receive an annual temperature of 13°C in winter and 34°C during summer. Harvesting of the tree leaves from the site was done at a height of 1.5 m or less (Ravhuhali *et al*., 2022).

Then, the samples were analyzed for phytochemical content and antioxidant properties in the biochemistry lab at the University of Limpopo. This was done to find out which compounds the plant entails, which was also useful in determining the bioactive agents that could be utilized as feed supplements and reduce or prevent the risk of many diseases and damage to cells.

Preparation of Equipment and Chemicals

The study identified and validated *Berchemia discolour* using freshly picked leaves collected (4 kg) and dried in a well-ventilated laboratory. The chemicals used were bought from Tamaa Products, and instruments such as Gallen Kamp (480'458'465 mm) and Orbital Incubator Shaker (340'340'435 mm) found in the microbiology lab at the University of Limpopo were used. Reagents and chemicals included water, methanol, dichloromethane, acetone, DPPH, hexane, aluminium chloride, phosphate buffer ferric chloride, ascorbic acid, and potassium ferricyanide trichloroacetic acid were among the reagents and chemicals used. All the solvents and chemicals were utilized for analytical standards.

Preparation of the Extract

The powder of finely ground dried leaves of *Berchermia discolor* was mixed with water solvents, methanol, hexane, acetone and dichloromethane. In order to prepare each extraction, 100 g of *Berchermia discolour* leaves were macerated in a solvent material of 1 lL and shaken in a mechanical shaker for 48 h. To ensure accuracy, a minimum of three samples with identical solvent concentrations were utilized. What man, no one filtered paper, which was connected to a vacuum pump, and a Burken funnel was used to filter extracts from the plant. Extracts were wilted at 57°C and re-suspended in acetone to create a 50 mg/mL stock solution.

Phytoconstituents Screening

Tannins (*Lead Acetate Test*)

In order to test for tannins, 0.5 mL of extract was diluted with 2 mL of the initial extraction solution, in accordance with Kumar *et al*. (2008). 4-6 drops of 1% lead acetate were added to the dilution. A positive outcome was indicated by a yellow precipitate.

Alkaloids (Meyer’s Test)

According to Hettiarachchi (2006), the alkaloids were tested by transferring 0.5 mL of each extraction sample to a different test tube and placing it in a steam bath. Each test tube was filled with 5 mL of 1% HCl. Filtration was done on the solutions. A few drops of Meyer's reagent were applied to 1 mL of each filtrate. The presence of alkaloids was indicated by any precipitate or change in turbidity.

Flavonoids (Ammonia Test)

Edeago *et al*. (2005). Adesegun *et al*. (2008) conducted a flavonoids test, wherein 1 mL of each extraction was sampled and placed in a test tube separately. From the 10% ammonia solution, 5 mL of it was poured into each tube along with 1 mL of concentrated H_2SO_4, which revealed the presence of flavonoids by turning each tube yellow.

Saponins (Foam Test)

The saponin test was conducted using the modifications in accordance with Hettiarachchi (2006). A 1cm diameter test tube, with a holding capacity of 15 mL minimum, was filled with 1 mL of extract and 1 mL of 70% ethanol. The solutions were shaken vigorously for two min after adding five mL of water at 60 degrees Celsius. The volume of froth was measured with a ruler every ten minutes.

Phlobatanins

The phlorotannin test was conducted using the following adjustments in accordance with Egwaikhide and Gimba (2007). 2 mL of 1% HCl solution was added dropwise to the extract. The presence of phlobatanins was determined whenever a red precipitate appeared, and the absence was seen whenever no precipitate formed in the solution.

Steroids (Acetic Anhydrate/H_2SO_4 Test)

According to Hettiarachchi (2006). with the following adjustments, the steroid test was conducted. 1 mL of the extract was mixed with 2 mL of 70% acetone, followed by six drops of acetic anhydride and 2 drops of concentrated H_2SO_4 to the test solution. The presence of steroids in the solution was indicated by a colour shift from violet to brown or dark brown.

