



Estimation of total carbohydrate content of *Achyranthes aspera* L. from Kathgodam, Nainital district by anthrone method

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Abstract

Carbohydrates are an essential source for living organisms to perform normal body functions. Reduced carbohydrate intake induces catabolic muscle metabolism, ketosis, and a state of hypohydration. The current study was conducted to estimate and compare the total carbohydrate content in different parts of the *Achyranthes aspera* L. plant collected from Kathgodam. The total carbohydrate content was estimated by the Anthrone method. The result showed that among all plant parts, the maximum total carbohydrate content was found in the leaves.

Keywords: Carbohydrates, plant extracts, *Achyranthes aspera*

Introduction

The presence of carbohydrates in plants, animals, and microorganisms is ubiquitous. There is no doubt that their biological roles are irreplaceable. Currently, a large number of carbohydrate-containing drugs are available in the market. Recent years have seen a slowdown in the development of drugs that contain carbohydrates. During the period from 2015 to 2020, more than 200 drugs have been approved, but only nine are small-molecule carbohydrates [1]. During respiration and growth, reserve carbohydrates are metabolized. These carbohydrates are located in the different parts of the plants. Plants use it to grow as well as to recover from stress, herbivory, or disturbances [2]. The consumption of wild edible vegetables constitutes a significant portion of the human diet, offering essential biochemical compounds such as carbohydrates, proteins, and lipids, which are vital for sustaining metabolic processes and overall health. These wild edible plants not only provide essential biochemical compounds and energy but also serve as supplementary sources of vitamins and minerals, which are indispensable for maintaining proper physiological homeostasis in the body. The nutritional attributes of wild edible plants are often equivalent to, and occasionally superior to, those of their domesticated counterparts [3]. In recent times, numerous studies have been dedicated to exploring wild edible plants as a source of both food and medicine, investigating their potential efficacy in treating various ailments such as diabetes, jaundice, wounds, cancer, and more [4 - 6]. The paste derived from aerial parts of *A. aspera* is typically applied to boils and wounds [7] and consumed as vegetables by people suffering from piles [8]. The present investigation was conducted to ascertain the total carbohydrate content through the anthrone method, which quantifies the overall carbohydrate content within the sample.

Materials and Methods

Sample collection

The *Achyranthes aspera* plants were collected from Kathgodam, Nainital District. The collected plants' parts were washed with tap water to remove dust and then rinsed with double distilled water, dried in the open air under

shade, and powdered with a mixer grinder. The dried powder was kept at 4°C in airtight polybags.

Extract preparation

A 100 mg sample powder was subjected to hydrolysis in a boiling tube containing 5 mL of 2.5 N hydrochloric acid, within a boiling water bath for a duration of 3 hours. Following this, the mixture was allowed to cool to room temperature and then neutralized using solid sodium carbonate until the cessation of effervescence. The contents of the boiling tube were then diluted to a volume of 100 mL using distilled water and centrifuged at 3000 rpm for 10 minutes at room temperature. The supernatant was subsequently collected and utilized for estimation purposes [9].

Quantitative estimation

The total carbohydrate content was estimated by the Anthrone method [9]. Initially, varying volumes of 0.2, 0.4, 0.6, 0.8 and 1 mL aliquots from a working standard solution were dispensed into separate test tubes. Subsequently, 0.5 mL of the sample's extract was added to another test tube, and all test tubes were adjusted to a total volume of 1 mL using distilled water. An additional 1 mL of distilled water served as the blank. Following this, 4 mL of anthrone reagent was introduced into each test tube, including the blank. The contents of all test tubes were homogenized using a vortex and then subjected to boiling in a water bath for 8 minutes. The test tubes were then rapidly cooled, and the absorbance of the resulting green to dark green was measured at 630 nm using a spectrophotometer. The experiments were conducted in triplicate. A standard graph was constructed by plotting the glucose concentration on the x-axis and the corresponding absorbance on the y-axis. Finally, the total carbohydrate content in the sample was determined and expressed as grams of glucose equivalents per 100 grams of plant sample.

