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Research Article

A comparative study of antioxidative property of polar and non-polar extracts of Date palm fruit *(Phoenix sylvestris)* and Hental fruit (*Phoenix paludosa*), collected from West Bengal, India

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Abstract

The current study was performed to compare the antioxidative properties of polar and non-polar extracts of *Phoenix sylvestris* (Indian Date fruit) and *Phoenix paludosa* (Hental fruit), which were collected from the South 24 Parganas district of West Bengal. To evaluate the antioxidative potential of these extracts, 2,2 diphenyl 1 picrylhydrazyl (DPPH) assay, Ferric reducing antioxidant power (FRAP) assay, Total phenolic content measurement and Total flavonoid content were performed. The results revealed that polar extracts of *Phoenix sylvestris* (Date), especially the seed extract dissolved in methanol expressed higher antioxidative potential compared to the non-polar extracts. Methanolic extract of Date seed showed 88.977%±0.224 ($p<0.05$) radical scavenging activity with a lower IC50 value, 321.89±1.62 mg AEAC/g DW ($p<0.05$) ferric reducing capacity and comparatively higher phenolic content (9979.1±82.2 mg GAE/g DW) ($p<0.05$) and flavonoid content (17150.3±5021.9 mg QE/g DW) ($p<0.05$) than all the other extracts. Polar extracts of *Phoenix paludosa* also showed higher antioxidative activity compared to non-polar extracts, but non-polar extracts showed higher content of phenolic and flavonoid compounds. The data reveals that specific extracts of Indian Date and Hental fruit are a rich source of antioxidants, and based on these preliminary findings, they can further be tested and utilized to treat conditions like oxidative stress and damages associated with it.

Keywords: Antioxidant, Date, Hental, RNS, ROS

Highlights

- *P. sylvestris* and *P. paludosa* were collected from Bengal to study for antioxidative potential.
- Polar extracts showed higher antioxidative potential compared to non-polar extracts.
- Methanolic extract of Date exhibited the highest antioxidative potential via DPPH and FRAP assay.
- Methanolic extract of Date also showed higher phenolic and flavonoid content.

INTRODUCTION

The generation of oxidative stress and the complications associated with it have put a major impact on human health, all over the world (Pizzino *et al*., 2017). Various pro-oxidative molecules such as superoxide ($O_2^{\bullet-}$), Hydroxyl ($^{\bullet}OH$), Peroxyl ($RO2^{\bullet}$), Alkoxyl ($RO^{\bullet}$), Hydroperoxyl ($HO2^{\bullet}$), Hydrogen peroxide (H_2O_2), Hypochlorous acid (HOCl), Ozone (O_3), Singlet oxygen ($_1O^2$) and Peroxynitrite ($ONOO^-$), collectively called ROS or reactive oxygen species and Nitric oxide ($NO^{\bullet}$), Nitrogen dioxide ($NO2^{\bullet}$) as RNS contribute in alteration of chemical architecture of the cellular components (Keshari *et al*., 2015; Pizzino *et al*., 2017). These pro-oxidative molecules are naturally produced in the various parts of the cell, such as cytosol, mitochondria, peroxisome, endoplasmic reticulum, etc, via multiple enzymatic and non-enzymatic pathways (Keshari *et al*., 2015; Di *et al*., 2016). These metabolic by-products are to be scavenged with the help of exogenous and endogenous antioxidants in order to maintain the structural integrity of the cell (Liguori *et al*., 2018; Brainina *et al*., 2019). However, upregulation of the former or downregulation of the later may lead to the initial stages of oxidative stress, inducing lipid peroxidation, DNA damage, membrane disruption, etc (Pizzino *et al*., 2017). Various research has shown that oxidative stress is related to the onset of cardiovascular diseases, cancer, neurological diseases, respiratory diseases, rheumatoid arthritis, kidney disease and many more yet to be discovered (Galle *et al*., 2001; Halliwell *et al*., 2001; Macnee *et al*., 2001; Mahajan and Tandon, 2004; Valko *et al*., 2004; Bahorun *et al*., 2006).