Terpenoids (Salkowski Method)

The terpenoids test was done in line with the methods of Egwaikhide and Gimba (2007), with slight modifications. After thoroughly mixing, 2 mL of

chloroform was added to the extract. Two layers were formed by carefully adding 3 mL of concentrated H_2SO_4. The presence of terpenoids was indicated by a reddish-brown colour at the interface of the layers.

Cardiac Glycoside (Keller Killiani's Test)

Following Keller Killiani's test, the cardiac glycoside test was conducted (Adesegun *et al*., 2008). 5 mL of water was used to dissolve 1 mL of extract. A single drop of ferric chloride solution was poured into two mL of the solution of glacial acetic acid, and another mL of H_2SO_4 concentrated solution was gently poured down the test tube's side to create two layers. The cardiac glycosides' existence in the extract was indicated by a slight green colour and a colour shift to brown during the interphase.

Total Phenolics Content

According to Humadi and Istudor (2008), the Folin-Ciocaltleu reagent was used in a study to quantify the amount of phenolics present in plant extracts. For fifteen min, the plant extracts were shaken after being diluted with 0.6mL distilled water, a standard and 0.2mL Folin-Ciocalteu reagent. After adding 1.0 mL of 8% w/v sodium carbonate solution, the mixture was then diluted again to 3.0 mL and left in a dark room for half an hour. Similarly, a blank was made with acetone and a UV/VIS spectrophotometer (Thermo Scientific) operating at 550 nm was used to measure the mixtures' absorbance. Green, yellow, orange or red colour formations were used to indicate the presence of phenol. The reference standard solutions (0.08, 0.16, 0.31, 0.63 and 1.25 mg/mL) were prepared using tannic acid (Sigma-Aldrich) as a standard. This was done 3 times for accuracy purposes, and the findings were recorded in milligrams of GAE/g extract.

Total Estimation of Flavonoids Content

To measure the total flavonoid content of plant extracts in accordance with methods by Tambe and Bhambar (2014), the study used the aluminium chloride colourimetric test. The 10 mg/mL plant extract was introduced into a 4.9 mL volume of distilled water and mixed with 300 mL of 5% sodium nitrate. It was then diluted with 300 mL of 10% aluminium chloride and 1 mL of 200 mL of 4% sodium hydroxide after a quiescent period of 5 min. After vertexing, the resulting solution was incubated at 40°C for 15 min. The standard used was Quercetin, which was produced using the same technique. Both the samples and the standard were measured for absorbance using a UV/VIS spectrophotometer set to 510 nm. The experimental and reference samples were made, along with a blank sample, in a similar way. However, the plant extract was substituted with 100 mL of distilled water in the blank sample. The total flavonoid content was expressed as milligram quercetin equivalence/gram of extract (mg QE/g extract) after the application of the equation ($y = 3.437\times+0.00017$, $R2 = 0.9996$), obtained from the quercetin standard curve. The test was conducted three times in triplicates. The occurrence of flavonoids was indicated when the reaction generated a red, orange and/or yellow colour.

Total Tannin Content Determination

The content of tannins in the plant extracts was determined by Tambe and Bhambar (2014) using the Folin-Ciocalteu technique. A test tube was filled with distilled water of 3.8 mL, 5L plant extract containing 10 mg/mL and 0.25 mL Folin-Ciocalteu reagent. The mixture was vortexed and diluted with 0.5 mL sodium carbonate solution into a 35% mixture. A blank was essentially created in the same way as the test solutions but without any extract. A 725 nm UV/VIS spectrophotometer was used to measure the mixture's absorbance. Tannin concentration was used as a standard, and reference standard solutions ranging from 1-0.625 mg/mL were prepared. The solution's absorbance was measured in mg of tannic acid equivalent per g of extract (mg GAE/g extract) and compared to the control. Each plant extract was used three times in triplicate.

