RESEARCH ARTICLE

Sugar Profiling and Antinutrient Analysis in Four Unexplored Wild Edible Fruits of Odisha

S. Samal, S. Subhashree, A. Anjeela and U.C. Basak*

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Abstract

The availability of wild edible fruits (WEFs) is crucial for fulfilling the nutritional needs of Odisha's tribes. This important study assessed the levels of antinutrients, specifically saponins, tannins, oxalates, and phytates in four key WEF species: *Flacourtia jangomas, Grewia asiatica, Syzygium jambos,* and *Pithecellobium dulce*. Additionally, it analyzed the sugar profiles, including total sugars, reducing sugars, and non-reducing sugars. Fruits were sourced from two distinct agroclimatic zones in Odisha. The North Central Plateau (NCP) and the East and South Eastern Coastal Plain (ESECP). These fresh fruits underwent rigorous spectral analysis using a UV-Vis spectrophotometer to accurately determine their sugar profiles and antinutrient levels. Notably, *Pithecellobium dulce* displayed the lowest concentrations of total sugar (3.52 ± 0.01%) and non-reducing sugar (1.29 ± 1.54%), making it a potentially excellent choice for individuals managing diabetes. Conversely, *Syzygium jambos* exhibited the highest amounts of total sugar (13.08 ± 0.0041%) and reducing sugar (8.27 ± 1.20%), demonstrating its rich sweetness. Moreover, *Grewia asiatica* showed low levels of tannins (0.03 ± 0.0014 TAE g/g), saponins (0.04 ± 0.0088 g/g), and oxalates (6.16 ± 0.038 mg/g) from the NCP region. In contrast, *Flacourtia jangomas* from the ESECP region presented the greatest oxalate concentration (11.24 ± 0.03 mg/g). Furthermore, *Syzygium jambos* had the highest levels of phytates (8.31 ± 0.051 mg/g) and tannins (0.12 ± 0.003 TAE g/g), with *Grewia asiatica* following closely behind (6.58 ± 0.02 mg/g). These findings highlight the significant influence of geographic areas on the sugar profiles and antinutrient compositions of these fruits. Raising awareness about the nutritional benefits of these wild fruits can encourage healthier eating habits, benefiting the tribes of Odisha and promoting overall well-being.

Keywords: Antinutrient, Agro-climatic zone, Diabetic, Sugar profiling, Wild edible fruits.

Highlights:

- *Pithecellobium dulce* had the lowest total sugar content among studied fruits, suggesting it may be suitable for diabetic individuals.
- *Grewia asiatica* had minimal oxalate, saponin and tannin content, making it potentially safer for consumption.
- The geographical location influences the sugar profile and antinutrient composition of the fruits.

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Introduction

Wild fruits are a significant source of nourishment for many tribal groups in Odisha. According to Kumar *et al*., (2013) and Bharti *et al*., (2021), most of these wild edible fruits (WEFs) remain unexploited and have yet to be recognized for their economic potential. Many people in tribal areas can benefit from the nutritional and medicinal properties of these WEFs. However, their utilization is limited due to a lack of indigenous knowledge and insufficient focus on assessing their nutritional composition and anti-nutritional properties (Duguma, 2020). Consequently, these WEFs could serve as a valuable supplement to the human diet, providing essential vitamins, minerals, amino acids, and antioxidants with notable medicinal importance (Li *et al*., 2016).

The flavor profile of fruits is significantly influenced by the concentration of soluble sugars, including glucose and fructose, as well as organic acids. The total amount of soluble sugars varies throughout the ripening process, typically reaching its peak at the point of full ripeness (Basson *et al*., 2010). While sugars are essential components of the diet, excessive intake can adversely affect health, particularly among individuals with diabetes (Misra *et al*., 2016).

In addition to sugars, wild edible fruits (WEFs) also contain notable anti-nutritional factors, such as phytates, oxalates, tannins, and saponins. These naturally occurring compounds are produced during the metabolic processes of plants and do not inherently impede nutrient absorption; however, excessive consumption may lead to negative health outcomes (Bhandari and Kawabata, 2004; Gemede and Ratta, 2014). For instance, oxalic acid, prevalent in various fruits, may chelate with calcium, potentially causing edema and irritation of the oral cavity and throat (Thakur *et al*., 2019). Furthermore, it has been demonstrated to enhance renal calcium absorption, which may contribute to the formation of nephrolithiasis (Chai and Liebman, 2005). Phytic acid is known to diminish the bioavailability of essential minerals by forming insoluble phytate salts with macronutrients such as magnesium, iron, calcium,

