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Evaluate The Vital Role Of Bioactive Phenolic Content Of Grape Extract In Miscellaneous Positive Health Effects On The Human Body

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Abstract

This study is for a better understanding of how phenolic compounds of grapes keep the body healthy by preventing disease. Plant-based beverages, such as fruit juice, soymilk, tea, coffee, and coconut drinks, often contain high amounts of polyphenols and total phenolic content, which can play a vital role in promoting human health. Here are some of the essential functions and benefits associated with ingredients, such as antioxidant capacity, anti-inflammatory effects, cardiovascular health, diabetes management, digestive health, brain health, weight management, etc. We used the Folin-Ciocalteu method which is an analytical technique to determine the total phenolic content by using a spectrophotometer in different samples. In that case, our result obtained was 8.632 mg gallic acid equivalents (GAE) per gram of fresh grape juice and 4.154 mg GAE/g of commercial grape juice. This means that for every gram of the sample being analyzed, there are approximately 8.632 mg GAE/g of phenolic compounds are present. The value is expressed in gallic acid equivalents because gallic acid is used as a standard reference compound to quantify phenolic content. The total phenolic content of 8.632 mg GAE/g in grape juice suggested that it can play a vital role in promoting good health.

Keywords – Plant-based beverage, Grape, Polyphenols, Total phenolic content, Folin-Ciocalteu method, Spectrophotometry, Functional properties

Hypothesis:

The hypothesis of the present investigation relates to measuring the phenolic content and functionality of grape

bioactive phenolic content with their positive effect on the human body.

Introduction

Polyphenols are a large group of phytochemicals that are naturally occurring compounds found in plants. They are a type of antioxidant and are known for their potential health benefits. Polyphenols are responsible for the vibrant colors of many fruits, vegetables, and flowers. They are also found in foods like tea, coffee, cocoa whole grains, and nuts. There are several subclasses of polyphenols including flavonoids, phenolic acid,

stilbenes, and lignans(Liu et al., 2009). Each subclass has a different chemical structure and characteristics, resulting in various health benefits(Williamson, 2017). Consumption of grape juice that is rich in phenolic compounds can have various health benefits, phenolic compounds are a type of phytochemical found in plants, including grapes that have antioxidant properties. Grape juice is known to be a good source of phenolic compounds, particularly in skin and seeds(Jumlah et al., 2016). Here are many potential benefits of consuming grape juice rich in phenolic compounds, like antioxidant protection. Phenolic compounds in grape juice, such as resveratrol, can help protect cells from damage caused by free radicles that can cause oxidative stress, leading to chronic diseases and aging (Capanoglu et al., 2013). The phenolic compounds of grape juice can help improve heart health by reducing inflammation, promoting blood vessel health, and lowering blood pressure. They have been shown to have anti-cancer properties. They may help inhibit the growth of cancer cells and reduce the risk of certain types of cancer, including breast. Colon, and prostate cancer (Capanoglu et al., 2013). Polyphenols are known for their antioxidant properties, which allow them to scavenge reactive oxygen species (ROS) and protect cells from oxidative damage. They can also modulate signaling pathways involved in inflammation and immune response(Dandavathi & Samshuddin, 2015). In plants, polyphenols act as defense compounds against pathogens and herbivores. They can inhibit the growth of bacteria and fungi, and some have been shown to have antiviral and antiprotozoal activities(Dandavathi & Samshuddin, 2015). In human health, the consumption of polyphenols-rich foods has been associated with a reduced risk of chronic diseases such as cardiovascular disease, certain types of cancer, diabetes, and neurodegenerative disorders. They may also have beneficial effects on gut health and the microbiome. It is important to note that the health effects of polyphenols can vary depending on their bioavailability, metabolism, and interactions with other dietary components. The type and concentration of polyphenols in food can also differ depending on factors such as cultivar, growing condition, and processing methods. Polyphenols are a diverse group of compounds that contribute to the defense mechanisms in plants and provide health benefits for humans(Mahdavi et al., 2010). Grape juice consumption has been found to have several benefits on the antioxidant status of healthy individuals. Grape juice consumption may impact antioxidant status like high antioxidant, increased antioxidant capacity, protection against oxidative damage, and antiflammatory effects (Yuan et al., 2011). We used the Folin-Ciocalteu method and spectrophotometer to measure the total phenolic content of grape juice. This Folin-Ciocalteu method is based on the chemical reagent. This chemical reagent is commercially available on the local market (Lin & Tang, 2007).

