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Comprehensive Phytochemical and Antioxidant Analysis of *Vitis Vinifera L.* Seed and Peel: A Comparative Study of Conventional and Non-Conventional Drying Method

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KEYWORDS

Dried grapes, Peel powder, Freeze-dried grape peel, Sun-dried grape peel

ABSTRACT:

Introduction: *Vitis vinifera* L., recognized as the grapevine, is indigenous to southern Europe and western Asia. It is beneficial to human health as it exhibits anti-diabetic, anti-inflammatory, anti-obesity, cardioprotective, vasorelaxant and immunomodulatory properties.

Objectives: The study aims to find out the comparison of phytochemical profile and antioxidant activity of conventionally and non-conventionally dehydrated grape peel powder.

Methods: The peel of thegrape was dried by sun-drying, shade-drying, cabinet drying and freeze-drying for seven consecutive days. The dried grape peel was powdered and extracted using aqueous, ethanol (70%) and methanol (90%) solvents. Characterization of the peel sample was evaluated before and after using different drying techniques

Results: Fifty gram of originally dried peel changed into shades of mauveine colour and weight changes occurred between 37g-31g by different modes of dehydration. The result shows the confirmed presence of alkaloids, flavonoids,sterols, anthraquinones, anthocyanins, phenolic compounds, proteins and volatile oil. Sundried [SD] (IC_{50} 90.16 M) and freeze-dried [FD] (IC_{50}93.44M) samples show maximum antioxidant activity yield maximum in methanol concentration. No significant difference between the phytochemical profile and antioxidant activity of different drying methods of grape peel was observed.

Conclusions: It is concluded that this study provides an insight into the phytochemical profile and antioxidant activity of conventionally and non-conventionally dried grape peel powder and higher activity in sun-dried [SD] and frozen grape [FD] peel powder than shade-dried [SHD] and cabinet-dried [CD] grape peel powder.

1. Introduction

A recent trend in the scientific community is to generate sustainable food products or drugs from food waste [12] that lowers the industrial processing residues. Grapes can be organized as table or wine grapes, depending on their intended use in the future. Wine grapes are used to make wine, while table grapes are mostly used for their raw edible qualities [2]. Grape peel is a solid organic waste from the juice and wine industry which is discarded deliberately [1]. Since 2015,the researcher developed several new technologies with a new application on

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the grape peel that dominated the area of food and several medical, and dental products as well [3].*Vitis vinifera* L. is embodied with seeds, stems and peels that contain a broad range of phytonutrients largely phenolic compounds[4]. Previous literature concluded that the resistance of *Vitis vinifera L.* to harmful circumstances *in-vivo* and *in-vitro* is largely dependent on phenolic compounds, and environmental and climatic factors have been found to have an impact on their synthesis [3]. As per ancient medicinal practice, this particular fruit is considered an alternative medicine for several common health disorders. As it is herbal in nature, it is considered a valuable reservoir for uncovering molecules with a propitious health effect.

Dehydration process is the well-understood liquid-solid uncoupling process in the food industry to outstretch any product's shelf-life through the inhibition of the growth and activity of the micro-organisms [14]. Since the drying procedure requires thermal energy and about 12% of the total energy is pre-owned by the manufacturing industry, thus it is considered an energy-intensive unit operation via the phase changes process of the water removal technique [4]. Depending upon the dehydration procedure, character, form, appearance, taste, colour and flavor will be retained. Raw grape peels are edible waste and also a value-added element that can be processed both conventionally and non-conventionally for storage, transit and extraction of the functionalized molecule without negatively affecting nutritional parameters [5] .Prioritizing non-conventional drying methods includes lesser usage of hazardous solvents to achieve satisfactory results [6].

2. Methods

Collection of sample

Whole fresh grapes are collected as an exemplification from Madhampatty grape farm, Coimbatore and authenticated at Botanical Survey of India, Tamil Nadu Agricultural (TNAU) Coimbatore, India (BSI/ SRC/5/23/2022/Tech/491) and identified as *Vitis vinifera* L., - VITACEAE, commonly known as Muscat grapes.

Preparation of sample

Four kilograms of whole fresh grapes were cleaned thoroughly and the skins were peeled by a stainless-steel knife. Grape peels [13] were collected and divided into four air- tight containers of the same weight of each. Different types of dehydration experiments were performed with the prepared sample until the final moisture content reached below 5% [4]. The drying experiment was conducted using two different modes of drying, i.e. indigenous conventional mode and non-conventional drying method (Figure 1).