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and zinc (Singh and Basu, 2012). Saponin, a naturally occurring glycoside found in numerous wild plant species, is generally considered non-toxic to warm-blooded animals; however, it can cause hemolysis of red blood cells if ingested in significant quantities (Rout and Basak, 2014). Additionally, saponin interferes with the absorption of fat-soluble vitamins A and E (Samitiya *et al*., 2020). Tannins can bind to digestive enzymes and precipitate specific proteins, thereby rendering them inert and unavailable for digestion (Baek *et al*., 2023). Although WEFs are recognized for their nutritional benefits and palatability, their excessive consumption may pose health risks. Therefore, prior to consumption, it is essential to assess the levels of anti-nutritional components present (Rathod and Valvi, 2011). The Eastern Ghats region of India boasts an extensive floral diversity, with Odisha being one of the most abundant states within this geographical area (Suwardi *et al*., 2020). Accordingly, the objective of the present study is to analyze the profiles of total sugar, reducing sugar, non-reducing sugar, and anti-nutritional factors in specific WEFs, namely *Flacourtia jangomas, Grewia asiatica, Syzygium jambos,* and *Pithecellobium dulce*, sourced from Odisha. These fruits are not only rich in nutrients but also possess therapeutic properties.

Materials and Methods

Specimen collection

This study examines four selected species of wild edible fruits (WEFs) that are frequently consumed by rural and tribal communities in Odisha due to their associated health benefits. A summary of the chosen WEFs is provided in Table 1. To assess the nutrient profiles and antinutrient content of these specific WEFs, fruits that were in optimal condition and had undergone appropriate decontamination procedures were gathered from two distinct agro-climatic forest zones in Odisha. These zones include the North Central Plateau (NCP), located in the Ghatagaon Forest Range (coordinates: 21.348850 N, 85.822070 E), and the East & South Eastern Coastal Plain (ESECP), situated in the Khordha Daspalla Forest Range (coordinates: 20° 30′ 32.01″ N, 85° 80′ 37.05″ E) as well as the Nayagarh Forest Division (coordinates: 20018 N, 84044 E), taking into account the seasonal availability of the fruits. The identification of the collected species was conducted utilizing authoritative reference texts, including "The Flora of Odisha" by Saxena and Brahmam (1995) and "Wild Edible Fruit Plants."

Methodology

Total Sugar analysis

To ascertain the total sugar content within wild fruit samples, 0.5 grams of fresh fruit pulp was homogenized using 5 mL of 80% ethyl alcohol. Following this, the sample underwent centrifugation for 20 minutes at a temperature of 4°C and a speed of 5000 revolutions per minute (rpm) utilizing an Eppendorf Centrifuge 5430 R. The supernatant was subsequently collected and subjected to boiling in a water bath at 80°C until the characteristic odor of ethanol dissipated. The remaining ethanolic extract was then adjusted to a final volume of 100 mL with the addition of distilled water. About 1-mL of this extract was transferred into a test tube and allowed to cool. To this, four mLs of anthrone reagent were incorporated, and the mixture was thoroughly agitated before being placed in a water bath set at 100°C for a duration of ten minutes. Upon cooling, the absorbance was measured at a wavelength of 625 nm using a UV-vis spectrophotometer (Spekol 2000, Analytik Jena). Total sugar content was subsequently calculated utilizing a D-glucose standard curve as outlined by Nayak and Basak (2015), referencing the modifications made by Rangana (1979). Results were expressed as a percentage of fresh weight (%).

Reducing Sugar analysis:

For the determination of reducing sugar, 0.5 g of fresh, seedless fruit was homogenized with 10 mL of 80% ethyl alcohol. The resultant extract was then subjected to centrifugation (Eppendorf Centrifuge 5430 R) for 20 minutes at 5000 rpm and 4°C. To eliminate the ethanol aroma, the supernatant was heated in a water bath at 80°C. Following the evaporation, 10 mL of distilled water was added to reconstitute the extract into the stock solution. Subsequently, 1-mL of 40% potassium sodium tartrate was introduced to the sample after it had been heated. The optical density (OD) of the solution was measured at a wavelength of 510 nm using a UV-vis spectrophotometer. The concentration of reducing sugar in the extract was calculated based on a conventional D-glucose curve in accordance with the methodology presented by Patra and Basak (2017).

Non-Reducing Sugar analysis

Non-reducing sugar content was computed by subtracting the quantity of reducing sugar from the total sugar content, as reported by Patra and Basak (2017).

Non-reducing Sugar (%) = Total Sugar (%) - Reducing Sugar (%)

Antinutrients analysis

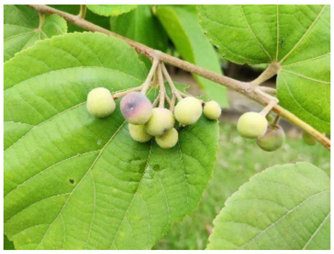
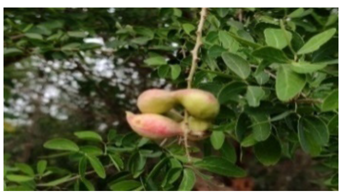
Estimation of Tannin content:

To evaluate tannin content, 0.25 g of powdered sample was dissolved in 37.5 mL of distilled water and incubated for 30 minutes at 100°C in a water bath. The mixture was then centrifuged at 2000 rpm for 20 minutes at a temperature of 4°C. The resulting supernatant was diluted to a total volume of 37.5 mL using distilled water. Subsequently, 1-mL of Folin-Denis reagent and 2 mL of sodium carbonate solution was combined with 500 μL of the test sample. The absorbance of the resulting solution was measured at 700 nm using a UV-vis spectrophotometer (Spekol 2000, Analytik Jena). Tannin concentration was expressed in grams of tannic acid equivalent per gram of dry weight, according to the methods described by Patra and Basak (2017) and Rathod and Valvi (2011).

