Foods 2024 Conference

The 5th International Electronic Conference on Foods

28–30 October 2024 | Online

MDPI

Green approach for phenolic compounds extraction from date fruit (*Phoenix dactylifera* L.)

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INTRODUCTION & AIM

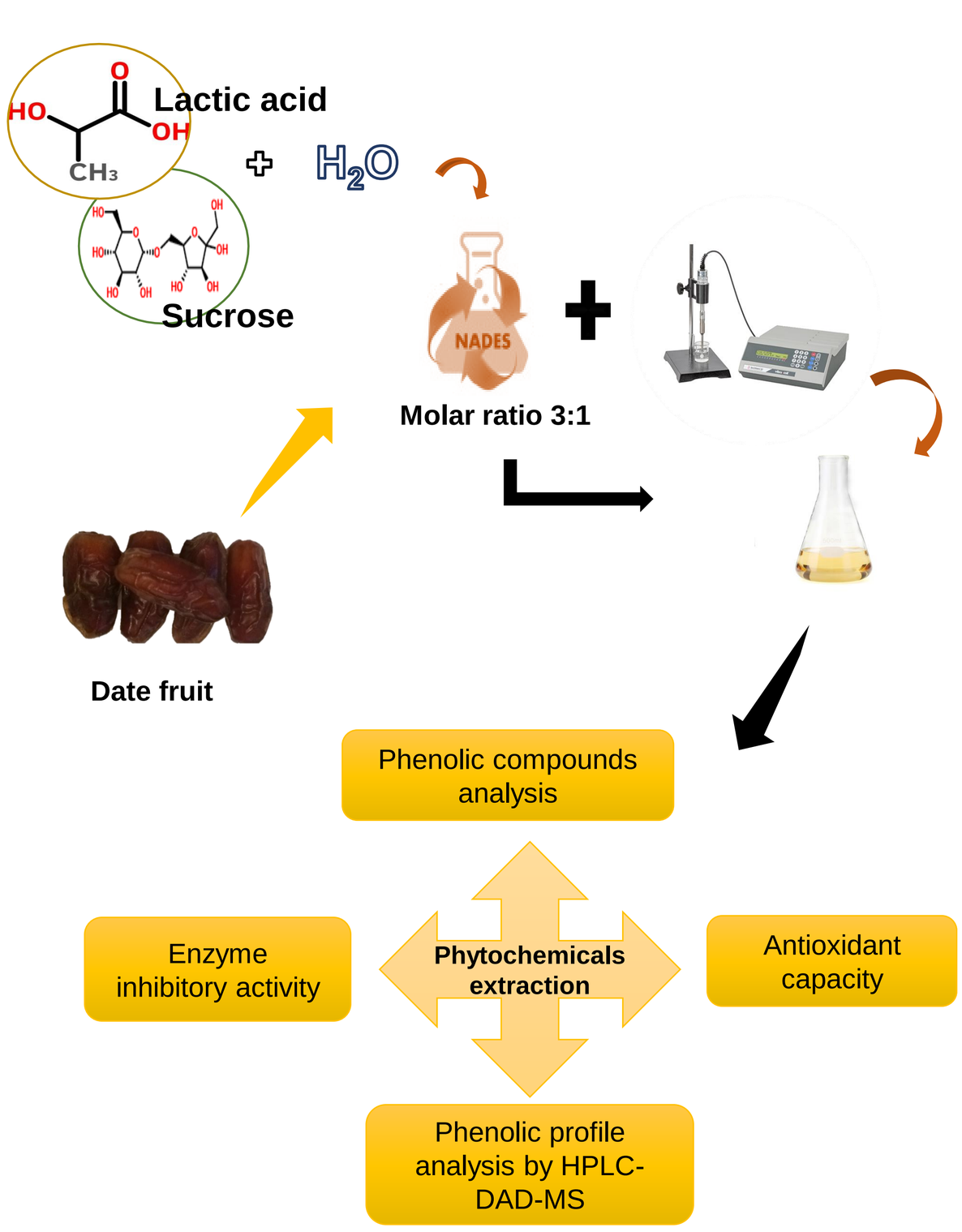
The fruit of the date palm (*Phoenix dactylifera* L.) is an important raw material, highly consumed and appreciated for its high sugar content, source of fast energy, and antioxidant components.

Research on bioactive compounds and nutraceutical properties of the date palm has highlighted the importance of the phenolic compounds and the possibility of using date fruit to develop functional food formulations with promising health potential.

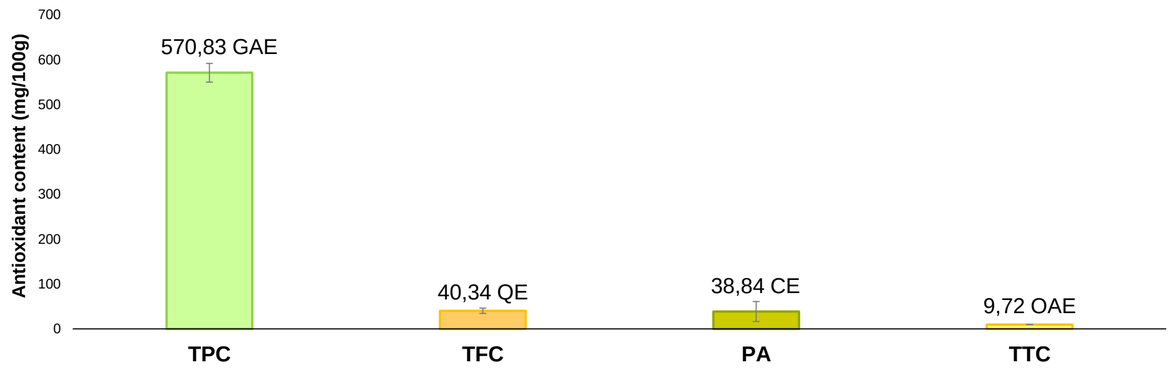
The traditional organic solvents currently used in extraction processes are known to be harmful to the environment and human health. Green and efficient natural deep eutectic solvents (NADES) that can replace the traditional harmful ones have emerged as an alternative to organic solvents due to their beneficial properties, such as reduced environmental impact and energy consumption during extractions, and the fact that the extracted materials can be safely used in the various fields (pharmaceutical, cosmetic, and food industries).