Antioxidant Activity Analysis

Qualitative DPPH Free Radical Scavenging Activity Assay on TLC Plates

The DPPH test, established by Braca *et al*. (2003), employed the color-changing 2, 2-Diphenyl-1-Picrylhydrazyl radical (DPPH) (Sigma-Aldrich). Diphenyl-1-picryl hydrazine, which was purple, was changed into yellow. 10 L of each extract were placed in a 1 cm wide line on the TLC plate after the extracts had been dissolved in acetone to a concentration of 10 mg/mL prior to being developed into CEF, BEA eluent systems and EMW. The plates were allowed to dry in a spray of air in order to eliminate the solvents. To see the colour change, 0.2% DPPH in methanol was sprayed onto the plate.

Quantitative Antioxidant Activity Assay

DPPH Free Radical Scavenging Assay

As reported by Chigayo *et al*. (2016), the plant extract's capacity to scavenge free radicals was assessed using the 2,2-Diphenyl-1-picrylhydrazyl (Sigma-Aldrich) method (Gyamfi *et al*., 1999). The concentrations of varying quantities of plant extracts (250-15.63 g/mL) were mixed to create a 1 mL volume solution. L-ascorbic acid served as the standard and was prepared in the precise concentration range of the plant extract. A 0.2 mmol/L DPPH solution of 1 mL volume that had been dissolved in methanol and thoroughly vortexed was then added to these 1 mL solutions. Similar to the experimental solutions, the blank solution was prepared. However,1 mL of acetone was added in place of plant extracts. To make the control solution, distilled water of 1 mL volume was combined with 2 mL of 0.2 mmol/L DPPH. After the required amount of time had elapsed, a Themo scientific UV/VIS spectrophotometer was used to analyze the solutions. The absorbance of the solution was measured at

517 nm, and the percentage inhibition was then calculated using the method below, wherein *As* was the absorbance of the plant extract and *Ac* was the absorbance of the control solution. After two trial runs, the experiment was then repeated three times:

$$\% \ inhibition = Ac\text{-}As/Ac \times 100$$

Ferric Reducing Power Assay

Employing the techniques described by Oyaizu (1986), with slight modifications by Ayiyegoro and Okoh (2009), the ferric reduction capacity of plant extracts was determined. A stock solution of 1250 g/mL was sequentially mixed to create five various concentrations of the plant extracts (625-39 L/mL). In a test tube, 2.5 mL of each concentration was combined with 2.5 mL of potassium ferricyanide (1% w/v in distilled water) and 2.5 mL of sodium phosphate buffer (0.2 M, pH 6.6). Following the addition of the solutions, the mixtures were vortexed. For 20 min, the mixes were incubated at 50°C, and after that, the test tubes received two mm of trichloroacetic acid (10% w/v in distilled water). 5 mL of the supernatant was transferred to a clean test tube after the mixtures were left for 10 min at 3000 rpm. Following thorough vortexing after each addition, 5 mL of distilled water and 1 mL of ferric chloride (0.1% w/v distilled water) were successively prepended for this solution. To measure the absorbance of solutions at 700 nm wavelength, UV/VIS spectrophotometer (Themo Scientific) was utilized. The blank for this technique was made in the same way, but this time, acetone was used (in an equal amount) in place of the plant extracts. L-ascorbic acid (625-39 g/mL), which was produced similarly to the plant extracts, was utilized as a positive control. Experiments were carried out three times in triplicates.

Statistical Analysis

SPPS Statistics 27 was used to analyze the data, which was presented as mean ± standard deviation. To ascertain the differences in the antibacterial and antioxidant activity of the various *Berchemia discolour* samples, a one-way analysis of variance (ANOVA) was used. The mean separation test was conducted using Fisher's least significant difference, with a significance level of $p<0.05$.

Results

Phytoconstituents Screening of Berchimia Discolour Extract

The phytoconstituents screening of *Berchemia* discolour extract is shown in Table (1). The presence of phytoconstituents is represented by (+), and the absence of phytoconstituents is represented by (-). The present compounds are saponins, tannins, phobatannins, flavonoids, steroids and cardiac glycosides, whereas absent compounds are terpenoids and alkaloids from *B. discolour* extract as suggested by screening results.