In order to counter the harmful effects of oxidative stress, scientists are continuously on the search for cheap, side effects-free, natural sources of antioxidants. Antioxidants mainly work via enzymatic and nonenzymatic fashion. The former includes various enzymes such as CAT, SOD, and GSHPx, which work by reducing the level of lipid hydroperoxide and H_2O_2 while

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the latter is involved in direct electron transfer from antioxidative molecules to free radicals. Nonenzymatic antioxidants include vitamins, flavonoids, carotenoids, hydroxycinnamates etc (Nimse and Pal, 2015). Date palm tree (*Phoenix sylvestris* L.) is a tree of palm family (Aracaceae), is indigenous to the countries around Arabian gulf. It is believed that Date palm tree was introduced in India by the soldiers of Alexandar the Great in fourth century BC in Indus Valley (Pareek, 2015). Later on, it spread to other parts of India. Now, Date fruit is a commonly cultivated horticultural crop, found all over India. Gujrat is one of the largest producers of this fruit crop. Other districts of Haryana and Rajasthan also contribute in Date cultivation (Pareek, 2015). Cultivation of Date palm tree requires specific conditions which include dry summer with a mean temperature of 18°C during six hottest months of the year, low rainfall as rainfall affects the ripening stage, sandy loam soil with good water holding capacity, etc (Meghwal, 2011). Date fruit is comprised of numerous nutraceuticals which contribute to its various properties. The bioactive components in Date include flavonoids, phenolic acids, anthocyanins, phytosterols, carotenoids, etc (Hussain *et al*., 2019). In many countries, Date has been used to cure diabetes, hypertension, hypercholesterolemia, reduction in lipoprotein oxidation and wrinkling in skin for women (Hussain *et al*., 2019). Multiple cultivars of Date have been shown to harbour anti-cancer, antidiabetic, antioxidative, antimicrobial, neuroprotective, anti-inflammatory and hemolytic properties. On the other hand, *Phoenix paludosa,* locally known as Hantal or Hital or Hental is a thorny palm tree, ranging in between 6 to 7 meters in height and has never been examined for its therapeutic properties (Alam *et al*., 2010). This unique tree, belonging to the family of Aracaceae, is widely available in the Indian peninsular region, mostly towards Eastern India (Sundarbans region), Bangladesh, Thailand, Cambodia, Peninsular Malaysia etc. Various *Phoenix* sp. are reported to have numerous medicinal properties such as diuretic, antioxidative, analgesic, ameliorative, etc, owing to the presence of therapeutic compounds in their fruits.

Indian Dates and Hantal (especially in the Bengal region) are relatively unexplored fields in the search for bioactive compounds and can shed light on the treatment of damages associated with oxidative stress. Since these natural resources are rich in therapeutic components, they may serve as a potential alternative to other costly, side effect prone, natural or synthetic medicines, ensuring sustainable usage of natural resources leading to positive impacts on environment, health and economy as well.

The current study aims to measure the antioxidative properties of different extracts of Date and Hental, collected from South 24 Parganas district of West Bengal, India. The study also puts forward a comparative analysis of Indian Date seed and mesocarp extracts with Hental mesocarp extracts in terms of exhibiting antioxidative effects. In order to find out the antioxidative potential, four cell free *in vitro* assays were performed and the results were analyzed with statistical measures.

MATERIALS AND METHODS

Collection of fruits: Ripe Date and Hental fruits were collected from South 24 Parganas district, West Bengal, India. The intact fruits were stored at -20°C for further analysis.

Preparation of extracts: Fresh fruits with seeds were collected and washed thoroughly with tap water and distilled water. Fruits were shade-dried for 7 days and powdered. Dried, powdered fruits were separated from seed and were extracted with choice of solvents from non-polar to polar such as petroleum ether or n-hexane, chloroform or di-chloro methane, 80% methanol (1 g of fruit powder in 20 mL of solvent) and water with the help of cold maceration, at room temperature for about 48-72 h and shaking frequently. The process of extraction was repeated two times. The solution was filtered using Whatman's filter paper no.1, and the solvent was allowed to evaporate completely by rotary vacuum evaporator to obtain the concentrated extract. The extract was stored in sterile glass vials at -20°C for freezing. The frozen extract was then run with lyophilizer to complete evaporation of the solvent. Then dried extracts were kept at 4°C for future use (Dutta and Banerjee, 2023).