Estimation of Phytate content:

For the determination of phytate content, three grams of fruit samples were treated with 25 mL of a 10% trichloroacetic acid (TCA) solution, following the described methodology by Mandizvo and Odindo (2020) and Patra and Basak (2017). An aliquot of 5 mL was collected and diluted with distilled water to a final volume of 70 mL. This solution was then mixed with 20 mL of 1.5 M potassium thiocyanate, and the optical density was

Table 1: Brief accounts on selected wild edible fruits of Odisha

Sl.no	*Name of the selected wild fruit species*	*Fruiting time*	*Ethnomedicinal Uses*
1.	***Flacourtia jangomas*** Odia name - Badabaincha Family: Flacourtiaceae 	Aug-Sept	Slightly ripened fruit is used to make jellies and also have been used traditionally for treating jaundice and liver related disorders. (Rai and Mishra ,2020)
2.	***Grewia asiatica*** Odia name-Phalsa Family-Tiliaceae 	May-June	It has beneficial effects for heart, blood, and liver issues, anorexia, indigestion, thirst, toxemia, high cough and can even be used for treating throat and tuberculosis ailments (Dev *et al*., 2017). They also serve as herbal medicine for cure of various disease especially cancer, ageing, fever, rheumatism and diabetes. (Zia-Ul-Haq *et al*.,2013)
3.	***Pithecellobium dulce*** Odia name-Akashakaiaan Family-Mimosaceae 	Apr-May	This fruit contains several vitamins like vitamin C, vitamin E, which help in delay ageing. Also, it has thiamine and riboflavin which helps for maintaining healthy skin and hair. (Reddy *et al.*,2022). Additionally acts as anti-diabetic agent**.** (Kulkarni *et al*., 2018)
4.	***Syzygium jambos*** Odia name-Jambos Family-Myrtaceae 	Nov-Jan	It exhibits therapeutic effect for control diabetes, reduce toxicity level in human being, and prevent development of kidney stone formation also enhance immune system. Additionally have significant medicinal properties for treating bacterial and fungal infection. (Joseph and Sivasubraamanian., 2021)

measured at 480 nm using a UV-vis spectrophotometer (Spekol 2000, Analytik Jena). The phytate content was calculated and reported as milligrams per gram of dry weight using phytate as a reference standard

Estimation of Saponin content:

In assessing saponin concentration, 0.25 grams of fruit powder was dissolved in 10 mL of 85% ethyl alcohol and agitated for a duration of two hours. The solution was vigorously shaken, followed by the careful transfer of 50 µL into a dry, clean test tube. An additional 250 µL of 8% vanillin reagent was incorporated, followed by 2.5 cm^2 of 77% sulfuric acid, and the mixture was maintained at 60°C in a water bath for 15 minutes. After cooling, the optical density was measured at 544 nm using a UV-Vis spectrophotometer (Spekol 2000, Analytik Jena). The saponin content was assessed using a calibration curve based on saponin as a standard, with the measurement expressed as grams per gram of dry weight, following the methodology of Patra and Basak (2017).

Estimation of Oxalate content

To determine oxalate concentration, powdered fruit samples were combined with 30 mL of 0.25 N hydrochloric acid and allowed to stand in a boiling water bath for 15 minutes. The filtrate was subsequently adjusted to a final volume of 50 mL with 0.25 N hydrochloric acid. In 1-mL of the filtered sample extract was mixed with 5 mL of 2 N sulfuric acid and two mL of 0.00 M potassium permanganate, and the mixture was agitated before being incubated at room temperature for ten minutes. The presence of oxalate in the sample was monitored by means of a colored solution, detected at a wavelength of 528 nm using a UV-vis spectrophotometer. Concentration was quantified using oxalic acid as the standard with the standard calibration plot, measuring in milligrams per gram as noted by Mishra *et al*., (2017), Kassie *et al*., (2019), and Rathod and Valvi (2011).

Statistical analysis

Data are presented as mean ± standard deviation (SD).

RESULTS

Sugar profiling

Total sugar contents of fruits

The total sugar content of the samples under analysis varied from 3.519 ± 0.010 to 13.077 ± 0.004, with the highest percentage being 13.077 ± 0.004 % when compared to the other fruits in the study. Table 2, Fig. 1,2 displays the percentage of total sugar content for the fruits, which were determined to be in the following order: *Syzygium jambos*> *Grewia asiatica*>*Flacourtia jangomas*>*Pithecellobium dulce*. *Syzygium jambos* (13.077 ± 0.004 %) and *Pithecellobium dulce* (3.519 ± 0.010%) reported the highest and lowest total sugar content from the ESECP zone, respectively, according to the order.

