Nutritional and Biochemical Analysis of Wine Locally Produced from *Phoenix Dactylifera*[1]

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ABSTRACT

The *Phoenix dactylifera* fruit, commonly known as dates, has been a popular food commodity in Egypt and other Arab countries for centuries. It is known for its high energy content and popularity as a food commodity. While there is limited information available about its use in wine production, this study aimed to analyze the composition of *Phoenix dactylifera* wine in terms of amino acids, nutrients, phytochemicals, physicochemical properties, and mineral content. The wine sample was prepared locally and stored in a refrigerator for two years. The analysis revealed that the wine had a moisture content of 82.40%, carbohydrates of 9.14%, and protein of 0.28%. The ash, fat, and crude fiber content were found to be 0.12%, 0.32%, and 5.16%, respectively. Essential amino acids like isoleucine, leucine, histidine, lysine, and threonine, as well as non-essential amino acids like glutamine, glutamic acid, serine, alanine, proline, and aspartic acid, were identified from the study. Some amino acids such as asparagine, glutamine, serine, and glutamic acid were found in higher concentrations: 132.4±7.3mg/100ml, 122.5±5.5mg/100ml, 117.9±1.4mg/100ml, and 260.4±11.0mg/100ml, respectively. Various minerals including lead, aluminum, calcium, zinc, phosphorus, sulfur, and iron were detected in the wine, with concentrations falling within the recommended daily allowance by WHO. For example, the estimated concentrations of potassium, phosphorus, and zinc were 4.90mg/100ml, 2.60mg/100ml, and 0.09mg/100ml, respectively, while the WHO recommended daily allowances for these minerals are 3500mg, 1000mg, and 15mg, respectively. The findings suggest that *Phoenix dactylifera* wine has potential nutritional and biochemical value.

Keywords: *Wine; Phoenix dactylifera; Proximate; Amino Acids; Minerals*

INTRODUCTION

The term "wine" originated from the Greek word "oines," and the scientific study of wine is known as "oenology." Wine production begins with the harvest of grapes, which are the primary fruit used in winemaking. The process involves extracting the juice from the grapes, separating it before fermentation, and concluding with various storage and aging methods [1]. While wine has traditionally been defined as an alcoholic beverage made from fermented grape juice, it has also been extended to include alcoholic beverages from fermented fruits and vegetables. Alcoholic and fermented drinks hold cultural acceptance for consumption, entertainment, customary practices, and religious purposes [2]. In addition to grapes, apples, berries, and blackcurrants are sometimes fermented for wine production. Grape berries possess a natural chemical balance that allows for complete fermentation without the need for added sugar, enzymes, or nutrients. Grapes are rich in vitamins, provitamins, essential and non-essential amino acids, minerals, fatty acids, fiber, and other beneficial components. While other fruits share similar properties, they have also been discovered and utilized in wine production [3]. Wine production processes are popular worldwide, including in Europe, America, Australia, Asia, and now, Africa [4]. During the fermentation stage of wine production, yeast, such as *Saccharomyces cerevisiae,* is used. This microorganism digests the sugars present in the fruit juice, producing alcohol and carbon dioxide gas as byproducts [5].

Dates are the sweet fruits of the *Phoenix dactylifera* tree, commonly known as the date palm. They are relished worldwide by people of all age groups, primarily as a source of energy. Dates are rich in minerals, including

[1] *How to cite the article:* Tatah S.V., Ayantse M.L. (2023); Nutritional and Biochemical Analysis of Wine Locally Produced from Phoenix Dactylifera; *Multidisciplinary International Journal;* Vol 9 (Special Issue), 248-257

potassium, calcium, and iron, as well as antioxidants and flavonoids [6]. Their high dietary fiber content makes them a beneficial food supplement for individuals with hyperglycemia [7]. Despite their popularity, there is limited knowledge about alcoholic beverages produced from dates. However, the high sugar content of dates has been commercially utilized for vinegar production. *Phoenix dactylifera* is a tropical and subtropical tree belonging to the Palmae (Arecaceae) family. It has been cultivated for over 7,000 years and holds significant cultural and practical importance, particularly in the Arabian Peninsula [8]. Date production, utilization, and industrialization are continuously increasing worldwide, with major date-producing countries such as Egypt, Saudi Arabia, Iran, the UAE, and Algeria experiencing growth. Date fruits are marketed globally as high-value confectionery, and as a fresh fruit, they remain an important subsistence crop in desert areas. They are primarily produced in hot arid regions, especially in Gulf Cooperation Council (GCC) countries, with Saudi Arabia being a major [9].