2,2 diphenyl 1 picrylhydrazyl (DPPH) assay: The antioxidative property of different extracts of Date (seed and mesocarp) and Hental fruit were measured by estimating the conversion of deep violet, crystalline 2,2 diphenyl 1 picrylhydrazyl to its reduced form, forming a yellow or colourless solution (Blois, 1958; Shah and Modi, 2015). Different concentrations of samples (0.2 mL) were transferred to a 2 mL centrifuge tube. 0.3 mM DPPH solution was prepared by adding DPPH to methanol. 0.4 mL of DPPH solution was added to the centrifuge tubes. The solutions were incubated at RT in the dark for 90 minutes. The absorbance was measured spectrophotometrically via a multi well plate reader at 517 nm. The absorbance was measured in triplicate manner. DPPH radical scavenging activity (%) was calculated using the formula:

$$\text{Inhibitory percentage} = \frac{Ao - A1}{Ao} - X\ 100$$

Where, Ao = Absorbance of the control; A1 = Absorbance of the sample

As a standard, ascorbic acid was used (ascorbic acid scavenges DPPH radical via hydrogen atom transfer method and gets converted to dehydroascorbate successively. The purple DPPH radical changes into colourless or pale yellow in the process). The IC50 values for different extracts of Date and Hental were compared with standard.

Ferric reducing antioxidant power (FRAP) assay: The effects of Date and Hental extracts in reducing Fe^{3+} ions into Fe^{2+} were measured with the help of Ferric reducing antioxidant power (FRAP) assay (Kumaran and Karunakaran, 2007; Kchaou *et al*., 2013). 1 mL of different samples were mixed with 2.5 mL of 0.2 M phosphate buffer (pH-6.6). To this solution, 2.5 mL of 1% potassium ferricyanide $[K_3Fe(CN)]_6$ was mixed and was further subjected to vortex. The mixture was incubated at 50°C for 20 minutes in a hot air oven and was further added with 2.5 mL of 10% trichloroacetic acid. The mixture was centrifuged at 3000 RPM for 10 minutes at room temperature. 2.5 mL of supernatant was carefully collected in a separate tube without disturbing the precipitate and 0.1% ferric chloride solution ($FeCl_3$) was added. The absorbance was measured at 700 nm with a multiwell plate reader (in triplicate manner). Ascorbic acid was used as a standard for comparison with the samples. Ascorbic acid transfers an electron to the Fe^3+ (potassium ferricyanide) to convert it into Fe^2+ (potassium ferrocyanide), which later on reacts with ferric chloride to produce a blue-coloured complex. This blue-coloured complex can further be measured spectrophotometrically.

Total phenolic content (TPC) measurement: To quantify phenolic contents of Date and Hental extracts, Folin-Ciocalteu assay was performed (Singleton *et al*., 1999; Razali *et al*., 2019). 0.1 mL of each sample was mixed with 0.5 mL of Folin-Ciocalteu reagent (0.2 N). The solution was incubated for 5 minutes at RT. The solution was further added with 0.4 mL of 7.5% sodium carbonate ($Na_2CO_{3)}$ and was allowed to incubate at 25°C for 60 minutes. The absorbance was measured spectrophotometrically at 765 nm via a multiwell plate reader.

Total phenolic content of different extracts of Date and Hental were determined from the standard curve of Gallic acid (gallic acid is a phenolic acid which reacts with the Folin-ciocalteu reagent, which contains phosphomolybdate and phosphortungstate. Gallic acid in alkaline condition gets oxidized and further reduces F-C reagent resulting in blue coloured complex) and was expressed in mg of gallic acid/gm of extract. The following formula was utilized:

$$\text{Total phenolic content} = \frac{C \times V}{M}$$

Where, C = Concentration of gallic acid; V = Volume of extract (mL); M = Weight of extract (g)

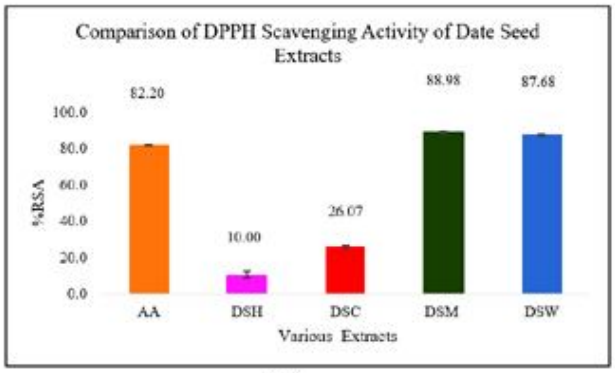
Total flavonoid content (TFC) measurement: Total flavonoid content for Date and Hental fruit extracts were measured via Aluminium chloride method (Zhishen *et al*., 1999; Al-Farsi and Lee, 2008; Jabeen *et al*., 2020). 1 mL of sample was mixed with 5 mL of deionized water and 0.3 mL of 5% sodium nitrite ($NaNO_2$). The mixture was subjected to 5 minutes of incubation at room temperature. To the solution, 0.3 mL of 10% aluminium chloride ($AlCl_3$) was added. The mixture was again allowed to incubate for 6 minutes at room temperature. After incubation, 2 mL of NaOH (1 M) was added and diluted with deionized water. The measurement of absorbance was done via a multi-well plate reader at 510 nm. Quercetin was used as a standard (aluminium chloride reacts with quercetin through C-4 keto group and C-3 hydroxyl group to form a labile complex. Thus, the yellow colour can be detected spectro-photometrically) and the total flavonoid content was expressed as mg of quercetin/gm of extract.