In the conventional modes of drying: sun-dry [SD] and shade dry [SHD] are widely used drying methods. Depending upon the indigenous temperature which is 33°C during the experimental sun drying session, 50gm grape peel was placed on stainless steel plate under the Sun from 10 am to 4 pm for two consecutive days (Figure 1).

Similarly, shade dry [SHD] was performed at an uncontrolled temperature of 27°C for seven consecutive days duration of 6 hrs.

To obtain a freeze-dried [FD] peel sample, peels were pre-frozen at -20°C for 24hrs. Frozen peels were lyophilized -at 45°C temperature and a vacuum pressure of 0.010-0.012 for 7 days.

The cabinet drying method is a widely used non-conventional modes drying method where a hot tray is placed under 80°C for 7 continuous days.

All four samples were powdered using a mixer grinder and kept in Ziploc bags until analysis. Aqueous, ethanol (70%) and methanol (90%) solvents were used for extraction for the phytochemical profile and antioxidant activity of four types of peel samples [9].

Phytochemical Profile of Sample

The samples were subjected to quality analysis for phytochemical profiling (Table 1) to check for the presence of seventeen metabolites. Both conventional and non-conventional dried peel powder was used for further analysis using different solvent extraction to identify phytochemical [l0].

Antioxidant Activity of Sample

All four samples were examined for free radical scavenging activity using the DPPH(2,2- diphenyl-1-

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picrylhydrazyl) assay. Aqueous extracts were assessed for oxidation inhibitor activity, based on ascorbic acid as a standard. The alloy of the absorbance and blank was deliberated at 517nm at ambient temperature. The DPPH radical & scavenging effect was shown as a percentage inhibition against the concentration in the sample.

Statistical analysis of the sample

Each observation was calculated in one-way ANOVA and compared to Sigma Plot, version 14.5. Samples were also correlated with the dehydration method and their antioxidant activity.

3. Results nad Discussion

Characterization

Peel of *Vitis vinifera* L is rich in moisture content and unable to store without the implementation of a preservation method [7]. The effect of different types of dehydration techniques can affect the quality of phytochemicals and oxidation inhibitor properties. Shade dried [SHD] peel powder did not show substantial changes in the parameter of colour and weight (Table 1). Maximum dehydrated weight changes and colour changes occur in cabinet-dried [CD] peel samples. Sun- dried sample [SD] necessitated fewer days than any other drying method.

Phytochemical profile of samples

The preliminary phytochemical screening [8] enhances the proof that the various solvent extract of different types of dehydrated peel powder contained alkaloids, flavonoids, phenolic compounds, sterols, anthraquinones, andanthocyanins. The presence of alkaloids and flavonoids was found in a higher degree of precipitation [11] and phenolic compounds, sterols, anthraquinones, andanthocyanins were low in amount in all extracts (Table 2).

Antioxidant activity of samples

The ability of the scavenging power of a hydrogen shift toa radical determined the usage of DPPH (2,2-diphenyl-1-picrylhydrazyl)solution in the analysis rapidly using aqueous, ethanol and methanol extract of *Vitis vinifera* L .peel sample. An expeditious change in colour occurs from light-coloured to colourless which demonstrates the scavenging capacity present in the extract. Figure 1 depicted that the dehydrated peel sample scavenged inhibition at an accumulation of 10 ug/ml which can be equalized with ascorbic acid (90.43%). It is interpreted as sundried [SD] and freeze-dried [FD] peel exhibiting the highest scavenging capacity amidst other examined extracts.

IC_{50} values constituted the efficacy to attain its 50% scavenging capacity where IC_{50}value and antioxidant value were conversely proportionate- the lower the IC_{50}value, the higher the scavenging action.

Statistical analysis

Each type of dried peel sample was compared wield Pearson correlation and one-way ANOVA. The P-value of each sample differs as the drying method is different. Among all peel powder samples, the shade-dried peel powder sample is the only sample that is statistically not signified (P=1.069). Other treatment groups of the dried sample are statistically significant and the one- tailed P-value = 0.0871, 0.0947, 0.113 respectively.

4. Conclusion

The present study concluded that the different modes of drying with different types of extraction had a positive effect on the phytochemical profile and oxidation inhibitor activity but there is no significant interconnection between the phytochemical profile and scavenging activity. Individual dehydrated samples in aqueous, ethanol and methanolic extracted peel samples exhibited good results which may be utilized in the pharmacological industry. The inclusion of*Vitis vinifera L.* peel into the circadian diet is very much advantageous as it takes effect as a functional food.