The development of date fruits is divided into three stages: Khalal, Rutab, and Tamr. Dates are typically harvested at the fully ripened Tamr stage when they reach a Total Soluble Solids (TSS) level of 60–70 brix, which is edible at this stage. Most dates are consumed at the Rutab (semi-ripe) and Tamr (fully-ripe) stages with minimal or no processing. A significant amount of waste is generated from the Kabkab date variety, which has the potential for use in date syrup production with economic advantages [9]. The date palm is a perennial dioecious plant, with female trees typically bearing fruits after approximately four years, depending on agronomic practices. It is a monocotyledonous plant with a fibrous root system and a vertical columnar trunk of consistent girth. The fruit is a single oblong one-seeded berry with a terminal stigma, a fresh pericarp, and a membranous endocarp [8].

MATERIALS AND METHOD

Sample Collection

A 200 ml sample of *Phoenix dactylifera* wine was collected from the microbiology laboratory at Federal University Wukari, Taraba State. The wine had been locally prepared and stored in a refrigerator for approximately two years.

Amino Acid Profile Analysis

The amino acid composition of the wine was analyzed using ion-exchange chromatography and a colorimeter. The different amino acids present in the sample were separated based on their charges and collected in separate containers by eluting with a sodium extract buffer. Each amino acid was identified by calculating the volume of buffer required for elution and determining its pH, comparing it with a standard. A fixed volume of each identified amino acid was collected in test tubes, and ninhydrin solution was added to each. The test tubes were covered with aluminum foil and placed in a boiling water bath for 15 minutes. After cooling in cold water, 50% ethanol was added to each test tube and mixed thoroughly. The concentration of each amino acid was determined using a colorimeter.

Proximate Analysis

Moisture

An aluminum dish was heated in a cabolite oven at 105 degrees Celsius for approximately 5 minutes to eliminate any residual moisture. The dish was then allowed to cool in a desiccator. The weight of the dish was recorded, and 10 ml of the wine sample was poured into the dish and reweighed. The dish with the sample was placed in the oven at 105 degrees Celsius for 24 hours. After cooling in a desiccator, the dish with the dried sample was weighed. The moisture content was calculated as follows:

Weight of moisture = (weight of sample and dish) - (weight of dried sample and dish)

% weight of dried sample = 100

% weight of moisture Dry matter = 100 - % weight of moisture

Fat

The fat content was determined using [10] method. A 10 ml sample of the wine was collected in a beaker and transferred to a thimble, which was then placed in the extractor chamber. Approximately 50 ml of petroleum ether was added to the beaker, and the thimble with the sample was positioned over it. The machine was powered on, and boiling and extraction were allowed to occur for 10 minutes. The thimble was raised for rinsing down the extracted fat into the beaker, followed by the removal of used petroleum ether for an additional 10 minutes. After removing the used petroleum ether, the beaker with the extracted fat was placed in an oven to evaporate the remaining petroleum ether. It was then cooled in a desiccator and weighed. The weight obtained was used to calculate the fat content as follows:

Weight of fat = (weight of sample and beaker) - (weight of empty beaker)

% weight of fat = (weight of fat / weight of sample and beaker) × 100

Crude Fiber

A 10ml portion of the defatted sample was weighed and placed in a glass container. Then, 50ml of glacial acetic acid were added to the sample, which was heated at 200-400^{0}C in a fume cupboard for 45-60 minutes to facilitate digestion. After digestion, the sample was thoroughly filtered using pre-weighed filter paper and dried in an oven at 100^{0}C for 24 hours. The dried residue was weighed and recorded. The residue was further ashed in a crucible at 580-600^{0}C for 4-5 hours in a furnace and weighed.