Quantity of Berchemia Discolour Plant Material Extracted

The quantity of *Berchemia* discolour plant material extracted is presented in Fig. (1). Five solvents of increasing polarity were used to extract active components from *B.* discolour leaves, namely: Methanol, DCM, hexane acetone extractant and water. The highest weight of extractants found was DCM, which contained 74 mg, followed by hexane (62 mg) and methanol, which had 46mg. The extractants with the lowest weight in the *B. discolour* plant material were acetone (36 mg) and water (42 mg).

Total Phenolic, Tannins and Flavonoid Content

The quantification of total phenolic content, tannins and flavonoid content in *B. discolour* is shown in Table (2). There was a substantial difference ($p<0.05$) of total phenolics across the treatment, with the acetone extractant having the highest phenolic content (1.089±0.06 mg/g) while water had the lowest content, at 0.081±0.06 mg/g. Tannin content was significantly different across the treatments. The highest tannin content was observed in acetone, followed by DCM, and the least was observed in water. The flavonoid content of *B. discolour* was significantly different across the treatments ($p<0.05$). Acetone had the highest flavonoid content, whereas water had the lowest flavonoid content.

Table 1: Phytoconstituents screening

Phytoconstituent	Occurrence
Saponins	+
Terpenoids	-
Phobatannins	+
Tannins	+
Cardiac glycosides	+
Flavonoids	+
Steroids	+
Alkaloids	-

Key: + = Present = Absent

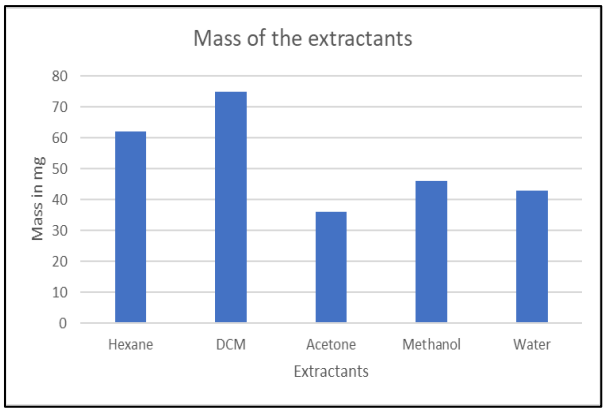

Fig. 1: Quantity of plant material extracted

Table 2: Quantification of total phenolic, tannins and flavonoids content

Treatment	Phenolic	Tannins	Flavonoids
Hexane	0.393±0.10	0.063±0.130	0.238±0.04
DCM	0.524±0.32	0.136±0.030	0.240±0.01
Acetone	1.089±0.06	0.141±0.070	0.515±0.01
Methanol	0.471±0.07	0.078±0.030	0.172±0.39
Water	0.081±0.06	0.057±0.040	0.114±0.04
P-value	0.000	0.050	0.000