Reducing sugar contents

For *Grewia asiatica*, the percentage of reduced sugar content varied from 1.477 ± 0.065% to 8.271 ± 0.025% for *Syzygium jambos*. The NCP region's *Syzygium jambos* has the highest sugar concentration (8.271 ± 0.025%), followed by the ESECP region's *Flacourtia jangomas* (3.279 ± 0.219%) and the NCP region's *Pithecellobium dulce* (2.530 ± 0.102%). (Figs 1,2 and Table 2)

Non-reducing sugar contents

The investigation yielded non-reducing sugar levels for *Pithecellobium dulce* ranging from 1.289 ± 1.542 to 9.412 ± 1.198% for *Grewia asiatica*. Of all the fruits examined, the *Grewia asiatica* fruit from the ESECP region had the most non-reducing sugar. (Figs 1, 2 and Table 2).

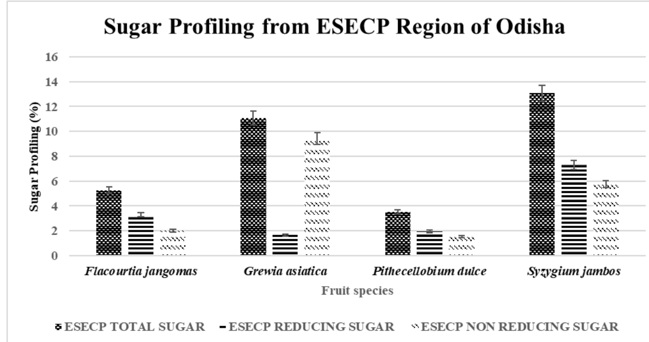


Fig. 1: Sugar profiling in 4 wild edible fruits from the ESECP region of Odisha

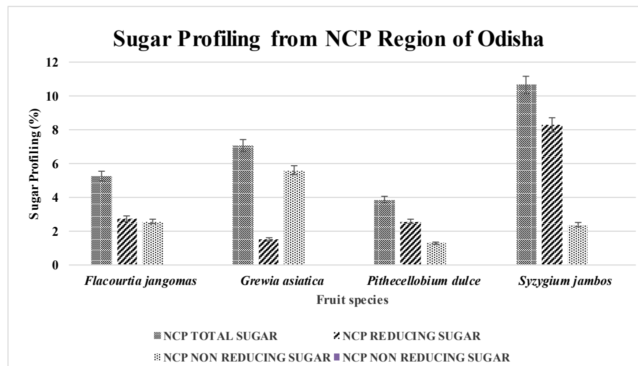


Fig. 2: Sugar profiling in 4 wild edible fruits from the NCP region of Odisha

Antinutrient analysis

Saponin contents

The saponin contents of specific fruits were changed in this investigation, ranging from 0.041 ± 0.008 to 0.441 ± 0.372 g/g. The ESECP region's *Pithecellobium dulce* (0.441 ± 0.37 g/g) has the greatest saponin concentration, followed by *Syzygium jambos* (0.405 ± 0.020 g/g) and *Flacourtia jangomas* (0.164 ± 0.049 g/g). The NCP region's lowest saponin concentration was found in *Grewia asiatica* (0.041 ± 0.088 g/g) (Table 3; Fig- 3)

Table 2: Sugar profiling of four wild edible fruits of Odisha

Name of fruits	*ESECP*			*NCP*		
	Total sugar (%)	*Reducing sugar (%)*	*Non-reducing sugar (%)*	*Total sugar (%)*	*Reducing sugar (%)*	*Non-reducing sugar (%)*
Flacourtia jangomas	5.279 ± 0.007	3.279 ± 0.219	2.007 ± 0.708	5.233 ± 0.003	2.710 ± 0.305	2.523 ± 0.331
Grewia asiatica	11.065 ± 0.011	1.653 ± 0.104	9.412 ± 1.198	7.063 ± 0.004	1.477 ± 0.065	5.586 ± 0.412
Pithecellobium dulce	3.519 ± 0.010	1.972 ± 0.210	1.547 ± 1.074	3.819 ± 0.016	2.530 ± 0.102	1.289 ± 1.542
Syzygium jambos	13.077 ± 0.004	7.320 ± 0.207	5.757 ± 0.494	10.627 ± 0.005	8.271 ± 0.025	2.356 ± 0.561

Data are presented as Mean ± SD (n = 5)