Statistical analysis

All the tests were performed in triplicates and the data was entered in MS Excel 19 for descriptive statistics such as mean, and standard deviation, and results were compared by

one-way ANOVA followed by Tukey's test and considered significant at $p < 0.05$.

Result and discussion

The data presented in (Table 1 and Figure 1) reveals the quantitative estimation of the total carbohydrate content of *Achyranthes aspera* L. root, stem, and leaves. The maximum total carbohydrate content of *Achyranthes aspera* was noted in the leaf extract and the minimum total carbohydrate content was observed in the root extract. The total carbohydrate content of *Achyranthes aspera* L. root showed (45.02 ± 0.26 mg GLU /g DW) which is lower than the previous report of Rana *et al.* [10]. They found that the carbohydrate contents in the root was 56.35 ± 1.46 g/100g DW. Stem showed the maximum content of carbohydrates (47.96 ± 0.41). The content of total carbohydrates in the leaf was obtained 51.41 ± 0.62 . In previous studies by Oommen & Umamaheswari, the total carbohydrate content of the leaves was found to be 35.5 ± 0.5 mg/100g which is less than our study [11]. One more study by Rana *et al.* found that the total carbohydrate content of the leaves was 39.91 ± 1.85 g/100g DW respectively which is also lesser than our study [10]. Earlier studies reported carbohydrate content in *A. aspera* was found to be $45.50 \pm 0.20\%$ [12]. Fatima *et al.* determined the carbohydrate content of *A. aspera* which was obtained to be 54.260 ± 0.490 g/100g [13]. The maximum total carbohydrate content for root, stem, and leaf was in the following order:

Leaves > Stem > Root

The leaves are the main photosynthetic part of the plants and the plant samples were collected during their growth phase. Moreover, the roots of *A. aspera* are not storage roots that could store starch or any other carbohydrate. Therefore, the presence of the maximum amount of carbohydrates in the leaves of *A. aspera* is justified.

Table 1: Comparison of the total carbohydrate content [Mean \pm SD(n=3)] in *Achyranthes aspera* L. different parts

Parts of <i>Achyranthes aspera</i>	Total carbohydrate content (mg GLU /g DW)
Root	45.02 ± 0.26
Stem	47.96 ± 0.41
Leaf	51.41 ± 0.62

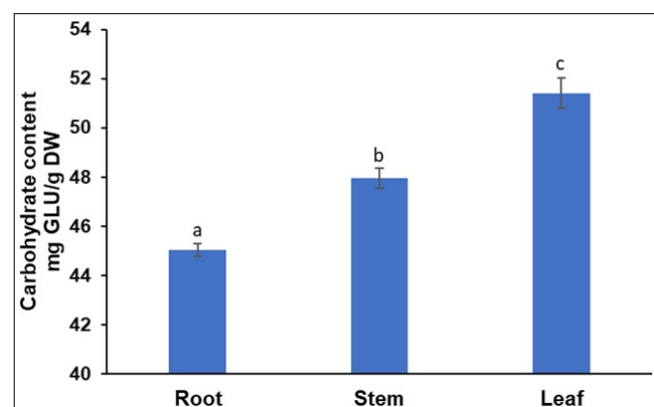


Fig 1: Variations in carbohydrate content within different parts of *Achyranthes aspera* L. extract. Data denoted by distinct letters indicate significant differences ($p < 0.05$) between them. Experiments were conducted in triplicates (Mean \pm SD).

Conclusion

The plant *Achyranthes aspera* shows a good quantity of carbohydrates. Further research on the isolation of carbohydrates can help to provide a natural source of carbohydrates. Thus, by knowing the percentage of the carbohydrate content in *Achyranthes aspera*, the utilization of it can be made as a commercial source of carbohydrates. It is a suitable raw material as it is found in large amounts and it has a high growth rate.

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Conflicts of interest

The authors assert that there is no conflict of interest.

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