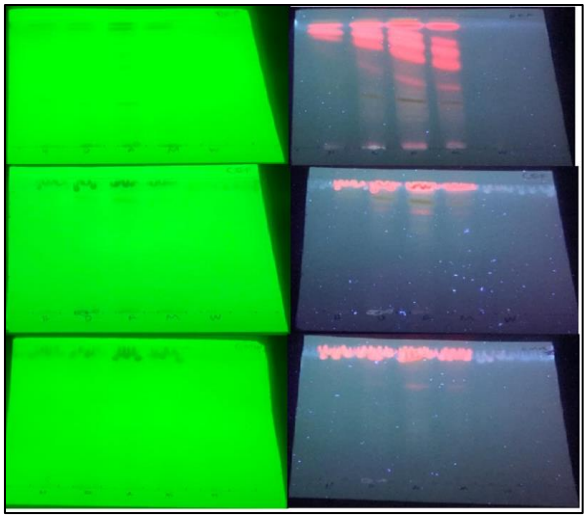

Fig. 2: Phytochemical screening by thin-layer chromatography

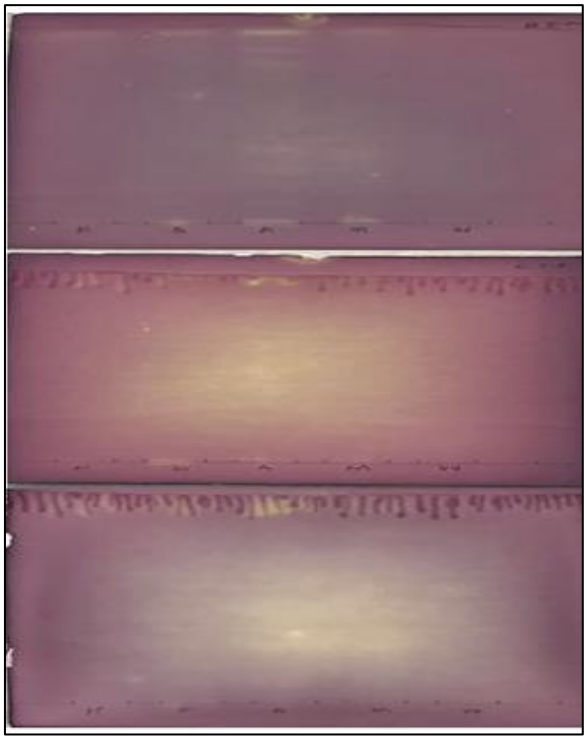

Fig. 3: Phytochemical screening by thin layer chromatography (DPPH free radical scavenging activity)

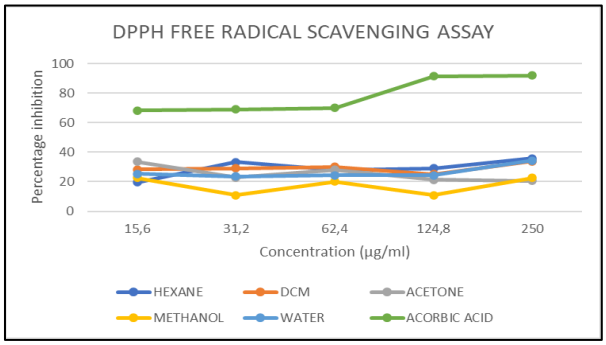

Fig. 4: Quantitative antioxidant activity, DPPH free radical scavenging assay

Antioxidant's Activity Analysis

Phytochemical screening by thin-layer chromatography, as shown in Fig. (2), and Phytochemical screening by thin-layer chromatography (DPPH free radical scavenging activity) is shown in Fig. (3). Under visible and ultraviolet light, the separated components were visualized. Bioautography revealed the presence of antioxidants. UV light (365 nm) and the vanillin-sulphuric acid reagent were used to identify phytochemicals represented by bands; phytochemicals are more visible under ultraviolet light. Most bands were detected on the TLC plates developed in BEA, followed by EMW, the CEF solvent system.

DPPH free radical scavenging assay activities of *B. discolor* leaf extracts are shown in Fig. (4). The activity of the extracts was compared to that of *L*-ascorbic acid, which was used as a standard. Antioxidant activity was of the highest quantity in the acetone extract and decreased with increasing concentration, followed by dichloromethane, which increased in quantity with increasing concentration. Water followed, which also increased in quantity with increasing concentration. Methanol was followed by acetone, dichloromethane and water; its quantity was the lowest of them all. It decreased in quantity with increasing concentration, but the quantity at the end was the same as that it was first administered, which is 15.6 µL/mL. Lastly, hexane was of the lowest quantitative activity but increased with increased concentration.

Quantitative Antioxidant Activity, Ferring Reducing Power Assay

The Ferric Reducing Power Assay (FRAP) of *B. discolour* leaf extracts is shown in Figs. (3-5). At varying concentrations, the ferric-reducing capacity of plant extracts is given as absorbance at 700 nm wavelength. L-ascorbic acid was used as a control, and its activity was compared to the activity of the extracts. The dichloromethane extract had high quantitative antioxidant activity, followed by acetone and then water, hexane, and methanol, which were performed at the same level but in a low quantity.