Statistical analysis: All the readings were obtained in triplicate manner. The data have been expressed in Mean ± SD. The results have been interpreted with the help of ANOVA and Tukey's post hoc test using SPSS software (Statistical Package for Social Science).

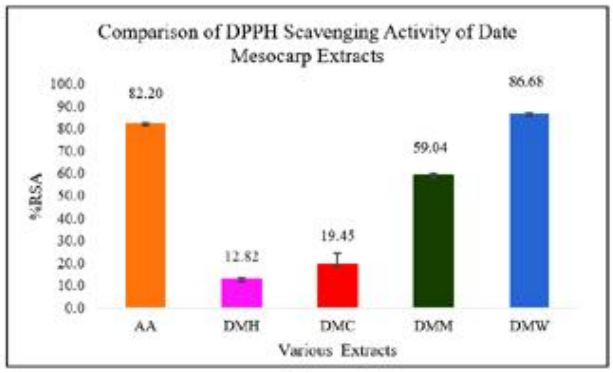
RESULTS

Total antioxidant activity

DPPH scavenging activity: To understand the antioxidative potential of Date (seed and mesocarp) and Hental (mesocarp) extract, 2,2 diphenyl 1 picrylhydrazyl (DPPH) assay was performed and their radical scavenging percentage and IC50 values were calculated and compared with that of standard (ascorbic acid) (Table 1, Fig. 1 and Fig. 2). The result revealed that polar extracts exhibited comparatively higher antioxidative potential to non-polar extracts. Polar Date seed extracts, water and methanolic showed 87.677%±0.196 ($p<0.05$) and 88.977%±0.224 ($p<0.05$) radical scavenging activity having IC50 values of 0.545 mg/mL and 0.358 mg/mL, respectively which are fairly close to the standard (82.201%±0.116 and 0.283 mg/mL). Polar Date mesocarp extracts, water and methanolic exhibited



(a)



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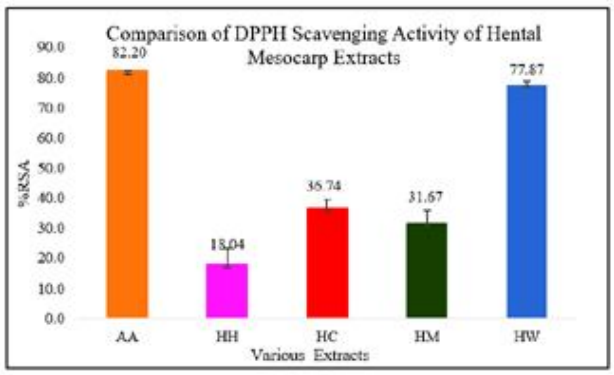


(c)