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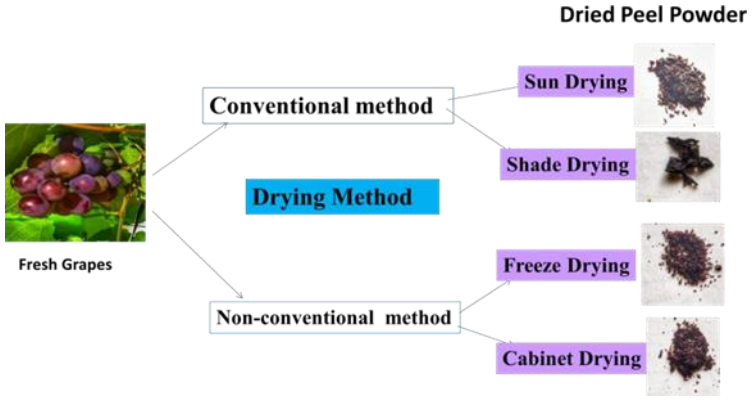

Figure 1. Preparation of the sample

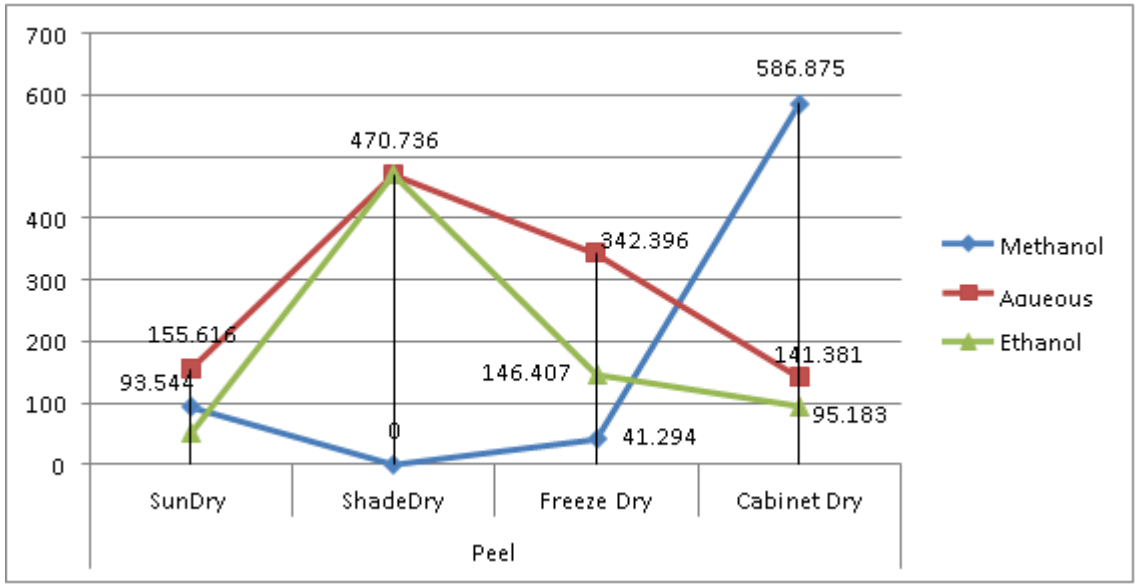

Figure 2. IC_{50}scavenging value of the

Table 1. Characterization of dried peel powder

Serial No.	Metabolites	Sun Dry [SD]			Shade Dry [SHD]			Freeze Dry [FD]			Cabinet Dry [CD]		
		A	E	M	A	E	M	A	E	M	A	E	M
1	Alkaloids	-	+	++	-	+	++	+	++	++	-	+	++
2	Flavonoids	++	-	++++	+	-	_	++++	++	++	++	++	+++
3	Sterols	-	-	-	-	-	-	+	+	+	-	-	-
4	Terpenoids	-	-	-	-	-	-	-	-	-	-	-	-
5	Anthraquinones	+	-	-	-	-	-	+	-	-	-	-	-

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6	**Anthocyanins**	-	-	-	-	-	-	-	-	+	-	-	-
7	**Phenolic Compounds**	+	-	-	+	-	-	+	-	+	+	-	-

Table 2. Phytochemical activity of dried peel powder

Drying Method	**Temperature (**°C)	**Number of days**	**Changes in Peel**		
			Colour	**Weight(g)**	
				Before	**After**
Sun Drying[SD]	33	2	Dark Mauveine	50	32.2
Freeze Drying[FD]	-45	7	Dark Mauveine	50	35.8
Cabinet Drying [FD]	80	3	Blackish Mauveine	50	31.8
Shade Drying [SHD]	27	7	Original Colour	50	37.9