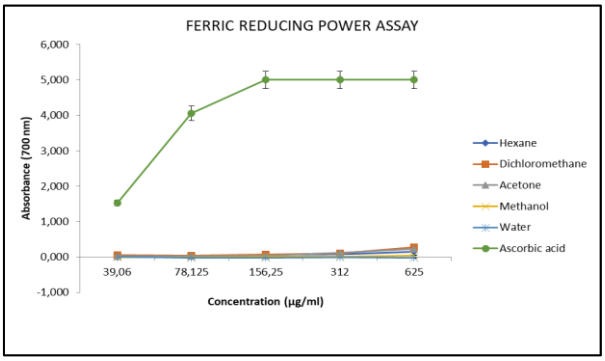

Fig. 5: Quantitative antioxidant activity, Ferric reducing power assay

Discussion

The phytochemical and antioxidant analysis conducted on *Berchemia* discolour leaves revealed that most phytoconstituents (i.e. saponins, tannins, phobatannins, flavonoids, steroids and cardiac glycosides) were present. The constituents found in the plant extracts have been linked to pharmacological effects that have medicinal significance, such as antispasmodic properties (Ameyaw and Duker-Eshun, 2009; Thite *et al*., 2013), redox properties influencing the antioxidative and antifungal properties and antioxidative properties, which are influenced by their redox properties (Ehiobu *et al*., 2021; Zheng and Wang, 2001) and lastly, anti-inflammatory properties (Iqbal *et al*., 2015; Augusto *et al*., 2011). In accordance with these results, plant-based steroids have been shown to have cardiotonic and antimicrobial qualities (Iqbal *et al*., 2015; Alexei Bagrov *et al*., 2009), whereas congestive heart failure and cardiac arrhythmia are treated using cardiac glycosides (Iqbal *et al*., 2015; Vladimir and Ludmila, 2001). Comparable results were also noted for the phytochemical analysis of Gunnera perpensa, revealing a high content of steroids, flavonoids, tannins, saponins and glycosides in the extracts (Jafri *et al*., 2022).

The results of the extract showed that the extract exhibited the highest ferric-reducing capacity, suggesting that it contains high levels of compounds. This indicates that non-polar or moderately polar compounds in *B.* discolour leaves are potent antioxidants, or they possess considerable antioxidant properties. The results are different from those of Senhaji *et al.* (2020), which suggests that if a solvent's polarity is high, it will increase the yield and efficiency of the extraction process. This is further explained by Nawaz *et al*. (2020) that polar solvents have a stronger attraction to antioxidant compounds in plants than non-polar solvents because of their chemical characteristics and their interactions with the phytochemicals in the plant material. Given that they include hydroxy groups that boost antioxidant activity, higher polarity solvents like ethyl acetate and ethanol are more likely to form bonds with hydrophilic antioxidant molecules like polyohenols and flavonoids. However, this supports the finding that different solvents yield extracts with varying antioxidant activities (Ndhlala *et al*., 2010). A study by Moyo *et al*. (2010) examined how different solvents impact the activity of antioxidants found in the plant extracts of various South African plants and found similar trends, where non-polar and moderately polar solvents often extracted compounds with higher antioxidant capacities.