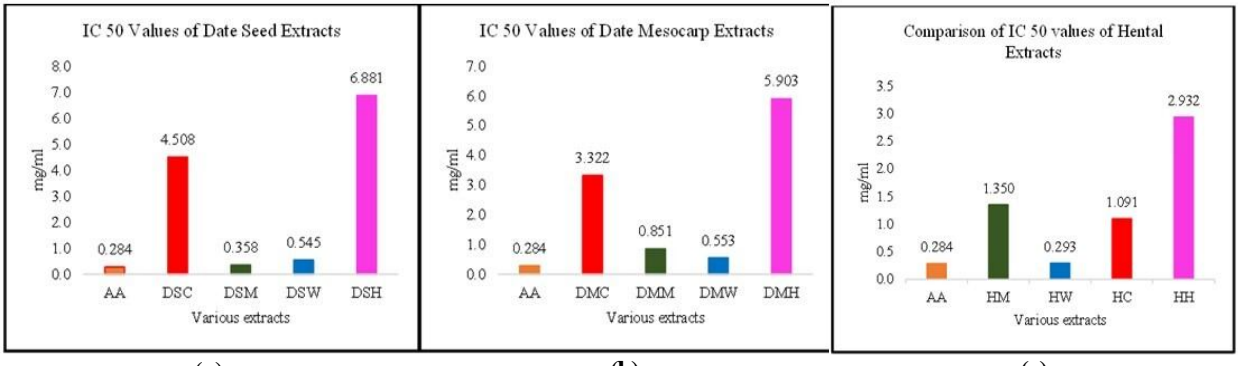
Fig. 1. Comparison of percentage radical scavenging activity of Date and Hental extracts with standard, (a) Seed extracts of Date fruit, (b) Mesocarp extracts of Date fruit, (c) Mesocarp extracts of Hental fruit

86.675%±0.258 ($p<0.05$) and 59.035%±1.163 ($p<0.05$) radical scavenging activity. The IC50 values of Date mesocarp water and methanolic extracts are 0.553 mg/mL and 0.850 mg/mL, respectively. However, only water extract of Hental exhibited highest radical scavenging activity than all other extracts with 77.867%±1.034 ($p<0.05$) and IC50 value of 0.634 mg/mL.

Table 1. Results of DPPH Assay

	Radical scavenging activity (%) for DPPH assay			
Solvents	**Hexane**	**Chloroform**	**Methanol**	**Water**
DATE (Seed)	9.998^{a}±2.682	26.07^{b}±0.825	88.977^{c}±0.224	87.677^{c}±0.196
DATE (Mesocarp)	12.817^{a}±0.787	19.447^{b}±4.85	59.035^{c}±1.163	86.675^{d}±0.258
HENTAL (Mesocarp)	18.037^{a}±5.343	36.743^{b}±2.829	31.669^{b}±4.120	77.867^{c}±1.034

Comparison of % RSA values for four different extracts of Date and Hental fruits (seed and mesocarp). The data have been represented as Mean ± SD. Different lower-case letters (a, b, c, d), appended at the end of each value, show significant differences at 0.05 probability level.



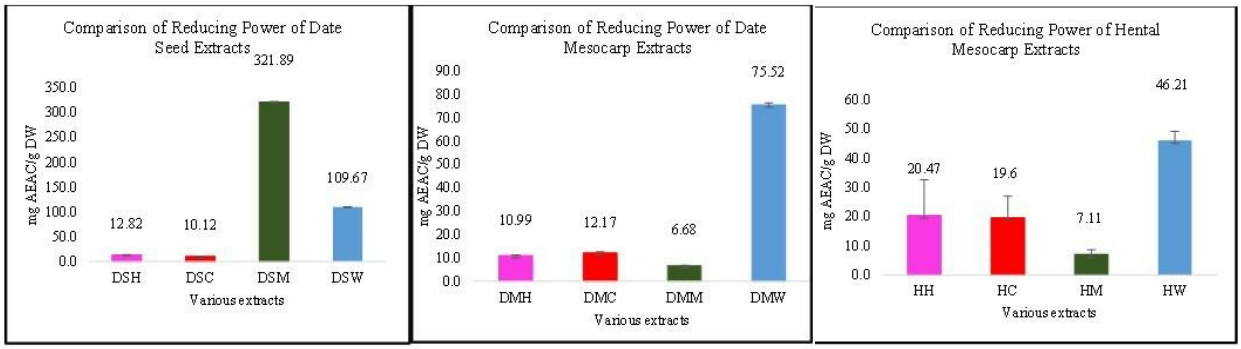
(a) (b) (c)

Fig. 2. Comparison of IC50 values of Date and Hental fruit extracts with standard (ascorbic acid), (a) Seed extracts of Date fruit, (b) Mesocarp extracts of Date fruit, (c) Mesocarp extracts of Hental fruit. The IC50 values have been expressed in mg/mL.

