

Watermelon, Kalium, and Kidney Health: A Review Literature

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ABSTRACT

Kidney disease is one of the lifestyle conditions that affect several people around the world. Furthermore, the disease can increase the risk of other chronic disorders and make it difficult for patients to live a healthy and active life. Over the years, attempts have been made to identify new and alternative methods that can be used to manage such complications. One of the areas where researchers have focused on is the use of diet-based interventions. This paper aimed to explore the impact of watermelon consumption on kidney function and health. The study entailed conducting a systematic review of articles related to the topic under investigation. The review yielded mixed results regarding the role of watermelon in the management of kidney disease. Most studies have shown that watermelon contains important nutrients and phytochemicals that protect the body from the adverse effects of free radical ions. In other studies, it was reported that overconsumption of watermelons might adversely affect renal function due to the high level of potassium in the fruit. Further investigations are required to examine the underlying mechanism through which the phytochemicals in watermelon affect kidney function. Furthermore, there is a need for additional empirical studies to assess the efficacy and safety of watermelon diets in the treatment and management of kidney-related complications.

Keywords: Watermelon, kidney, health, kalium, citrullus

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INTRODUCTION

Kidneys play a critical role in ensuring normal body functions and good health. The organs are primarily responsible for the filtration of waste products, impurities, and excess water from the blood (Thomas, Kanso, & Sedor, 2008). The toxins that are filtered through the kidney are normally stored in the bladder before they are removed from the body during the urination process. It is also imperative to state that the human kidneys are involved in the regulation of PH, potassium, and salt levels in the body. In addition, the organs are linked to the production of hormones that are involved in the regulation of red blood cell synthesis and blood pressure (Fraser & Blakeman, 2006; Levey, Eckardt, & Tsukamoto, 2005). Therefore, failure of the kidneys or any disease that affects the functioning of the organs can lead to adverse health outcomes (Tonelli, Wiebe & Guthrie, 2015; Hsu & Hsu, 2011). Besides, kidney diseases may cause high blood pressure, diabetes, and other related chronic complications. Available research evidence shows that kidney problems can also result in the weakening of bones, damaged nerves, and malnutrition (Tonelli, Wiebe & Guthrie, 2015; Hsu & Hsu, 2011). As a result, there is a need to identify ways through which the functioning of the organs can be safeguarded. The process may entail drinking plenty of water, reducing salt intake, and ceasing smoking. In recent years, the attention of researchers and experts has

also been drawn to the dietary approaches that may be used in reducing the risk of kidney diseases. One of the areas where studies have been done is the potential impact of watermelon consumption on kidney function and health.

Watermelon is a fruit that belongs to the family Cucurbitaceae. Other fruits and vegetables that are linked to it include gourds, pumpkins, and cucumbers. A review of previous studies shows that watermelon contains a wide range of chemicals that may be beneficial to the human body and help in the fight against various diseases. For instance, watermelon is rich in a non-provitamin A carotenoid called lycopene (Bangalore, McGlynn, & Scott, 2008; Fuhrman, Elis, & Aviram, 1997; Helyes et al., 2009). It is worth stating that the carotenoid is beneficial to the body because of its antioxidant capabilities (Dahan, Fennal & Kumar, 2008; Erdman, Ford, & Lindshield, 2009). Furthermore, it has certain protective effects against diseases such as cardiovascular complications and cancers. According to Oms-Oliu et al. (2009), nutritional profile analysis of watermelon revealed that it contains about 92% water, 7.55% carbohydrate, and 0.4% dietary fiber. The author added that watermelon is rich in carotenoids, flavonoids, fat, and vitamin C. Besides, it is considered to be an important source of β -carotene. Kaur and Kapoor (2001)

further opined that watermelon is an essential source of vitamin B1 and B6 and minerals like magnesium and calcium. Furthermore, it is nutritious, inexpensive, and available to people from all socioeconomic groups throughout the world. However, the consumption of the fruit may depend on different factors such as income level, availability, ethnic norms, race, and gender.

Accumulating research evidence shows that fruits such as watermelon contain natural components that can promote health and wellbeing. In particular, the plant-based diets are linked to bioactive ingredients that are vital in different metabolic functions such as protection against physiological threats, development, and growth. In this context, the chemicals in the fruits are of great importance as they enhance human health and wellbeing in different ways. Furthermore, diets can be regarded as vital regimens that may protect people from life-threatening illnesses. The primary objective of the current study is to examine the potential health benefits of watermelons and the way they affect the risk of kidney disease.