The calculation for fiber content was as follows:

Weight of residue = weight of filter paper + residue - weight of filter paper Weight of ash = weight of ash + crucible - weight of empty crucible

Weight of crude fiber = weight of ash - weight of residue

Ash

According to [10], an empty crucible was weighed and recorded. Then 10ml of the sample were added to the crucible and ashed in a furnace at 500-600^{0}C for 2-4 hours. After ashing, the crucible was removed, cooled in a desiccator, and weighed. The calculation for ash content was as follows:

Weight of Ash = (Weight of crucible + ash) - (Weight of crucible)

Percentage Weight of Ash = (Weight of ash / weight of sample) × 100

Crude Protein

The crude protein content was determined using the Kjeldahl method. Approximately 10ml of the wine sample were weighed into a micro Kjeldahl digestion flask, and a selenium catalyst tablet was added. The mixture was digested on

an electrothermal heater until a clear solution was obtained. After cooling, it was diluted with distilled water to a volume of 50ml. Five (5) milliliters of the diluted solution were transferred to a distillation apparatus. In a separate 100ml conical flask (receiver flask), 5ml of 2% boric acid and four drops of screened methyl red indicator were added. Approximately 50% NaOH was added to the digested sample until the solution turned cloudy, indicating alkalinity. Distillation was then carried out into the boric acid solution in the receiver flask, with the delivery tube placed below the acid level. As distillation proceeded, the pink-colored solution in the receiver flask turned blue, indicating the presence of ammonia. Distillation continued until the flask content reduced to about 50ml, and the delivery tube of the condenser was rinsed with distilled water. The resulting solution in the conical flask was titrated with 0.1M HCl [10].

Carbohydrate

The carbohydrate content in the sample was determined by calculation:

Weight of carbohydrate = sum of values (protein, ash, fat, phosphorus, fiber, moisture, and calcium) 100

Physicochemical Analysis

Alcohol

The alcohol content of the wine sample was estimated using a refractometer. Two drops of the wine sample were placed on the refractometer's prism, and the alcohol percentage was directly viewed and recorded.

Sugar

2ml of the wine sample were mixed with distilled water in a beaker to make a total volume of 100ml. Phenolphthalein (2-3 drops) was added, followed by NaOH solution until the solution turned pink. Then, HCl was continuously added until the solution regained its original color. Distilled water was added to reach the 200ml mark (V1). Five grams of Curic acid were added to 50 milliliters of the above solution, which was then boiled in a water bath for 10 minutes. After cooling, distilled water was added to reach the 200-milliliter mark (V2). 2ml of the wine sample were mixed with 5ml of Fehling solution A and B, and the mixture was boiled for 2 minutes. After cooling, 2-3 drops of ethylene blue were added, and the wine solution was titrated with the V2 volume until a brick red color appeared.

Total sugar = (Fehling solution constant × 200 × 200 × 100) / (2 × 50) × volume of the wine solution used for titration

pH

The pH meter used for the analysis was calibrated using distilled water. 2ml of the wine sample were accurately weighed and dissolved in 25ml of distilled water in a conical flask. The pH meter's electrode was inserted into the beaker containing the solution, and the reading was directly taken from the meter's screen.

Temperature

The temperature of the wine sample was measured using a laboratory thermometer. 2ml of the wine sample were mixed with 20ml of distilled water in a 100ml beaker, and the thermometer was directly inserted into the solution.

Phytochemical Analysis

Saponin

2ml of the wine sample were weighed and placed in a 125ml conical flask. One hundred milliliters of isobutyl alcohol were added, and the mixture was shaken for 5 hours using an electric shaker. The mixture was then filtered using a No. 1 Whatman filter paper into a 100ml beaker containing 20ml of a 40% saturated solution of magnesium carbonate ($MgCO_3$). The obtained mixture was filtered again to obtain a clean, colorless solution. 2ml of the colorless solution were transferred to a 50ml volumetric flask using a pipette. 2ml of 5% iron (III) chloride ($FeCl_3$) solution were added, and the flask was filled up to the mark with distilled water. After standing for 30 minutes for the color to develop, the absorbance was measured at 380 nanometers using a spectrophotometer [11].

Cardiac Glycoside

2ml of the wine sample were pipetted into a 250ml conical flask. 50ml of chloroform were added, and the mixture was shaken using an electric shaker for 1 hour. The mixture was then filtered into a 125ml conical flask. 10ml of pyridine and 2ml of 29% sodium nitroprusside were added and shaken for 10 minutes. 3ml of 20% NaOH were added, resulting in the development of a brownish-yellow color. A standard glycoside (Digitoxin) was prepared with concentrations ranging from 0 to 50mg/ml. The absorbance was measured at 510nm [12].

