The potential of *Tribulus terrestris* L. as nutraceutical

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Abstract. *Tribulus terrestris* was a shrub plant that can grow in all types of soil. This plant was popularly used as traditional Chinese medicine, but there were not many reports regarding the use of *T. terrestris* in animal. Objective: The aim of this study was to determine content of nutrient and secondary metabolites of *T. terrestris*. Methodology: The whole plants of *T. terrestris* was collected from Yogyakarta. Nutrient content was analyzed by proximate analysis and content of secondary metabolites used spectrophotometer. Result: *T. terrestris* contain high fiber (25.78%) and protein that was almost the same as grass (13.03%). The content of each secondary metabolite consisted of alkaloid 311.65 ug/g, phenol 3.90 %w/w, flavonoid 0.78 %w/w, tannin 28.99 %w/w, and essential oil <0.12 %v/w. Conclusion: Based on the content of nutrients and secondary metabolites, *T. terrestris* can be used as a feed or medicine.

1. Introduction

Tribulus terrestris belong to Family *Zygophyllaceae*. This plant had commonly named as Chota Gokhru [1] or Gokhru (India), and Caltrop. It was an annual plant, could grow in all types of soil, and at an altitude 3,000 m. It was a shrub plant and could grow up under shade. The leaves were pinnate and hairy, flowers were yellow with 4 to 10 mm wide, fruits were the round shape and hard sharp spines [2]. *T. terrestris* can be found in the tropic region like as Asia, Africa, Europe, America, and Australia [3] and subtopic regions [4].

T. terrestris was commonly used as herbal medicine (traditional medicine) because of the secondary metabolites content or was used to supplement nutrients [5]. All part of *T. terrestris* could use as medcine. But in traditional Chinese medicine, part of *T. terrestris* that used was fruit, and in Indian Ayurvedic medicine, part of *T. terrestris* that used were fruit and root. In traditional medicine, it was used in mastitis, flatulence, abdominal distention, edema, and acute conjunctivitis [1], genitourinary tract disorder, genital disease, treat impotence [2], used as a tonic, aphrodisiac, palliative, astringent, stomachic, antihypertensive, diuretic, lithotriptic [6].

Nutraceutical was a term for the hybrid of the words 'nutrient' and 'pharmaceutical', mainly feed as a medicine. Gupta *et al.* [7] defined the Nutraceutical as pharmaceutical-grade and standardized nutrient. Nutraceutical can be used as antibacterial alternatives in animal health and disease, treatment of organ and system disorder (including gastrointestinal and metabolic disorders, reproductive disorder, immune disorder, and wound healing). *T. terrestris* was popularly used as traditional medicine, but there were not many reports regarding the use of *T. terrestris* in the animal as a feed or additive. Therefore, this study examines the potential of *T. terrestris* in Yogyakarta as nutraceutical by determining the content of nutrient and secondary metabolites.

2. Material and methods

2.1. Plant material

T. terrestris were collected from Kaliurang District, Yogyakarta. The whole plants of *T. terrestris* were dried and were grounded for analyzed. The analysis was carried out in Food Chemistry and Biochemistry Laboratory, PAU UGM and Integrated Research and Testing Laboratory (LPPT) UGM.

2.2. Extraction of plant material

The plant material was extracted using method Sultana *et al.* [8].

2.3. Determination of nutrient content

Nutrient content of the plant was analyzed by proximate analysis with AOAC method [9]. The analysis was carried out to determine the content of organic matter (OM), crude protein (CP), crude fiber (CF), extract ether (EE), extract without nitrogen (ETN), and metabolic energy (ME).

2.4 Determination of secondary metabolites content

Analysis of secondary metabolites content including phenols and flavonoids following the Sultana *et al.* method [10], alkaloids following the Ajanal *et al.* method [11], essential oils following the Sedlakova *et al.* method [12], tannins following the Chanwitheesuk *et al.* [13].

3. Results and discussion

In Table 1 and Table 2, nutrient content and secondary metabolites content of *T. terrestris* were presented. Based on nutrient content, *T. terrestris* had a good nutrient composition. If comparing with the some forages, CP content of *T. terrestris* was not differ greatly from the nutritional content of some forages such as *Imperata cylindrica* (12.2%), *Artocarpus heterophylus* (12.2%), *Cynodon dactylon* (12.6%), hay *Centrosema pubescens* (13.1%), wheat grain (13.6%), *Hibiscus rosa-sinensis* (13.8%), rice brand (13.8%), and hay *Arachis hypogea* (14.7%) [14]. *T. terrestris* had quite high CF content (25.78%) which might be classified into fiber source feed group because high fiber source feed group contain CF> 18% and cell walls> 35% [15]. Based on nutrient content, *T. terrestris* had the potential to be used as feed. Essential nutrients were required to stimulating growth hormone, testosterone, maintaining metabolic rate and muscle building [16]. *T. terrestris* was known to be a natural stimulant of luteinizing hormone (LH) which signals the body to produce more of testosterone. It could improve reproductive function, including the increased concentration of hormones (estradiol) [2]. Increased testosterone levels can promote synthesis proteins and positive nitrogen balance, resulting in muscle cell growth, an increase in body strength, and faster recovery from injury. The active compound in *T. terestris* responsive for muscle development and treatment of prostate, urinary, and cardiovascular system disorders [16].

Table 1. Nutrient content of *T. terrestris*

	OM (%)	CP (%)	CF (%)	LK (%)	ETN (%)	ME (kcal/kg)
T. terrestris	88.19	13.03	25.78	1.28	48.09	3,794.94

A plant contained more than one type of secondary metabolites and had more than one pharmacological effect. Plants produce a huge variety of secondary metabolite compounds as natural protection against microbial and insect attack. Some of these compounds were toxic to the animal, but others may not be toxic [17]. It also had pharmacological effects. Screening the content of secondary metabolites of *T. terrestris* consisted of tannins, phenol, flavonoid, alkaloid, and essential oil. The variation in chemical content of plants according to Salim *et al.* [18] were caused by soil texture, soil nutrition, and precursor sof biosynthesis of secondary metabolites.

Table 2. *Tribulus terrestris* secondary metabolite content

	Tannin (%w/w)	Phenol (%w/w)	Flavonoid (%w/w)	Alkaloid (ug/g)	Essential oil (%v/w)
T. terrestris	28.99	3.90	0.78	311.65	<0.12

Some components of secondary metabolites *T. terrestris* were reported to function as antibacterial, antihypertension, anti-acetylcholine, had antitumor activity [6], diuretic activity [19], and many other. In previous studies revealed that tannins, flavonoids, and alkaloids had hypoglycemic activities, and effects of anti-inflammatory [2], antidiarrheal, antibacterial, antiparasitic. Tannin as an antibacterial by causing microbial protein deposition. The mechanism for the antibacterial activity of flavonoids with their ability to form complexes with extracellular and soluble proteins, also with bacterial cell walls [3]. Chang *et al*. [17] and Imai *et al*. [20] reported essential oils as antibacterial against several pathogenic bacteria (*Eschericia coli, Enterococcus faecalis, Staphylococcus aureus* (including the clinically problematic methicillin-resistant *S. aureus*), *Salmonella* sp., *Vibrio parahemolyticus,* and *Helicobacter pylori*.

4. Conclusion

Based on the content of nutrients and secondary metabolites, *T. terrestris* can be used as feed or medicine. Further research is needed to find out the limits on the use of *T. terrestris* in the animal in order to get optimal production.

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