Problem Statement

The consumption of watermelon fruits is a common practice that has been observed throughout the world over the years. In some cases, watermelons are processed into different commercial products to ensure availability throughout the year. According to Kim et al. (2014), watermelon is an important fruit that is rich in lycopene and chemicals that are needed for the proper functioning of the body. In addition, the fruit can be processed into different healthy products like sweets, sauces, and smoothies that are also beneficial to the consumer. With the burden of kidney disease increasing globally, there has been a need to explore new ways of preventing complications. Furthermore, researchers have attempted to gain insights on how the consumption of different beverages and foods affect kidney function. Most of the studies that have been done on watermelon have focused on the lycopene components of the fruits and the way it impacts on normal body function. In particular, the studies have revealed that lycopene in watermelon can enhance metabolic functions in the human body. However, minimal attention has been paid to other additional components of watermelon and the way they can influence kidney function and processes. It is against this background that the present review was done to gain vital insights on the potential link between watermelon diets and renal function.

RESEARCH QUESTIONS

- 1) What are the components of watermelon?
- 2) How the influence of watermelon components on bodily functions?
- 3) How is the relationship between watermelon consumption and kidney function?

AIMS

The study was done to achieve three objectives. The first one to study the components of the watermelon fruit.

Second, to examine the effect of watermelon components on body function. The final to explore the link between watermelon consumption and kidney function.

METHODS

Study Population and Sample

In the current study, the narrative review method was adopted and used to explore the potential link between watermelon intake and kidney function. The approach entailed identifying and reviewing literature related to the research topic under consideration. A narrative review method is considered to be one of the gold standards that can be used to search for, critique, summarize and collate best practice evidence on a clinical subject matter. The results of the review provided an appropriate evidence base that can help in developing reliable clinical guidelines. Also, the findings from such studies have been used in clinical decision making in complex settings and environments.

Data Collection

The research process entailed conducting a systematic search of electronic databases to identify articles related to kidney health and watermelon. The articles were obtained from four major databases that included EMBASE, PubMed, Cochrane Library, and The National Library of Medicine. The search terms, in this case, were "kidney," "watermelon," "kidney function," "effect," and "health." A total of 40 peer-reviewed journal articles were obtained from the four electronic databases, reviewed, and used to meet the objectives of the study.

Data Analysis

In the narrative review research, the investigator follows a rigorous and structured process to facilitate the collection of data that will be meaningful to the research team and the end-users. Thus, the narrative research design remains a critical methodology that can be used to obtain valid evidence required to make clinical decisions. The present study was done to examine the possible link between watermelon diets and kidney health. Therefore, it was imperative to identify and analyze studies that have been done on the subject.

RESULTS

The kidney is a vital body organ located in the dorsal regions in vertebrates. They are osmoregulatory organs that are critical to the normal functioning of the body. Existing research evidence shows that the fundamental functional unit of the kidney is referred to as the nephron. The units are involved in the filtering of blood to remove harmful toxins and salts. A damaged or diseased kidney cannot carry out the filtration functions optimally. Some of the factors that can affect the functioning of the kidney include high sugar intake, drug overdose, and deficiency in vitamin B6 and magnesium. Tzanakaki et al. (2014) also noted that the normal functioning of the human kidney might be caused by catheter-related infections and pulmonary edema. Patients who have diseased or damaged kidneys show a

wide range of symptoms that include fatigue, anemia, proteinuria, hepatic necrosis, and high blood pressure. Other common indications of kidney problems may include fever, non-productive coughs, and shortness of breath. The severity of the symptoms will depend on the level of toxicity of the materials that caused the problem, age of the patient, and the existence of other comorbid diseases.

The treatment of damaged kidneys normally entails the use of different interventions, including surgery and dietary interventions. In recent years, researchers have strived to examine the importance of consuming nutrient-rich foods as a way of dealing with the signs and symptoms of kidney diseases. One of the foods that have been studied widely due to its potential in aiding the process of correcting the damaged kidney is watermelon. Research shows that water mellow contains a wide range of bioactive components such as sterols, cucurbitacin, and triterpenes, which can aid recovery from various health conditions. Furthermore, watermelon contains compounds like arginine, glutathione, and citrulline (Hayashi, 2005; Godwin et al., 2008). Available research evidence shows that the watermelon seeds may also contain minerals like zinc, potassium, calcium, and magnesium, which are critical to metabolic functions in the body. In a healthy individual, the normal body functions are normally sustained through the various biochemical reactions that take place in organelles and cells. One such reaction is oxidation, which leads to the formation of various free radicals in the body. It is imperative to state that the free radicals are categorized as highly instance ions and molecules that can also react with other substances in the body to affect normal cellular functions and processes. For instance, research shows that the redox reactions that occur in the cells often results in the formation of reactive oxygen species (ROS) that is linked with both beneficial and harmful effects in the body (Elumalai et al., 2013). The chemical reactions between the free radicals can support metabolic processes and facilitate the normal functioning of vital organs such as the liver, heart, and kidneys. In other cases, the reactions lead to oxidative stress that affects the functioning of cells and damages cellular components such as proteins, lipids, and DNA. In cases where a patient suffers from conditions such as cancer, neurodegenerative disorders, or kidney complications, the unregulated action of the ROS can worsen the symptoms and lead to further complications (Ijah et al., 2015; Choudhary et al., 2015). Therefore, attempts have been made to identify ways through which the reactions can be controlled to improve the wellbeing of the patients. Research shows that eating balanced diets that contain a sufficient amount of phytochemicals and nutrients can help inhibit the harmful effects of free radicals, thus enhancing the wellbeing of a person. The process entails enhancing the antioxidant status of the body and scavenging the oxidation reactions. Furthermore, the nutrients and phytochemicals that are contained in fruits such as watermelon and oranges have