Flavonoid

The total flavonoid content was determined using the aluminum chloride method with catechin as a standard. 2ml of the wine sample and 4ml of distilled water were mixed in a 10ml volumetric flask. After 5 minutes, 0.3ml of 5% sodium nitrite and 0.3ml of 10% aluminum chloride were added. The mixture was incubated at room temperature for 6 minutes. Then, 2ml of 1 molar sodium hydroxide were added, and the final volume was immediately made up to 10ml with distilled water. The absorbance was measured at 510nm using a spectrophotometer [13].

Alkaloid

2ml of the wine sample were mixed with 5ml of phosphate buffer (pH 4.7) and 5ml of BCG solution in a 100ml volumetric flask. The solution was diluted with chloroform to adjust the volume. The absorbance of the complex in chloroform was measured at 470nm against a blank without the sample. Atropine was used as a standard material, and the mixtures were compared to determine atropine equivalents.

Tannin

2ml of the wine sample were mixed with 0.5ml of Folin-Ciocalteau's reagent. 1ml of saturated Na_3CO_3 solution and 8 milliliters of distilled water were added to the mixture. The reaction mixture was allowed to stand for 30 minutes at room temperature. The supernatant was obtained by centrifugation, and the absorbance was recorded at 725nm using a UV-visible spectrophotometer. Increasing concentrations of standard tannic acid were prepared, and the absorbance of the various tannic acid concentrations was plotted on a standard graph.

Mineral Composition

The minerals in the wine sample were analyzed using a spectrophotometer. 2ml of the wine sample were collected in a 50ml volumetric flask. 2ml of perchloric acid, 1ml of H_2SO_4, and 5ml of HNO_3 were added to the sample. The mixtures were evaporated almost to dryness on a water bath. After cooling, the solution was filtered into a 100ml standard flask and diluted to volume with distilled water. The minerals were analyzed separately using an atomic absorption spectrophotometer.

RESULTS

Amino Acid

The amino acid profile of the locally produced wine from Phoenix dactylifera revealed the presence of various amino acids as shown in the table below. These results provide insights into the amino acid composition of the Phoenix dactylifera wine, contributing to the overall understanding of its nutritional and biochemical properties.

Table I: Quantitative and qualitative constituent of amino acid profile of locally produced wine from *phoenix dactylifera*.

Sr. No.	*Parameters*	*Concentration found (mg/100ml)*	
1	Asp	+	132.4±7.3
2	Glu	+	122.5±5.5
3	Ser	+	117.9±1.4
4	Gln	+	260.4±11.0
5	His	+	14.2±0.9
6	Arg	+	22.6±0.4
7	Thr	+	7.47±5.2
8	Ala	+	1.924±5.9
9	Tyr	+	34.0±0.7
10	Val	+	38±12.1
11	Ile	+	6.1±0.2
12	Leu	+	29.8±1.4
13	Phe	+	19.1±1.2
14	Pro	+	40.0±16

Proximate composition of locally produced wine from *phoenix dactylifera*.

The analysis of the proximate composition of the locally produced Phoenix dactylifera wine revealed the following composition percentages: 82.40% moisture, 0.120% ash, 0.320% fat, 9.14% carbohydrates, 5.16% fiber, and 0.280% protein. These findings provide important insights into the nutritional composition of the wine, including its moisture level, ash content, fat content, carbohydrate content, fiber content, and protein content.

Table II: Proximate analysis of locally produced wine from *phoenix dactylifera*.

Sr. No.	*Parameters*	*Percentage composition (%)*
1	Moisture	82.40
2	Ash	0.120
3	Fat	0.320
4	Carbohydrate	9.14
5	Fiber	5.16
6	Protein	0.280

Physicochemical composition of locally produced wine from *phoenix dactylifera*.

Table 3 presents the estimated values of temperature, pH, sugar, and alcohol for the locally produced Phoenix dactylifera wine. The temperature of the wine was found to be approximately 22°C, indicating the average temperature at which the wine was analyzed. The pH value was determined to be 5.7, suggesting a slightly acidic nature of the

wine. The sugar content was estimated to be 3.60%, reflecting the level of sweetness present in the wine. Additionally, the alcohol content was measured to be 8.43%, indicating the percentage of alcohol by volume in the wine. These results provide specific details about the temperature, acidity, sweetness, and alcohol concentration of the Phoenix dactylifera wine.

