Tannin Contents of Jackfruit Leaves (*Artocarpus heterophyllus*) Extract and Moringa Leaves (*Moringa oleifera*) Extract as Functional Additive Feed in Ruminant Livestock

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**Abstract.** Tannin compounds are polyphenolic compounds that function as antioxidants and inhibit tumor growth in plants, foods, and drinks that can dissolve in water and organic solvents. This research’s objective is to identify tannin contents of Jackfruit leaf extract and Moringa leaf extract as functional additive feed for ruminant. Detecting simple phenolic compounds the extract with 1% FeCl₃ solution in water, which gives rise to strong green, red, purple, blue, or black colors. The formation of blackish green or blackish blue color in the extract after adding FeCl₃ because tannins will form complex compounds with Fe³ ions. The research’s result shows that phytochemical test of tannins on moringa and jackfruit leaf extracts showed positive results and generated sediment. The conclusion of this study is the presence of tannin compounds in jackfruit and moringa leaves as a functional feed additive to increase the productivity of ruminants.

**Keywords:** FeCl₃; Generated sediment; Phenolic; Compounds

1. Introduction

At this time, many agricultural waste has been used which have been tried as a feed ingredient, the availability of feed in tropical areas is generally very dependent on the season, low quality and unstable continuity because in the dry season there is a shortage of feed and vice versa in the rainy season the feed will be abundant. One way to overcome the problem of feed availability is to use alternative feed ingredients that can come from forages such as jackfruit and moringa leaves. Jackfruit is a fruit tree belonging to the Moraceae family, originating from India, Indonesia, Central Africa, Florida, Brazil, Australia and the Pacific Islands. Parts of the jackfruit plant such as stems, roots, leaves and fruit have medicinal properties. Specifically, jackfruit leaves also contain sapogenins, cycloartenone, cycloartenol, β-sitosterol, and tannin [1]. The jackfruit plant (*Artocarpus heterophyllus*) has a family, namely Moraceae, which also has potential as a cytotoxic agent containing high phenolic content, including flavonoids which have high toxicity. In Indonesia, the Moringa tree is widely used as a living fence, which is planted along the fields or the edge of rice fields, which functions as a green plant. In addition, the moringa plant is also known as a medicinal plant by utilizing all parts of the moringa plant, from the leaves, bark, seeds, to the roots. Many researches on moringa plants are carried out abroad using samples from outside Indonesia [2]. Jackfruit leaves and Moringa leaves have high nutritional content including protein and tannins which can increase microbial protein synthesis while reducing methane gas in ruminants, especially goats. However, this research is still limited to
being carried out in Indonesia, therefore it is important to conduct this research using Moringa leaves which come from Indonesia, especially the South Tapanuli area, North Sumatra. In this research, phytochemical screening will be carried out for the tannin content of jackfruit and moringa leaves as additional forage for goats.

2. Materials and Methods

2.1 Material
The test materials used are jackfruit leaves and Moringa leaves which have been dried and mashed in a blender. The chemicals used are as follows, 1) For the material during the maceration process using dried Moringa leaves and acetone; 2) For the phytochemical screening process using Mayer's Reagent, Wagner's Reagent, Bouchardat Reagent, concentrated sulfuric acid, 2 N HCl, 1% iron (III) chloride, Mg, 2% HCl, anhydrous acetic acid.

2.2 Method
Extraction of jackfruit and moringa leaves by extraction process was carried out by maceration. The jackfruit and moringa leaf powder was extracted twice with n-hexane (1: 4 w/v). The residue was extracted twice with ethyl acetate (1: 4 w/v). The ethyl acetate residue was then extracted twice with methanol (1: 4 w/v). The solvent evaporated each filtrate using a rotary evaporator. The extract obtained was used as a sample for phytochemical analysis. Phytochemical analysis of extracts and essential oils Phytochemical analysis of the extracts of n-hexane, ethyl acetate and methanol of andaliman fruit was carried out by several methods.

2.2.1 Maceration [3]
Samples of jackfruit leaves and dried moringa leaves were then weighed as much as 50 grams. The sample was immersed in 200 mL acetone, after that it was extracted with ultrasonic waves at a frequency of 50 kHz for 10 minutes and maceration was carried out for 2 hours. After 2 hours, the jackfruit and moringa leaves are then filtered to obtain the filtrate and the residue is macerated again with acetone for 2 hours. The maceration process is carried out four times. The filtrate obtained is then put together and then evaporated using a rotary evaporator to obtain a thick extract of 11.5684 grams.

2.2.2 Phytochemical Screening [3]
After obtaining the thick extract, the phytochemical screening test was carried out in the form of flavonoid test, tannin test, saponin test, alkaloid test, steroid test and triterpenoid test. Flavonoid Test. Examination of flavonoids was done by taking a spatula from the maceration result of the sample, then adding a spatula of Mg powder and four drops of 2% HCl. The presence of flavonoids will be indicated by a change in the color of the filtrate to orange-red.