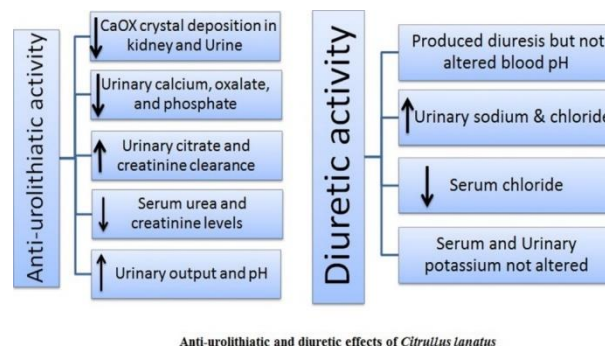
been linked to inhibition of the actions of the free radical through electron transfer and radical adduct formation.

The rapid increase in the risk of chronic illnesses such as renal failure and cardiovascular diseases has motivated experts, researchers, and health-conscious individuals to explore ways of using dietary interventions with potential health benefits that go beyond the provision of essential nutrients. Existing literature shows that watermelon is considered to be an important fruit with vital components with anticancer, antioxidant, and anti-inflammatory properties (Ijah et al., 2015; Choudhary et al., 2015). The dietary intake of the phytochemicals found in watermelons such as lycopene, vitamin C, and β -carotene is believed to be an important practice that can reduce the risk of diseases like kidney problems, diabetes, and hypertension (Adedeji & Oluwalana, 2013). The protective effect of the chemical is linked to the ability to inhibit the formation of reactive oxygen species and free radicals that may be harmful to the normal functioning of the body. Furthermore, the presence of the phytochemicals in the body can improve the functional ingredient effects of foods that people consume. According to Maoto et al. (2018), the consumption of watermelon is a practice that can have positive biological effects on the human body. The author added that watermelon is a fat-free fruit that contains low levels of sodium and high amounts of vital phytochemicals and minerals. Maoto et al. (2018) also stated that previous studies have revealed that the intake of the fruits can lead to positive and long-term health effects like improved blood pressure, low risk of heart disease, reduced LDL oxidation, and cardiovascular protective effect. Unlike other fruits like guavas and tomatoes, watermelon contains phytochemicals that give it a high antioxidant capacity. Furthermore, the other nutrients, such as fiber, vitamins, and carbohydrates that are found in the fruit, are critical in maintaining normal body function. Thus, the fruit is considered to be a vital medicinal plant that can help in reducing and managing the risk of complications affecting the heart, kidneys, and liver.

Studies on the protective effect of watermelon components against complications involving organs such as the kidney and the liver have yielded mixed results. Siddiqui et al. (2018), for instance, stated that the recent dietary recommendations on increased intake of diets that are rich in antioxidants had been motivated by the desire to find long term solutions to lifestyle disease complications. The author added that such diets had replaced the energy-dense snacks that people were used to because of the perceived antioxidant effect. The trend has resulted in the increased production of watermelons, which is considered to be a quintessential fruit with beneficial chemicals and nutrients (Lemos et al., 2017; Bailey et al., 2016; Kabel, 2014; Jumde et al., 2015). Epidemiological research shows that the chemicals in the watermelon have antioxidant, anti-inflammatory, and antihypertensive properties that protect against radical ions that can worsen the symptoms of kidney diseases (Kim et al., 2014; Naz et al., 2014; Romdhane et al., 2017).

Furthermore, the chemicals have a protective element that reduces the risks of carbon tetrachloride-induced toxicity. It is also imperative to state that the natural phytochemicals found in watermelons such as polyphenols, β -carotene, vitamin C, and lycopene are capable of mediate processes and mechanisms related to cell growth regulation, immune response, and gene expression. Siddiqui et al. (2018) argued that there is a need to carry out further investigations into the health-promoting compounds found in watermelons. Moreover, it is imperative to analyze the impact of the substances on the various cellular processes that occur when an individual develops kidney complications.