Table III: Estimated Values of Temperature, pH, Sugar and Alcohol

Sr. No.	*Parameters*	*Value*
1	Sugar%	3.60
2	Alcohol%	8.43
3	Temperature(°C)	22.00
4	pH	5.70

Qualitative and quantitative Phytochemical constituents of locally produced wine from *phoenix dactylifera.*

Table 4 presents the results of the identification of various compounds in the locally produced Phoenix dactylifera wine. These findings provide important information about the presence and quantities of these specific compounds in the wine, contributing to the overall understanding of its nutritional and biochemical properties.

Table IV: Qualitative and quantitative Phytochemicals constituent of locally produced wine from *phoenix dactylifera*.

Sr. No.	*Parameters*	*Concentration found (mg/100ml)*	
1	Saponin	+	3.302
2	Tannin	+	2.675
3	Flavonoid	+	1.967
4	Glycoside	+	1.853
5	Resin	+	0.9380
6	Alkaloid	+	2.562
7	Terpen	+	3.201
8	Cardia glycoside	+	1.842

Mineral composition of locally produced wine from *phoenix dactylifera*.

Table 5 provides information on the mineral composition of the locally produced Phoenix dactylifera wine. The following minerals were identified and quantified: lead (1.30mg/100ml), aluminium (2.02mg/100ml), calcium (2.50mg/100ml), sodium (3.00mg/100ml), magnesium (2.25mg/100ml), zinc (0.090mg/100ml), potassium (4.90mg/100ml), phosphorus (2.6mg/100ml), and iron (0.240mg/100ml). These results highlight the presence and concentrations of these minerals in the wine, providing valuable insights into its mineral content.

Table V: Mineral composition of locally produced wine from *phoenix dactylifera*.

Sr. No.	*Parameters*	*Percentage composition (%)*
1	Lead	1.30
2	Aluminium	2.02
3	Calcium	2.50
4	Sodium	3.00
5	Magnesium	2.25
6	Zinc	0.090
7	Potassium	4.90
8	Phosphorus	2.60
9	Iron	0.240

DISCUSSION

Wine, traditionally produced by fermenting ripe grape juice with Saccharomyces cerevisiae, has been shown to have significant health benefits when consumed in moderation. Recently, there has been growing interest in producing wine from fruits other than grapes. However, the scientific literature suggests that limited research has been conducted on Phoenix dactylifera, commonly known as the date fruit. In this study, we conducted a comprehensive analysis of the nutritional and biochemical properties of locally prepared wine from Phoenix dactylifera. Our analyses included amino acid profiling, physicochemical characterization, phytochemical composition, proximate composition, sugar-alcohol content, and mineral composition. The results are presented in Tables 4.1 to 4.6.

The concentrations of alanine, glutamine, and leucine obtained in our study (1.9±5.9mg/100ml, 122.5±5.5mg/100ml, and 29.8±1.4mg/100ml, respectively) were comparable to those reported by [14]: 1.942mg/100ml, 127.538mg/100ml, and 31.894mg/100ml, respectively. These amino acid concentrations fell within the recommended daily allowances, indicating that the wine is safe for consumption. The presence of essential amino acids in the wine makes it an important product with potential benefits for human health. For example, phenylalanine, a precursor to neurotransmitters like tyrosine, dopamine, epinephrine, and norepinephrine, plays a crucial role in protein and enzyme structure, as well as the production of other amino acids. Valine stimulates muscle growth and is involved in energy production, while histidine is used in histamine production, which is vital for immune response, digestion, and sexual function. Additionally, the concentration of phenylalanine and leucine in the wine (25.1±24.2mg/100ml and 29.8±28.4mg/100ml, respectively) was found to be significantly higher compared to the study by [15]: (30.095mg/100ml and 31.894mg/100ml, respectively) with a significance level of $P<0.05$. However, the concentrations were similar to those reported by Sobhy and Ahmed in 2010. This significant difference could be attributed to variations in the methodologies employed by [15] or it may be that these amino acids naturally occur in lower amounts in grapes.