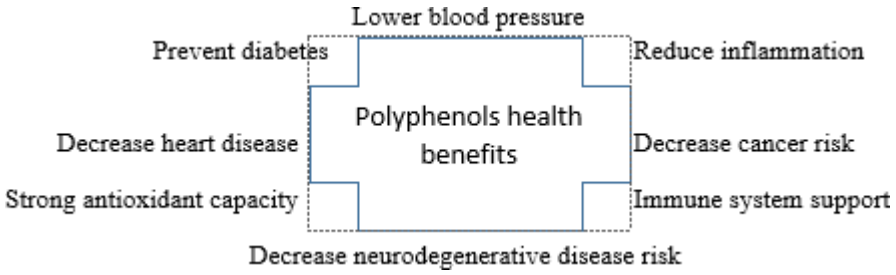

Fig1: Plant-based compounds polyphenols may have numerous health benefits (Williamson, 2017).

1. Materials and Methods

We have collected two types of samples for test purposes. One is fresh grape and the other is 100% grape juice from the retail market. All reagents and solvents are used from our university lab. Total phenolic content was measured using a spectrophotometer.

1.1. Extract and sample preparation

A sample (10 g) from each sample was used for the extraction. 20 ml of methanol was added to each sample (centrifuge tube) and solicited for 40 minutes at 40°C and the sample was agitated by agitation for 30 minutes at room temperature, then centrifugation at 4000 rpm for 10 minutes at 4°C. 1 ml extract to keep each vial for the first step and put the refrigerator at -20°C. Then discharge the remaining solution and add 20 ml methanol then shake by hand. Again agitation for 30 minutes at room temperature and centrifugation at 4000 rpm for 10 minutes at 4°C. Kept 1 ml in the same vial and put the refrigerator at -20°C. Protected each vial from direct light with an additional aluminum foil coat.

1.2. Preparation of FCR Reagent

2 ml of FCR reagent was taken into the beaker and then added distilled water for 10-time dilution. We have taken a standard measuring cylinder to make up a volume of 20 ml.

1.3. Preparation of 7.5% sodium carbonate Na2CO3 solution

7.5 grams of sodium carbonate was taken by using weight balance to prepare a 7.5% sodium carbonate solution. Dissolved 10 ml of distilled water then made up the volume to 100 ml in a conical flask.

1.4. Preparation of standard gallic acid solution

1mg gallic acid was dissolved into 1 ml distilled water, so the concentration of the solution is 1mg/ml or 1000 µg/ml. This is called a stock solution. The serial dilution was performed to proper different concentration solutions.

1.5. Preparation of blank solution

5 ml Folin-Ciocalteu reagent, 1 ml methanol, and 4 ml sodium carbonate Na2CO3 solution were taken into the test tube.

1.6. Determination of total phenolic content TPC

The amount of total phenolic content of the extract was determined by the Folin-Ciocalteu method by using a spectrophotometer. 1 ml of two plant extract samples solution was taken in VF. 5 ml of Folin-Ciocalteu reagent solution was added into VF. 5 ml of 7.5% sodium carbonate solution was added to the VF. Incubated for 20 minutes at 25°C to complete reaction. Then 2 ml of solution was pipet out separately and made up the volume to 5 ml with distilled water and the cuvette was allowed for absorbance at 760 nm was measured by spectrophotometer. TPC was measured as gallic acid equivalent to GAE. (Waterhouse AL, 2002)

2. Result

$Y = mx+c$
$X= y-c/m$
$X= 0.999-0.1357/0.0002$
$X=4316$ mcg/ml
$X= 4316/1000$ mg/ml
$X= 4.316$ mg/ml
$C= x(v/m)$
$C=4.316(1/0.5)$
$C= 4.316x2$
$C= 8.632$ mg GAE/g