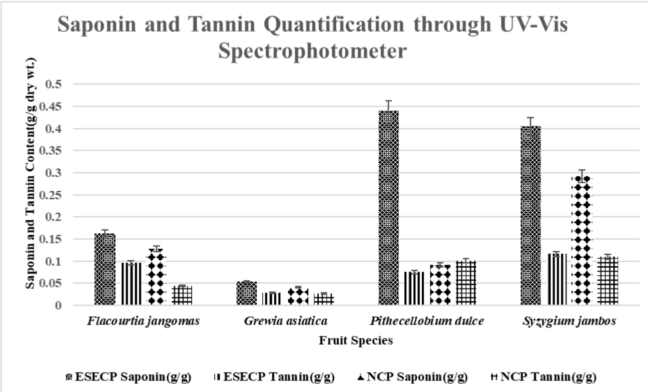


Fig. 3: Saponin and Tannin contents in WEFs of Odisha

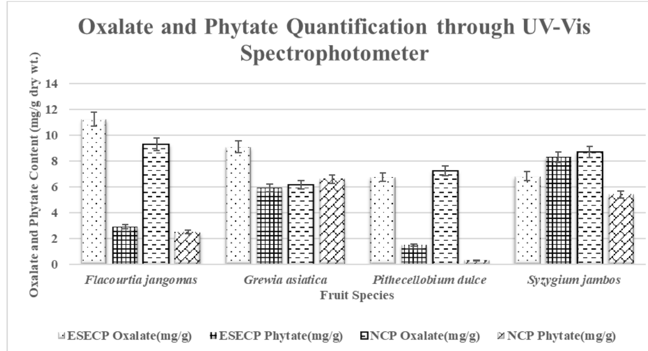


Fig. 4: Oxalate and Phytate contents in WEFs of Odisha

Tannin contents

The studied fruit samples had varying concentrations of tannin, ranging from 0.027 ± 0.001 g/g for *Grewia asiatica* to 0.116 ± 0.003 g/g for *Syzygium jambos*. *Syzygium jambos* had a higher tannin content value (0.116 ± 0.003 g/g), while *Grewia asiatica* from the ESECP region had a lower value (0.027 ± 0.001 g/g), ahead of *Pithecellobium dulce* (0.101 ± 0.026 g/g) and *Flacourtia jangomas* (0.096 ± 0.021 g/g) from the NCP and ESECP region, respectively. (Table 3, Fig. 3)

Oxalate contents

The order of the fruit samples' oxalate contents, according to the results, was *Flacourtia jangomas* > *Syzygium jambos* > *Pithecellobium dulce* > *Grewia asiatica*. The NCP and ESECP regions had oxalate contents of 6.165 ± 0.038 mg/g for *Grewia asiatica* and 11.248 ± 0.030 mg/g for *Flacourtia jangomas*, respectively. (Table 3, Fig. 4).

Phytate contents

According to the data we currently have, the phytate concentration of *Pithecellobium dulce* ranges from 0.273 ± 0.007 to 8.314 ± 0.051 mg/g in *Syzygium jambos* (Table 3). Fruit samples' oxalate contents were in the following order: *Syzygium jambos, Grewia asiatica*, *Flacourtia Jangomas*, and *Pithecellobium dulce* (Figure 4).

Discussion

Odisha, a state located in eastern India, is characterized by its rich biodiversity and the presence of several wild edible fruits (WEFs). This study employed standardized methodologies to assess the sugar profile and antinutrient status of selected WEFs, with findings detailed herein. The results indicate that *Syzygium jambos* exhibited the highest total sugar content among the four species examined, measuring 13.077%. This figure surpasses the previously reported total sugar content of 8.25% in the same species, as well as in other *Syzygium* species, including *Syzygium amarangense* (both red and white varieties) and *Syzygium malaccense*, which demonstrated total sugar levels ranging from 3.95% to 8.25%, as noted by Jayasree *et al*., (2022). Furthermore, the total sugar content among various *Syzygium* species, such as *Syzygium cumini, Syzygium claviflorum, Syzygium jambolana,* and *Syzygium samaragense,* was reported to range from 4.08% to 9.00%, which aligns with the findings of the current investigation, as cited by Singh *et al*., (2001). Hossain *et al*., (2021) reported that the fruit of *Flacourtia jangomas* contained 3.83 ± 0.15% total sugar, a value slightly lower than that of *Pithecellobium dulce* identified in the present study, which was found to have a total sugar content of 5.27%. Prior data indicated that *Pithecellobium dulce* had a total sugar content of 19.09 ± 0.005 mg/g (1.9%) at the ripened stage, which is lower

Table 3: Anti-nutritional analysis in four wild edible fruits of Odisha

Name of fruits	*ESECP*				*NCP*			
	Oxalate (mg/g dry wt.)	*Saponin (g/g dry wt.)*	*Tannin (TAEg/g dry wt.)*	*Phytate (mg/g dry wt.)*	*Oxalate (mg/g dry wt.)*	*Saponin (g/g dry wt.)*	*Tannin (TAEg/g dry wt.)*	*Phytate (mg/g dry wt.)*
Flacourtia jangomas	11.248 ± 0.030	0.162 ± 0.049	0.096 ± 0.021	2.910 ± 0.007	9.301 ± 0.042	0.128 ± 0.005	0.044 ± 0.001	2.482 ± 0.031
Grewia asiatica	9.103 ± 0.087	0.053 ± 0.012	0.029 ± 0.010	5.931 ± 0.019	6.165 ± 0.038	0.041 ± 0.008	0.027 ± 0.001	6.581 ± 0.021
Pithecellobium dulce	6.762 ± 0.045	0.441 ± 0.372	0.075 ± 0.003	1.471 ± 0.025	7.244 ± 0.026	0.092 ± 0.002	0.101 ± 0.026	0.273 ± 0.007
Syzygium jambos	6.832 ± 0.029	0.405 ± 0.020	0.116 ± 0.003	8.314 ± 0.051	8.720 ± 0.024	0.292 ± 0.008	0.110 ± 0.012	5.421 ± 0.031