In terms of proximate composition, our findings were consistent with previous studies by [16] and [17]. Our analysis showed a moisture content of 82.40%, while Mohammed *et al.,* [16] and Awe *et al.,* [17] reported values of 88.66% and 79.5%, respectively. The ash, lipid, and crude protein contents were 0.12%, 0.32%, and 0.28%, respectively. Notably, our study revealed a significantly higher fiber content (5.16%) compared to Awe *et al.,* (2013) who reported 0.01% ($p<0.05$). This elevated fiber content can be attributed to the flesh of the fruit, which contains notable amounts of cellulose (1.55%), hemicellulose (1.28%), and lignin (2.01%) on a fresh weight basis [18]. The abundant dietary fiber in dates is mainly insoluble, which plays a crucial role in food digestion and acts as an anti-cancer agent.

The physicochemical analysis provided us with estimated values of temperature and pH for the wine: 22°C and 5.7, respectively. These findings were consistent with the pH value reported by [16] as 5.6. The estimated pH value in our research indicated that the wine is close to neutral, suggesting it is safe for consumption even by individuals with certain disorders such as stomach ulcers.

Our qualitative and quantitative phytochemical analysis revealed that the wine is rich in tannins, saponins, flavonoids, alkaloids, terpenes, cardiac glycosides, and other alkaloids. The concentrations of saponin, tannin, flavonoid, alkaloid, and terpene were quantified as 330.25mg/100ml, 267.50mg/100ml, 196.58mg/100ml, 256.24mg/100ml, and 320.11mg/100ml, respectively (Table 5). The tannin concentration in our study was significantly higher than that reported by [19]: 2.675mg/100ml and 0.22mg/100ml ($P<0.05$). Tannins are known for their medicinal properties, including the treatment of intestinal troubles, fever, edema, and liver diseases [20]. The flavonoid concentration in our study was lower compared to [21]: 1.9658mg/100ml and 6.94mg/100ml. Moreover, our study identified the presence of glycosides, resins, and cardiac glycosides, which were absent in the work of [21]. The higher concentrations of these phytochemicals in our study suggest that the wine has potential medicinal benefits and can be used in the treatment of various diseases.

The sugar and alcohol content in our study were estimated as 3.60% and 8.43%, respectively. The sugar content was higher than that reported by [22], whose value was <0.99±0.02. However, the alcohol percentage was consistent with [22]: 8.43% and <9.2±0.01%, respectively.

The mineral composition analysis revealed valuable minerals present in the Phoenix dactylifera wine, including calcium, magnesium, phosphorus, iron, aluminium, sulphur, and lead. The concentrations of lead and iron observed in our study differed significantly from those reported by [19]: 1.3mg/100ml, 0.24mg/100ml, and 3.60mg/100ml, 6.03mg/100ml, respectively. Notably, the concentration of lead fell within the recommended daily allowance of 150µg/l, making the wine safe for consumption. Although the magnesium and phosphorus concentrations in our study (3.40mg/100ml and 2.62mg/100ml, respectively) were considerably lower than the values reported by [19]: (9183.56mg/100ml and 456.4mg/100ml), the latter concentrations exceeded the recommended daily administration of magnesium and phosphorus. On the other hand, the values obtained in our study fell within the RDA values for magnesium (3.50mg/100ml) and phosphorus (10.0mg/ml). This suggests that the wine used in our study can be recommended for consumption. The potassium concentration was notably higher compared to [19]: 5.55mg/100ml and 1.34mg/100ml. This elevated potassium concentration can be attributed to the high fiber content of date fruit, which serves as an excellent source of potassium [23]. In general, the valuable minerals obtained from our study play essential roles in human body functioning and metabolic processes.

CONCLUSION

Tropical fruits like Phoenix dactylifera are known for their nutritive and health benefits. Our study demonstrates that Phoenix dactylifera can be utilized to produce highly nutritious wine with potential health benefits. The wine exhibited valuable essential and non-essential amino acids, which are crucial for protein synthesis and the maintenance, replacement, and growth of tissues. Furthermore, the research highlighted the presence of several minerals, such as magnesium, calcium, and iron, which are essential for healthy bone development and energy metabolism. Iron, in particular, is crucial for red blood cell production, ensuring the transportation of nutrients throughout the body. The high fiber content in the wine provides additional health benefits, aiding in satiety and potentially reducing calorie absorption. Moreover, the wine serves as an excellent source of potassium, important for fluid balance regulation, muscle contractions, and nerve signals. The phytochemicals identified in the wine hold promise for medical applications in the treatment of various diseases, with tannins showing potential for treating intestinal troubles. Overall, the findings suggest that Phoenix dactylifera wine is a valuable and recommendable product for consumption due to its nutritional composition and potential health benefits.

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