2.2.3 Saponin Test [3]
The acetone extract was put into a test tube then hot water was added, cooled, then shaken for 10 seconds. After that, the changes that occur are observed. Then added again 1 drop of 2N HCl and observed the changes again. Positive results if the foam appears stable for 10 minutes.

2.2.4 Alkaloid Test [3]
The extract to be examined is put into a test tube, then a few drops of 2 N HCl and distilled water are added, after which it is heated over a water bath for 2 minutes, then cooled and filtered. The filtrate used for the alkaloid test are as follows: a. Three drops of the filtrate are added to 2 drops of Mayer's reagent solution, then what happens is the observation. b. Three drops of the filtrate were added to 2 drops of Bouchardat's reagent solution, then what happened was observed. c. Three drops of the filtrate were added to 2 drops of Wagner's reagent solution and then observed what happened. Alkaloids are positive if there is sedimentation or turbidity in at least two of the three experiments above. The characteristic of the positive reaction of alkaloids is the formation of a brownish yellow color with Wagner's reagent and a yellow precipitate with Meyer reagent.

2.2.5 Steroid and Triterpenoid Test [3]
The acetone extract to be examined is put into a test tube, then 2 - 3 drops of anhydrous acetic acid are added, then stirred slowly for a while until it dries, then 1 - 2 drops of concentrated sulfuric acid are added and the staining is observed. Red or red purple staining gives an indication of triterpenoids while green - blue coloring is for steroids.

3. Result

Extraction is a process of chemical and physical separation of the contents of the simplicia substance using a suitable solvent. The purpose of extraction is to attract chemical components found in natural materials. This extraction is based on the principle of mass transfer of the components of the substance into the solvent, namely the displacement begins to occur in the interface layer and then diffuses into the solvent. The extraction technique used in this study is maceration because in addition to easier processing, the equipment used is simple. The maceration process is very beneficial in the extraction of natural compounds because immersion of plant samples will result in the breakdown of cell walls and membranes due to the difference in pressure between inside and outside the cell, so that the secondary metabolites in the cytoplasm will dissolve in organic solvents and the compound extraction will be complete [4]. In addition, the maceration process is carried out without heating so that there is no damage to the secondary metabolites to be analyzed. Before the maceration process is carried out, the Moringa leaves to be used are cleaned first and then dried at room temperature without sunlight [2]. This is because exposure to direct sunlight at high temperatures can damage and cause degradation of the compounds contained in the sample. After drying, the jackfruit leaves and moringa leaves are then mashed using a blender.

Phytochemical Screening After obtaining the thick extract, the extract was then tested for the chemical compounds contained in it using a phytochemical screening test [5]. At this stage, five types of examinations are carried out, namely the examination of alkaloids, flavonoids, tannins, saponins, steroids and triterpenoids. The results of the phytochemical screening test are presented in figure above.

Figure 1. Alkaloid content positive (+) in Moringa leaf and Jackfruit leaf

Figure 2. Flavonoid content positive (+) in Moringa leaf and Jackfruit leaf
Phytochemical test results show that jackfruit and moringa leaves contain various types of secondary metabolites such as phenolics, saponins, flavonoids, tannins, triterpenoids and alkaloids. This is supported by the color change that occurs due to the supply reagent for extracting jackfruit and moringa leaf [6]. The taller plants have good flavonoids in the vegetative section, especially in the flower. Flavonoids as flower pigments play an important role. Other functions of flavonoids are able to absorb ultraviolet light to direct insects, regulate plants, regulate photosynthesis, work antimicrobial and anti-virus so that it can work on insects. The effects of flavonoids on many organisms are numerous and may explain why plants containing flavonoids are widely used in traditional medicine. In addition, the content of flavonoids can work as a strong respiratory inhibitor, inhibiting enzyme and non-enzyme oxidation reactions [7]. The sugar content that is bound to flavonoids tends to cause flavonoids to dissolve easily in water. The highest chemical extracts of jackfruit and moringa leaves are obtained from triterpenoid and steroid substances, while flavonoids are found in low content. Steroids are compounds derived from triterpenoids and their structure is a multiple of the 6 units of isoprene commonly found in plants. The most important of which includes the physiological use of steroids is a very active compound involved in life processes that can affect the hormonal system, such as adrenal hormone (cortisone) [8], hormonal sex (estrogen and testosterone). The biosynthetic pathway before becoming a steroid hormone is completely derived from acetic acid and a further
conversions to mevalonic acid [9].

4. Conclusions
Secondary metabolite compounds contained in jackfruit leaves (Artocarpus heterophyllus) and Moringa oleifera leaves are Alkaloids, Flavonoids, Tannins and Steroids.

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