Data are presented as Mean ± SD (n = 5)

than the 7.063% reported for *Grewia asiatica* in the NCP region. In the ESECP region, *Grewia asiatica* fruits exhibited total sugar levels of 11.06%, comparable to 13.24% as reported by Pangotra *et al*., (2018). According to Cheema *et al*., (2017), *Pithecellobium dulce* contains 2.56 ± 0.09 (%d.w.) reducing sugar and 0.15 ± 0.04 (%d.w.) non-reducing sugar, findings that closely match those obtained in the current study. Additionally, *Syzygium jambos* revealed slightly lower levels of reducing and non-reducing sugar in fruits from the NCP region, measured at 8.27 ± 0.025 and 2.356 ± 0.561%, respectively. Sugar serves as a vital energy source and plays a critical role in numerous metabolic processes. As it is stored as glycogen in the muscles and liver, the body can access it as an immediate source of energy (Patra and Basak, 2017). However, excessive sugar consumption has been associated with various cardiometabolic diseases, including diabetes, dental issues, certain cancers, and mental health concerns (Prada, 2022).

Rout and Basak (2014) reported that antinutrient contents in the fruits of *Syzygium cumini* were relatively lower than those recorded in the current study, with oxalate (1.1 ± 0.22 g/g), tannin (0.076 ± 0.001 g/g), saponin (0.178 ± 0.025 g/g), and phytate levels (4.92 ± 0.08 mg/g). Kumar *et al*. (2021) observed that the fruit of *Grewia tiliifolia* contained lower tannin (7.3 mg/100g) and oxalate (10.3 mg/100g) levels compared to those found in the current study focusing on *Grewia asiatica* fruits. However, the antinutrient content of *Grewia tiliifolia* fruits identified by Rathod and Valvi (2011) closely matched the findings of the present study, excluding the saponin content, which was absent in their report. The current study did, however, identify saponin in *Grewia asiatica* fruits, measured at 0.053 g/g and 0.041 g/g from the ESECP and NCP regions, respectively. Pangotra (2018) reported a tannin level of 1.92 mg/g in ripe fruits of *Grewia subinaequalis* L., which is nearly equivalent to the levels found in this study for *Grewia asiatica* fruits. Rathod and Valvi (2011) determined that the levels of tannin (1.956%), phytate (0.3534%), and oxalate (0.7934%) in *Flacourtia indica* were comparable to those currently detected in *Flacourtia jangomas*. While antinutrients can lower the risk of chronic diseases and possess antioxidant properties, excessive amounts may hinder the body's absorption of essential minerals and lead to deficiencies (Ratta and Gemede, 2014). Variability in sugar and antinutrient content across diverse geographic areas may result from changes in soil quality, climate, and agricultural practices. Understanding these variables can contribute to promoting a healthier lifestyle. It is also crucial for producers and consumers to recognize and manage the relationship between sugar and antinutrients to achieve the desired flavor and quality in fruit-based products. The study highlights significant variations in the sugar and antinutrient content of wild edible fruits (WEFs), influenced by species, geography, and environment. *Syzygium jambos* had the highest sugar content, while other fruits showed regional differences. While sugars provide energy, excess can harm health. Antinutrients have protective benefits but may hinder mineral absorption at high levels. These findings emphasize the need to understand WEF composition for better dietary planning, agriculture, and health use. The research promotes exploring WEFs for nutrition, health benefits, and medicinal potential while advocating for sustainable biodiversity conservation in Odisha to address malnutrition and food security.

Conclusion

This study concludes that among the fruits analyzed, *Pithecellobium dulce* possesses the lowest sugar concentration, while *Syzygium jambos* contains the highest, followed by *Grewia asiatica*. Furthermore, *Grewia asiatica* was identified as having the lowest levels of oxalate, saponin, and tannin content among all the fruits studied. The analysis encompassed four edible wild fruits from two distinct agroclimatic zones in Odisha, revealing the presence of antinutrients as well. This examination may enhance awareness regarding the appropriate incorporation of specific fruits into the diet, ultimately fostering improved dietary habits.

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Authors Contribution

Sandhyarani Samal, Subhasmita Subhashree and Abhipsa Anjeela have executed research work (Lab-Land) as designed against the concerned project objective under the supervision and guidance of Uday Chand Basak. Sandhyarani Samal compiled the data and prepared the manuscript. Uday Chand Basak reviewed, corrected and edited the whole manuscript.