Table 2. Results of FRAP Assay

Solvents	Antioxidative potential determination using FRAP assay (mg AEAC/g DW)			
	Hexane	Chloroform	Methanol	Water
DATE (Seed)	$12.82^{a}\pm0.67$	$10.12^{b}\pm0.49$	$321.89^{c}\pm1.62$	$109.67^{d}\pm0.67$
DATE (Mesocarp)	$10.99^{a}\pm0.32$	$12.17^{b}\pm0.49$	$6.68^{b}\pm0.19$	$75.52^{c}\pm0.93$
HENTAL (Mesocarp)	$20.47^{a}\pm12.22$	$19.60^{a}\pm7.44$	$7.11^{a}\pm1.62$	$46.21^{b}\pm3.08$

Comparison of AEAC of different extracts of Date and Hental fruits. The data have been represented as Mean ± SD. Different lower-case letters (a, b, c, d), appended at the end of each value, show significant differences at 0.05 probability level.



(a) **(b)** **(c)**

Fig. 3. Comparison of reducing power of Date and Hental fruit extracts (a) seed extracts of Date fruit, (b) mesocarp extracts of Date fruit, (c) mesocarp extracts of Hental fruit. The reducing power of the samples were expressed in ascorbic acid equivalent antioxidant capacity per gram dry weight (mg AEAC/g DW).

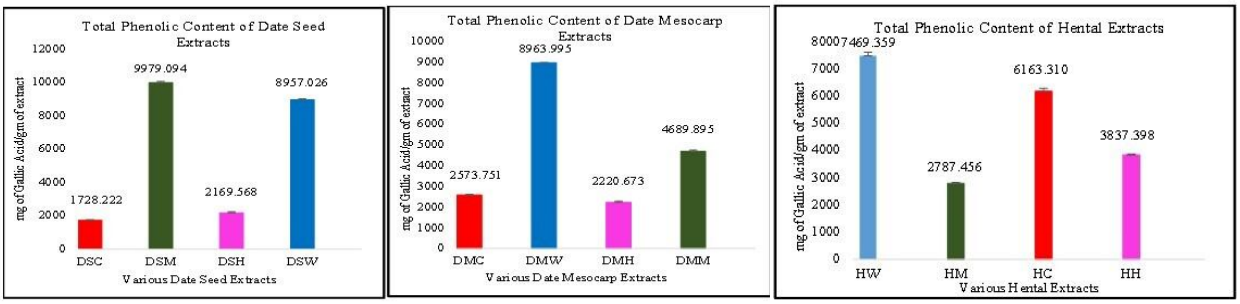
Ferric reducing power capacity: Ferric reducing capacity of Date (seed and mesocarp) and Hental (mesocarp) extracts were determined via FRAP assay and the potency of the extracts were represented by mg of ascorbic acid equivalent antioxidant capacity per gram of extract (mg AEAC/g DW) (Table 2 and Fig. 3). Only, the polar extracts of Date seed (methanol and water) exhibited significantly higher antioxidative potential (321.89±1.62 and 109.67±0.67mg AEAC/g DW, respectively) ($p<0.05$) compared to other polar and non-polar extracts of Date and Hental fruit.

Total phenolic content: To measure total phenolic content of different extracts of Date and Hental fruit, Folin-Ciocalteu assay was performed and the total phenolic content was measured in milligram of gallic acid equivalent per gram of extract (mg GAE/g dry weight) (Table 3 and Fig. 4). Polar extracts of Date seed and mesocarp exhibited higher phenolic content compared to non-polar extracts. Date seed extracts of water and methanol showed phenolic content of 8957±54.1 and 9979.1±82.2 mg GAE/g DW($p<0.05$), whereas Date mesocarp extract revealed the phenolic content to be 8963.9±13.9 (water) and 4689.8±57.0 (methanol) mg GAE/g DW ($p<0.05$), respectively. Extracts of Hental in different solvents, however, showed unconventional results, having water and chloroformic extracts with greater phenolic content (7469.3±136.1 and 6163.3±113.6 mg GAE/g DW, respectively) ($p<0.05$) than methanol and hexane.

Table 3. Results of total phenolic content determination via Folin-Ciocalteu method

Solvents	Total phenolic content determination via Folin-Ciocalteu method (mg GAE/g extract)			
	Hexane	Chloroform	Methanol	Water
DATE (Seed)	$2169.5^{a}\pm68.8$	$1728.2^{b}\pm42.4$	$9979.1^{c}\pm82.2$	$8957^{d}\pm54.1$
DATE (Mesocarp)	$2220.7^{a}\pm69.8$	$2573.7^{a}\pm44.8$	$4689.8^{b}\pm57.0$	$8963.9^{c}\pm13.9$
HENTAL (Mesocarp)	$3837.4^{a}\pm28.2$	$6163.3^{b}\pm113.6$	$2787.4^{c}\pm30.4$	$7469.3^{d}\pm136.1$

Mean and standard deviation of total phenolic content of Date (seed and mesocarp) and Hental (mesocarp) extracts. The total phenolic content was expressed in mg gallic acid equivalent / g DW (mg GAE/g DW). Significant difference at 0.05 probability level.