Phytochemicals present in *B. discolour*, such as flavonoids, phenolics and tannin compounds, are likely responsible for the plant's high antioxidant activity (Ndhlala *et al*., 2010). The study showed that the highest phenolic content aligns with the general understanding that phenolic compounds and flavonoids are more soluble in polar organic solvents, as indicated by previous research findings (Gebashe *et al*., 2020; Ojha *et al*., 2018). According to studies conducted by Jafri *et al*. (2022), where the antioxidant properties of four Iranian herbs were assessed in a similar manner, their total phenolic content and total flavonoid contents were examined. The DPPH assay results indicated that the dragon head and thyme had the highest levels of antioxidant activity among the examined plants. This is likely due to their high antioxidant capacity, which makes them valuable dietary sources of phenolic compounds (Iqbal *et al*., 2006). The present investigation, however, yields distinct results from that of the study conducted on *L.* discolour, which demonstrated the highest level of phenolic content but the lowest amount of flavonoid content (Mwatope *et al*., 2020). This could be due to the difference in location, as this study was done in South Africa and that one in Malawi, and/or it could also be due to the different tree species being different. The extraction of tannins often involves the use of organic solvents to yield higher tannin content. For example, studies conducted on Acacia plant types by Osuga *et al*. (2007) found that the blackthorn leaves also have high tannins, resulting in increased oxidant properties. These results highlight how crucial the extraction solvent selection is in influencing the amount of bioactive chemicals that may be extracted from plant materials.

Our results provide insights based on comparing the *B.* discolour leaf extracts' antioxidant activity with L-ascorbic acid, which was used as a control. The absorbance values that were obtained at varying concentrations reflected the ferric-reducing capacity of the plant extracts, with higher absorbance indicating higher quantitative antioxidant activity. The dichloromethane extract exhibited high quantitative antioxidant activity, followed by acetone, while water, hexane and methanol performed at a lower level of quantity.

Dichloromethane extract is a non-polar solvent that contains high levels of compounds capable of donating

electrons to reduce ferric ions. This indicates that non-polar or slightly polar compounds in *B. discolour* leaves are potent antioxidants. This is consistent with studies on South African medicinal plants where non-polar solvents often extract highly active compounds (Moyo *et al*., 2010).

The acetone extract displayed substantial antioxidant capacity, although slightly lower than dichloromethane. This means that since the acetone extract exhibits high activity, it is likely that the leaves contain moderately polar chemicals with strong antioxidant potential.

Acetone is effective in extracting a broad range of antioxidant compounds, including flavonoids and phenolics, which are common in South African flora (Ndhlala *et al*., 2010).

Water, being a polar solvent, extracts polar compounds. The lower activity compared to dichloromethane and acetone indicates that the polar compounds in *B. discolour* leaves have less ferric-reducing ability, which indicates that polar antioxidants are less prevalent or less active in *B. discolour*. This is consistent with the general observation that non-polar and moderately polar solvents often yield extracts with higher antioxidant activities (Wyk & Nigel, 2015).

Both hexane (non-polar) and methanol (polar) extracts showed similar and relatively low antioxidant activities. This suggests that while non-polar compounds extracted by hexane may contribute to antioxidant capacity, they are less effective than those extracted by dichloromethane. Similarly, the polar compounds extracted by methanol are less effective than those extracted by acetone and dichloromethane. The similar and lower activities of hexane and methanol extracts highlight that highly non-polar and highly polar solvents may not be as effective in extracting the most active antioxidant compounds from *B. discolo*ur; hence, non-polar compounds extracted by hexane are less effective than those extracted by dichloromethane, similarly, the polar compounds extracted by methanol are less effective than those extracted by acetone. This is supported by research conducted by Shai *et al.* (2008), which shows that extreme polarities often do not yield the highest antioxidant activities.

Conclusion

The significant levels of phenolic and flavonoid compounds, along with vitamin C in *Berchemia discolour*, are likely contributors to its pharmacological effects, particularly its free radicals scavenging ability. Tests for total antioxidant activity, DPPH and FRAP confirm the plant extract's strong free radical scavenging potential. Including *Berchemia discolor* leaves in the diets of goats consuming low-quality roughages may improve their performance. Thus, it's important to develop feeding strategies that optimize these benefits and provide economic advantages at a lower cost.

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Author's Contributions

Mosima Molepo: Collected the data and wrote the paper. The authors read and approved the final manuscript.

Grace Manyelo and Busisiwe Gunya: Conceptualized and designed the work, analyzed the data, visualized the results and proofread the manuscript.

Ethics

There are no ethical issues that may arise after the publication of this manuscript since the study did not require ethical clearance.

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