Here,
C=TPC
Y= sample absorbance
V= volume of the extract solution in ml
M= weight of extract in gm

We took 10 gm of sample and dissolved 20 ml of solvent. So we have to know how many gm of sample in 1 ml, so we calculated
1 ml = 10/20
1 ml = 0.5 gm

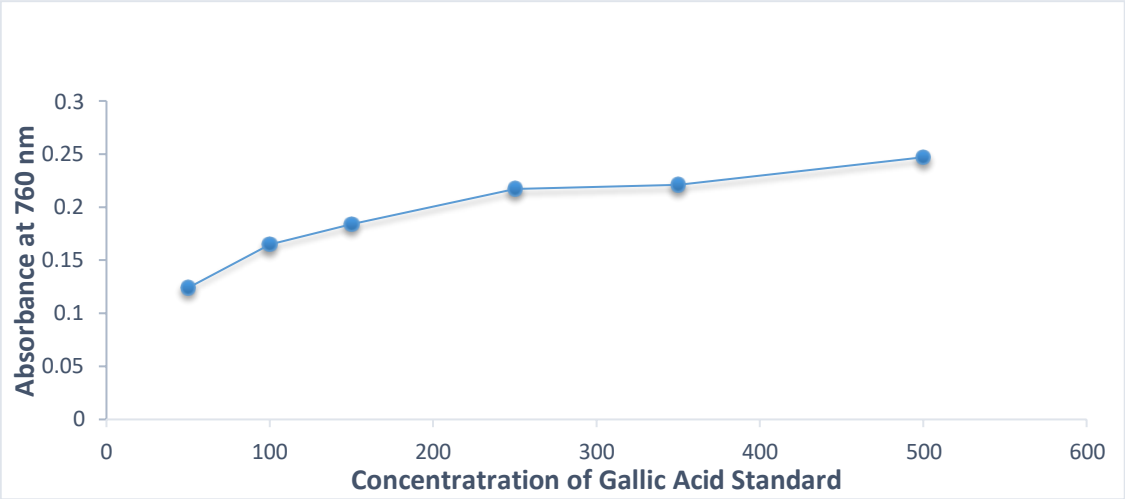

Fig3: Concentration of gallic acid standard with absorbance scale to determine total phenolic content of fresh grape.

Y = mx+c
X= y-c/m
X= 0.879-0.0481/0.0004
X=2077 mcg/ml
X= 2077/1000 mg/ml
X= 2.077 mg/ml
C= x(v/m)
C=2.077(1/0.5)
C= 2.077x2
C= 4.154 mg GAE/g
Here,
C=TPC
Y= sample absorbance
V= volume of the extract solution in ml
M= weight of extract in gm

We took 10 gm of sample and dissolved 20 ml of solvent. So we have to know how many gm of sample in 1 ml, so we calculated
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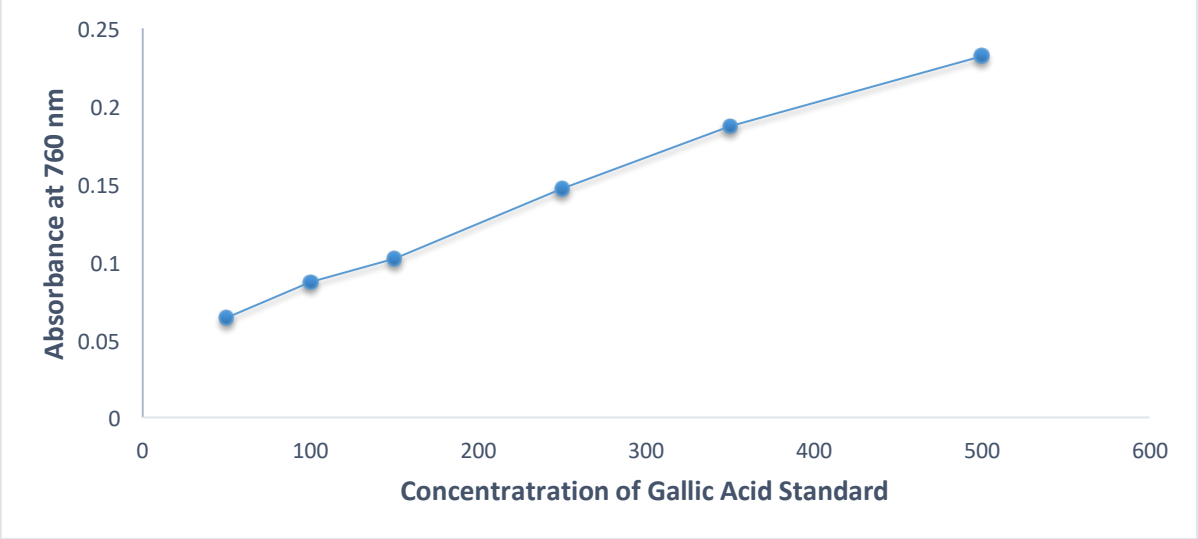