(a) (b) (c)

Fig. 4. Comparison of total phenolic content of Date and Hental fruit extracts, (a) Seed extracts of Date fruit, (b) Mesocarp extracts of Date fruit, (c) Mesocarp extracts of Hental fruit. The total phenolic content was expressed in mg gallic acid equivalent/g DW (mg GAE/g DW).

Table 4. Results of total flavonoid content determination via aluminium chloride method

	Total flavonoid content determination via aluminium chloride method (mg quercetin equivalent (QE)/g DW)			
Solvents	**Hexane**	**Chloroform**	**Methanol**	**Water**
DATE (Seed)	3849.2^{a}±146.4	1445.6^{a}±30.9	17150.3^{b}±5021.9	5364.9^{a}±7.8
DATE (Mesocarp)	5402.1^{a}±341.2	2120.2^{b}±200.8	4488.6^{c}±264.1	6213.6^{d}±75.9
HENTAL (Mesocarp)	4551.9^{a}±805.4	8566.3^{b}±657.3	1388.7^{c}±40.9	3952.5^{a}±911.4

Mean and standard deviation of TFC of Date (seed and mesocarp) and Hental (mesocarp) extracts. The total flavonoid content was expressed in mg quercetin equivalent/g DW (mg QE/g DW). Significant difference at 0.05 probability level was shown with different lower-case letters, appended at the end.

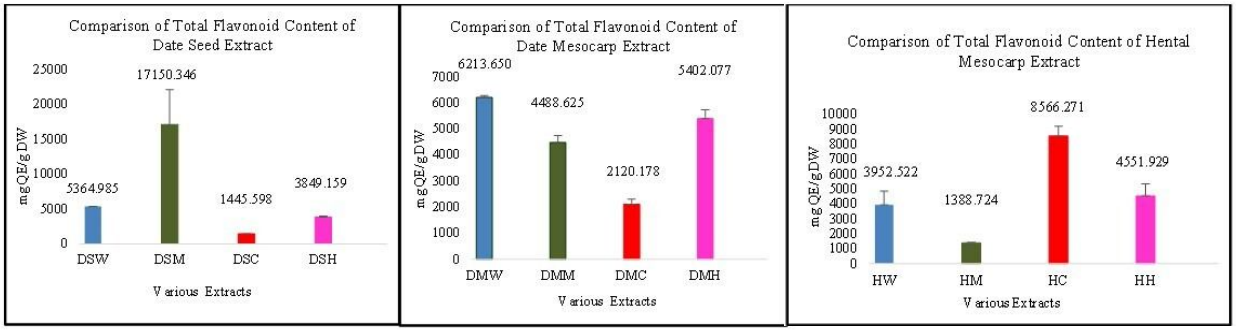


Fig. 5. Comparison of total flavonoid content of Date and Hental fruit extracts, (a) Seed extracts of Date fruit, (b) Mesocarp extracts of Date fruit, (c) Mesocarp extracts of Hental fruit

Total flavonoid content: Total flavonoid content of Date and Hental fruit extract was measured with the help of Aluminium chloride method, and the total flavonoid content was expressed as milligram quercetin equivalent per gram dry weight (Table 4 and Fig. 5). Methanolic extract of Date seed indicated greatest total flavonoid content (17150.3 ± 5021.9 mg QE/g DW) ($p<0.05$) than water extract of Date seed (5364.9 ± 7.8 mg QE/g DW) ($p<0.05$) and other non-polar extracts. Polar extracts of Date mesocarp (water, methanol) and non-polar extract (such as hexane) exhibited relatively higher total flavonoid content. Non-polar extract of Hental mesocarp (Chloroform) showed comparatively higher total flavonoid content (8566.3 ± 657.3 mg QE/g DW) ($p<0.05$) than polar Hental extracts.