Therefore, the main objective of this work is to investigate NADES efficacy in extracting of bioactive compounds from date palm fruit (Tazizaout cultivar) combined with ultrasound-assisted extraction (UAE) method. This investigation represents a significant innovation in the analysis of the phytochemical composition of date fruit, regarding their antioxidant activity evaluated by various methods and enzyme inhibitory potential against acetylcholinesterase (AChE) and α-amylase.

MATERIALS & METHODS



RESULTS & DISCUSSION



***TPC**: total phenolic content; **TFC**: total flavonoid content; **PA**: proanthocyanidins; **TTC**: total triterpenoids content. **GAE**: gallic acid equivalent; **QE**: quercetin equivalent; **CE**: cyanidin equivalents **OAE**: oleanolic acid equivalent.*

Figure 1: Phytochemicals content of NADES extract from Tazizaout fruit cultivar

Table 1: Antioxidant and enzyme inhibitory potentials of NADES extract from date Tazizaout cultivar

Antioxidant activity					
FRAP (mg AAE/100 g DM)	**DPPH scavenging Activity** (mg AAE/100 g DM)	**ABTS scavenging activity** (mg TE/100 g DM)	**Phosphomolybdenum** (mg GAE/100 g DM)	**NO° inhibition** (%)	**LALP inhibition** (%)
136.58 ± 8.18	27.91 ± 8.61	214.08 ± 19.28	806.44 ± 52.21	45.94 ± 1.55	28.78 ± 1.99
Enzyme inhibitory potential (%)					
AChE	**Standard** (Galantamine)	**α-amylase**		**Standard** (Acarbose)	
34.28 ± 1.51	76.69 ± 0.61	33.25 ± 1.27		79.60 ± 1.28	

LALP: linoleic acid lipid peroxidation

Table 2: Individual phenolic composition determined by HPLC-DAD-MS from date fruit extract of Tazizaout cultivar

Phenolic Composition	mg/100 g DM	Calibration curves equation
Ferulic acid	5.749 ± 0.306	Y= 5E+07x-10514
Vanillic acid	1.738 ± 0.173	Y= 6E+06x-1281.4
Gallic acid	25.274 ± 3.401	Y= 6E+08x- 10578
Isoquercetin	0.01 ± 0.002	Y= 2E+08x+351.27
Rutin	1.087 ± 0.032	Y= 3E+07x-63.393

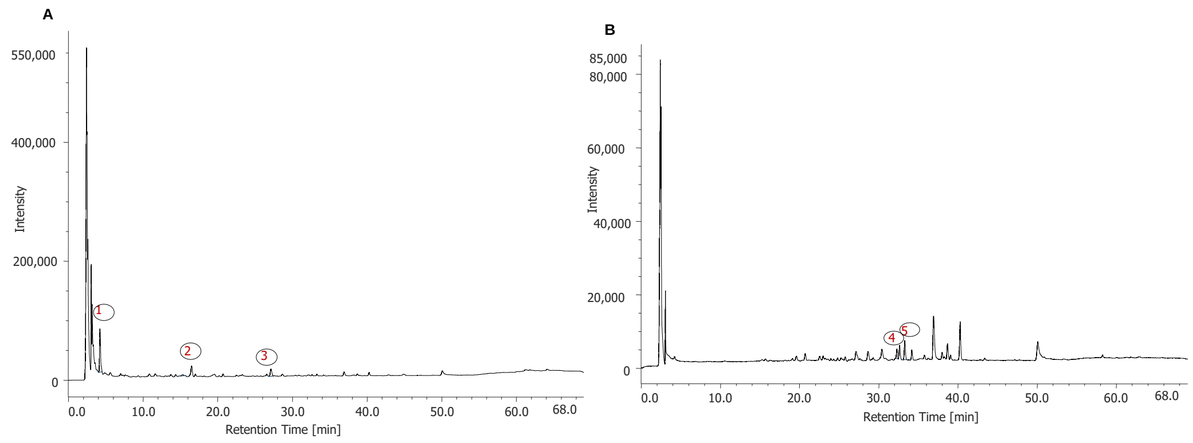


Figure 2: Chromatograms of HPLC-DAD-MS depicting the phenolic acids and flavonoid composition; (**A**) 280 nm and (**B**) 360 nm

1: gallic acid; 2: vanillic acid; 3: ferulic acid; 4: rutin; 5: isoquercetin

CONCLUSION

This work demonstrated that the combination of UAE with a green lactic acid-based system is a very attractive approach to obtaining rich phenolic extracts from date fruits. It was shown that this solvent allows obtaining extracts with a significant content of phytochemicals (phenolic acids and flavonoids) with excellent antioxidant activity and acetylcholinesterase and α-amylase inhibition.

FUTURE WORK

Further research based on *in vivo* and clinical studies is needed to confirm this extracts as viable food matrices with distinct biological properties. In parallel, it may also be interesting to investigate the stability of NADES and gain insight into their physicochemical properties in order to understand their influence on extraction efficiency.