Fig4: Concentration of gallic acid standard with absorbance scale to determine total phenolic content of 100% grape juice.

3. Discussion

Based on our analysis, the total phenolic content of the fresh grape juice was determined to be 8.632 mg GAE/g of juice, and commercial grape juice was determined to be 4.154 mg GAE/g. The total phenolic content of grape juice can vary depending on the grape variety and process. The grape variety plays a significant role in determining the phenolic content of the juice(Padilha et al., 2017). This result value indicates a moderate to high phenolic content of the grape juice. Phenolic compounds are known for their antioxidant activities and potential health benefits. They have been associated with various protective effects against chronic diseases, including cardiovascular disease, cancer, and neurodegenerative disorders(Vauzour et al., 2010). The measured phenolic content of 8.632 mg GAE/g suggested that the grape juice contains a significant amount of these beneficial compounds. This is favorable as it indicates that consuming grape juice could potentially provide antioxidant support and contribute to the overall health of individuals(Xia et al., 2010). It is important to note that the phenolic content can depend on several factors, including grape variety, geographical location, cultivation practices, and processing methods. Additionally, the conditions of our analysis, such as the extraction solvent, temperature, and time, may also influence the measured phenolic content. The determination of the total phenolic content of 8.632 mg GAE/g of grape juice suggested that it is a valuable source of phenolic compounds with potential antioxidant properties(Mirbagheri et al., 2018). The total phenolic content of 8.632 mg GAE/g in grape juice suggested that it can play a vital role in promoting good health due to its various functions such as strong antioxidant capacity, Anti-inflammatory effects, immune system support, brain health, digestive health, etc. It is important to note that while the phenolic content in grape juice is beneficial, other factors may also contribute to overall good health. Grape polyphenols have a beneficial effect on cardiovascular disease and diabetes in humans. Grapes are rich in antioxidants, such as resveratrol, quercetin, and catechins, which have been shown to have cardioprotective effects. These compounds help reduce oxidative stress and inflammation in the arteries, thereby improving their function and reducing the risk of cardiovascular disease (Rasines-Perea & Teissedre, 2017). Grape polyphenols have been found to have anti-diabetic effects. They can improve insulin sensitivity and reduce insulin resistance, thereby helping to regulate blood sugar levels. The consumption of grape polyphenols has shown promising effects in reducing the risk of cardiovascular disease and managing diabetes in humans(Rasines-Perea & Teissedre, 2017).

4. Conclusion

The plant-based beverage grape juice ingredients like a high content of phenolic compounds have been shown to have antioxidant and anti-inflammatory properties. These compounds can scavenge free radicals and reduce oxidative stress in the body, which can contribute to various health benefits. While high phenolic content in a beverage is generally considered to be beneficial, it is essential to note that the specific phenolic compounds and their concentration in the beverage can vary greatly depending on the source and preparation methods. Therefore, it is necessary to consider the overall composition of the beverage and a balanced diet to achieve the potential health benefits associated with phenolic compounds. This study ensures this grape sample samples present polyphenols with a high content of phenolic compounds which have a lot of positive health effects on the human body.

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