Conflict of Interest

No conflict of interest

References

Baek, M.W., Choi, H.R., Hwang, I.G., Tilahun, S.,& Jeong, C.S. (2023). Prediction of tannin content and quality parameters in astringent persimmons from visible and near infrared spectroscopy. Frontiers in Plant Science, 14:1260644, doi: 10.3389/fpls.2023.1260644

Basson, C.E., Groenewald, J.H., Kossmann, J., Cronjé, C., & Bauer, R. (2010). Sugar and acid related quality attributes and enzyme activities in strawberry fruits : Invertase is the main sucrose hydrolyzing enzymes. Food Chemistry. 121, 1156-1162, doi: 10.1016/j.foodchem.2010.01.064

Bhandari, M.R., & Kawabata, J. (2004). Assessment of antinutritional factors and bioavailability of calcium and in wild yam (Dioscorea spp.) tubers of Nepal. Food Chemistry, 85(2):281–287 doi: https://doi.org/10.1016/j.foodchem.2003.07.006 .

Bharti, H., Kusum, & Verma, J. (2021) Wild edible fruits and vegetables of Himachal Pradesh. Journal of Research: The Bede Anthenaeum., 12(1):53-66, doi: http://dx.doi.org/10.5958/0976-1748.2021.00006.0

Chai, W., & Liebman, M. (2005). Oxalate content of legumes, nuts, and grain-based flours. Journal of Food Composition and Analysis .18(7):723-729 doi: https://doi.org/10.1016/j.jfca.2004.07.001 .

Cheema, J.,Yadav, K., Sharma, N., Saini, I., & Aggarwal, A.(2017).Nutritional quality characteristics of different wild and underutilized fruits of Terai region, Uttarakhand(India). International journal of food science. 17(1):72-81. https://dx.doi.org/10.1080/15538362.2016.1160271.

Dev, R., Sharma, G.K., Singh,,T., Dayal ,D., & Sureshkumar, M.(2017).. Distribution of *Grewia* species in Kachchh Gujurat, India: Taxonomy, traditional knowledge and economic potentialities.International.

journal of pure Applied Bioscience, 5(3):567-574 doi: http://dx.doi.org/10.18782/2320-7051.5000 .

Duguma , H.T.(2020). Wild Edible Plant Nutritional Contribution and Consumer Perception in Ethiopia. International Journal of Food Science. 2020(1):1-16, doi: http://doi.org/10.1155/2020/2958623 .

Gemede, H.F., & Ratta, N. (2014). Antinutritional factors in plant foods:potential benefits and adverse effects.International Joural of Nutrition and Food Science,3(4):248-289, doi: 10.11648/ijnfs.20140304.18 .

Hossain, M.M, Rahim, Md.A., &. Haque, RMd..(2021)..Biochemical properties of some important underutilized minor fruits.*Journal of Agriculture and Food Research*. 5(2021) 100148, doi: https://doi.org/10.1016/j.jafr.2021.100148 .

Jayasree, O., Haldavanekar, P.C., Parulekar, YR., Burondkar, MM., Dhopakar, RV., & Prasana, D.L. (2022). Morphological characterization of quantitative character in Rose apple genotype (*Syzygium*spp.).The Pharama Innovation ,11(7);1939-1943, doi: http://dx.doi.org/10.22271/tpi

Joseph, D., & Sivasubramanian,,S.(2021). General properties and pharmacological benefits of *Syzygium jambos*.Advance in pharmaceutical science., 1(8): 77-83, ISBN:978-81-951323-7-9.

Kassie, W., Washe, A.P., & Etsay,H.(2019). Spectrophotometric Determination of Oxalic Acid in Dietary Sources Through Catalytic Titration with Hexavalent Chromium. Food Science and Quality Management., Vol.83, doi: https://doi.org/10.7176/FSQM .

Kulkarni, K.V. , & Jamakhandi, V.R. (2018). Medicinal uses of *Pithecellobium dulce* and its health benefits. Journal of Pharmacognosy and phytochemistry,7(2):700-704, doi: https://dx.doi.org/10.22271/phyto .

Kumar, G.M.P., & Shiddamallayya, N. (2021). Nutritional and anti-nutritional analysis of wild edible plants in Hassan district of Karnataka, India. Indian Journal of Natural Products and Resources., 12(2):281-290, doi: http://nopr.niscpr.res.in/handle/123456789/57750 .

Kumar, M., Husaini, S.A, Uddin, Q., Aminuddin, Kumar, K., & Samiulla, L. (2013). Ethnobotanical study of the wild edible plant from Odisha,India. Life Science Leaflets*.,* 41:13-20, Retrieved from: https://petsd.org/ojs/index.php/lifesciencesleaflets/article/view/55 .

Li, Y., Zhang, J.J., Xu, D.P., Zhou, T., Zhou, Y., Li, S,. & Li, H.B. (2016). Bioactivities and Health Benefits Of Wild Fruits. International Journal of Molecular Science, 17(8):1258, https://doi.org/10.3390/ijms17081258 .

Mahapatra, A.K., & Panda, P.C. (2009). Wild Edible Fruit Plants of Eastern India. Regional Plant Resource Centre, Bhubaneswar, India. ISBN: 81-900920-6- 5: 1-15.