DISCUSSION

Date palm tree is indigenous to South Asia, mainly Gulf countries and the Indian peninsular region. There is a record of profound usage of Date fruit in ethnomedicine for imparting a positive impact on human health upon consumption (Vayalil *et al*., 2012; Gnanamangai *et al*., 2019). *Phoenix sylvestris* and *Phoenix paludosa*, locally known as Indian Date and Hental, are two majorly found *Phoenix* sp. in southern Bengal, India and are rather unexplored in terms of their

nutraceutical components and positive biological properties. The study aims to specifically explore the antioxidative properties and also to quantify the nutraceutical compounds of Date and Hental fruit extracts in different non-polar to polar solvents.

The results revealed that in most of the cases, the polar extracts of Date seed generated higher antioxidative activity in DPPH assay with lower IC50 value (for water and methanol, 87.677%±0.196 and 88.977%±0.224 radical scavenging activity) ($p<0.05$) than non-polar extracts. The data is further supported by the results of total phenolic content and total flavonoid content which showed that again the polar extracts of Date seed harboured higher phenolic (for water and methanol, 8957±54.1 and 9979.1±82.2 mg GAE/g DW) ($p<0.05$) and flavonoid content (for water and methanol, 5364.9±7.8 and 17150.3±5021.9 mg QE/g DW) ($p<0.05$) compared to other non-polar extracts. The results of FRAP assay also showed a high antioxidative potential of polar Date seed extracts compared to non-polar extracts. The polar extracts of Date mesocarp also revealed similar results to that of Date seed extracts. Water extract of Date mesocarp exhibited the highest antioxidative activity in DPPH assay (86.675%±0.258 radical scavenging activity) ($p<0.05$) with a lower IC50 value and FRAP assay (75.52±0.93 mg AEAC/g DW) ($p<0.05$). The total phenolic and flavonoid content of water extract of Date mesocarp also showed the presence of a greater content (8963.9±13.9 mg GAE/g DW and 6213.6±75.9 mg QE/g DW) ($p<0.05$).

The polar extracts of Hental (mainly water), in comparison to other non-polar extracts, have also shown similar results to the polar extracts of Date seed and mesocarp. The result of DPPH assay showed radical scavenging activity of 77.867%±1.034 ($p<0.05$) and IC50 value of 0.634 mg/mL and for FRAP assay 46.21±3.08 mg AEAC/g DW($p<0.05$) which are significantly higher compared to non-polar extracts of Hental. However, apart from the polar extracts of Hental, chloroformic extract showed higher phenolic content (6163.3±113.6 mg GAE/g DW) ($p<0.05$) and non-polar extracts (hexane and chloroform) indicated higher flavonoid content (4551.9±805.4 and 8566.3±657.3 mg QE/g DW) ($p<0.05$) than polar extracts of Hental.

The polar extracts of Date and Hental fruits having higher antioxidative potential indicate the presence of certain polar antioxidative components, which can be utilized to diminish damages related to oxidative stress. Overall, among the three extracts of multiple solvents of Date and Hental fruits, methanolic extract of Date seed has shown highest antioxidative potential and can be tested for further analysis to identify and characterize the compounds present in the extract via high performance liquid chromatography. However, further cell based *in vitro* and *in vivo* studies are to be performed in order to determine the effectivity of these extracts. For *in vivo* and cell-based studies, 2 mg/kg concentration of methanolic extract of Date seed can be used due to its highest antioxidative potential at 1 mg/mL in *in vitro* assays. Finally, this novel study effectively identifies and compares the outcomes of the *in vitro* assays and also marks Date and Hental fruits of south Bengal to be a potential source for multiple valuable bioactive compounds which can contribute to the treatment of various diseases.

The objective of the study is to discover and develop techniques (formulations) to abate the usage of side effect prone, synthetic medicines in order to treat oxidative stress related damages. Reliance on natural sources has continuously been increasing due to their positive impacts on human health with additional benefits to the environment. The results of our study have shown that Indian Date and Hental fruits are full of antioxidants and can be considered as a replacement for synthetic medicines which are used to treat conditions like oxidative stress.

Conflict of interest: The authors have declared that no conflict of interest exists in the study.

Author's contribution: AD: Data generation, data analysis, statistical analysis, original draft preparation; ERB: Experimental framework design, supervision, data interpretation, final editing; RD: Collection of fruits, preparation of extracts, data analysis; AM: Data analysis, experiment execution.

Data availability statement: The authors confirm that the data supporting the findings of this study can be availed on reasonable request.

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