Mandizvo, T., & Odindo, A.O.(2020). Spectrophotometric quantification of phytic acid during embryogenesis in bambara groundnut (Vigna subterranea L.) through phosphor molybdenum complex formation. Emirates Journal of Food and Agriculture., 32(11) : 778-785, doi: https://doi.org/10.9755/ejfa.2020.v32.i11.2178 .

Mishra, D.P., Mishra, N., Musale, H.B, Samal, P., Mishra, S.P., & Swain, D.P. (2017).Determination of seasonal and developmental variation in oxalate content of *Anagallis arvensis* plant by titration and spectrophotometric method.ThePharma Innovation journal., 6(6):105-111,doi: https://dx.doi.org/10.22271/tpi .

Misra, V., Shrivastava, A.K., Shukla, S.P., & Ansari, M.I.(2016).Effect of sugar intake towards human health.Saudi Journal of Medicine. 1(2):29-36, doi: 10.21276/sjm.2016.1.2.1 .

Pangotra, B.B.,Gupta, N., & Sharma, A. (2018). Development of freshly prepared phalsa-pear blended beverage.Intrnational Journal of Current Microbiology Applied Science.7(2):2870-2876, doi: https://doi.org/10.20546/ijcmas.2018.702.350 .

Patra, P.A., & Basak, U.C.(2017).Nutritional and Antinutritional Properties of *Carissa carandas* and *Cordia dichotoma*, two Medicinally Important Wild Edible Fruits of Odisha. Journal of Basic and Applied Science Research., 7(7):1-12.

Prada, M., Saraiva, M., Garrido, M.V., Sério, A., Teixeira, A., Lopes, D., Silva, D.A., & Rodrigues, D.L.(2022).Perceived association between excessive sugar intake and health condition. Nutrients14(3):640 doi:10.3390/nu14030640.

Rai, A., & Mishra, T. (2020). Ethnomedicinal and therapeutic values of *Flacourtia jangomas*.Journal of Indian botanical society, 100 (3 and 4) : 42-52 doi:10.5958/2455-7218.2020.00037.6.

Rangana, S.C.(1979).Manual of Analysis of Fruit and Vegetable Products. Tata McGraw Hill Publishing Company Limited, New Delhi .

Rathod, V.S., & Valvi, S.R. (2011). Antinutritional factors of some wild edible fruits from Kolhapur district. Recent Research in Science and Technology.3(5):68-72, Retrieved from https://updatepublishing.com/journal/index.php/rrst/article/view/693 .

Reddy, M. K.,. Kumar, K.V.P., & Baig, M.S.(2022). Nutritional, health and therapeutic benefits of *Pithecellobium dulce.* Agriculture and food: E-newsletter.4(10):231-233. http://agrifoodmagazine.co.in/ Article ID:38282, ISSN:2581-8317.

Rout, P., & Basak, U.C. (2014). Evaluation of antinutritional factors in sixteen wild edible fruits of Odisha, India. International Journal of Current Science.13: E:34-42, https://rjpn.org/ijcspub/papers/IJCSP10A1107.pdf .

Samtiya, M., Aluko, R.E., & Dhewa, T. (2020). Plant food anti-nutritional factors and their reduction strategies: an overview. Food Production,Process and Nutrition, 2(6):1-14, doi: https://doi.org/10.1186/s43014-020-0020-5 .

Saxena, H.O., & Brahmam, M. (1995).The Flora of Orissa, Regional Research Laboratory & Orissa Forest Development Corporation Ltd. I- IV.

Singh, D.B.,Attri ,B.I., Sharma, T.V.R.S., & Sreekumar ,P.V.,(2001). Nutrient composition of some wild edible fruits of Andaman and Nicobar Islands. Journal of Applied Horticulture,3(1):60-62 doi: https://doi.org/10.37855/jah.2001.v03i01.15 .

Singh, J., & Basu, P. (2012). Non-Nutritive Bioactive Compounds in Pulses and Their Impact on Human Health: An Overview. Food and Nutrition Sciences, 3(12):1664-1672, doi: 10.4236/fns.2012.312218 .

Suwardi, A.B., Navia, Z.I., Harmawan, T., Syamsuardi, & Mukhtar, E.(2020). Ethnobotany and conservation of indigenous edible fruit plants in south Aceh , Indonesia. Biodiversitas, 21(5):1850-1860, doi: https://doi.org/10.13057/biodiv/d210511

Thakur, A., Sharma, V., & Thakur, A.(2019). An overview of anti-nutritional factors in food.International Journal of Chemical Studies,7(1): 2472-2479, doi: https://dx.doi.org/10.22271/chemi .

Zia-Ul-Haq, M., Stanković, MS., Rizwan, K.,, & Feo, VD.(2013).*Grewia asiatica* L.a food plant with multiple uses. Molecule*.,* 18(3):2663-2682, doi: HYPERLINK "https://doi.org/10.3390%2Fmolecules18032663"10.3390/molecules18032663