Traditionally, watermelon has been incorporated in dietary interventions because of the protective effect that it has on patients who suffer from kidney diseases. Besides, researchers have stated that the chemicals found in watermelon can help in clearing urine among patients with kidney problems and other renal complications. Siddiqui et al. (2018) conducted a study to validate the traditional use of *Citrullus lanatus* in the management of kidney disease by focusing on the diuretic and anti-urolithiatic properties of the components of the fruit. The study entailed conducting both in vivo and in vitro experiments using male Wistar rats. Siddiqui et al. (2018) used eosin and hematoxylin staining methods to examine the kidney. The results of the in vivo experiments show that there was reduced calcium oxalate (CaOX) crystal count following the treatment with the watermelon extracts. The reduction was witnessed both in the urine and kidney samples. Furthermore, the researcher stated that the pulp extracts that were used in the in vivo experiments led to an increase in urinary output and PH while also preventing weight loss. Siddiqui et al. (2018) further conducted a serum analysis that showed increased creatinine levels in the kidney samples. The change was attributed to the protective effect of the *Citrullus lanatus*-derived chemicals against changes that can worsen kidney disease. It is also imperative to state that urinary analysis has revealed that watermelon pulp extracts can restore altered levels of citrates, oxalate, phosphate, and calcium in kidney diseases (see figure 1). Furthermore, the extracts can initiate diuresis, increase urinary serum and chloride levels, and cause anti-urolithiatic activity. The results of the animal model studies validate the traditional use of watermelon in the management of the symptoms of kidney diseases. Furthermore, the studies have shown that the anti-urolithiatic and diuretic effects of the components of watermelon may be critical in improving the health and wellbeing of people who have renal complications. However, further analysis of the pulp extracts may be required to isolate and examine the active constituents that are responsible for the beneficial health effects.



Anti-urolithiatic and diuretic effects of *Citrullus lanatus*

Figure 1: Diuretic and anti-urolithiatic of water melon (Siddiqui et al., 2018)

There is a consensus among researchers that changes interfering with the osmoregulation process in the human body can lead to significant and adverse health outcomes. Therefore, human beings need to take diets that can improve the functioning of the kidney and prevent reactions that can adversely affect the processes that occur in the nephrons.

Animal model studies have also shown that watermelon can have a protective effect on kidney-related infections. Atlas et al. (2011), for example, conducted a study to examine the effect of Diyarbakır watermelon on lipid peroxidation state in the brain, liver, and kidney of a rat. The experiment entailed conducting an in vivo administration of carbon tetrachloride (CCl₄) to cause serum marker elevation. The markers that the researchers targeted in the study included albumin, total bilirubin (TB), alanine aminotransferase (ALT), and aspartate aminotransferase (AST). The researchers reported that the administration of CCL, together with watermelon extracts, reduced the level of lipid peroxide in the brain, liver, and kidney tissues. The authors conducted that the watermelon juice samples had a protective effect on the tissues that were examined. The trend was attributed to the antioxidant capabilities of the juice. Atlas et al. (2011) remarked that watermelon juice could be considered to be an alternative method for treating chemical-induced hepatotoxicity that may affect the normal functioning of the liver and kidney. Bazabang et al. (2018) also carried out a study to examine the protective effect of watermelon against ethanol-induced oxidative using Wister Rats models. The results of the study revealed that watermelon extract treatment resulted in a significant increase in plasma ALT and AST. Furthermore, the researchers stated that the intervention resulted in a significant increase in body weight. Based on the results, Bazabang et al. (2018) concluded that watermelon had an important hepatoprotective effect in the body. The researchers linked the effect to the antioxidant phytochemical components of watermelon.

The effect of watermelon on renal processes and kidney function have also been explored by focusing the way potassium may affect normal body processes (Chan et al., 2016; Hayes et al., 2011). Research shows that potassium is an important mineral that is involved in muscular works that occur in various body systems and organs (Hayes et al., 2011; Menahem et al. 1999; He et al., 2015). When the human kidney is not functioning at normal levels, there might be a buildup of potassium in the blood. The changes can affect normal heart functions, thus increasing the risk of further cardiovascular complications. Watermelon is one of the fruits that contain potassium, thus can affect normal body processes. Giebisch, Hebert, and Wang (2003) noted that the kidney plays a critical role in the homeostasis of potassium. The process entails regulating the secretion of potassium and controls its reabsorption. Patients with kidney problems normally experience a condition called Hyperkalemia, which is characterized by electrolyte disturbances (Einhorn et al., 2009; Moranne et al., 2009; Korgaonkar et al., 2010; Hayes et al., 2011; Menahem et al., 1999). It is imperative to state that chronic hypokalemia can lead to intestinal scarring and renal cytogenesis. Recent studies have shown that increased levels of potassium may augment the risk of adverse renal outcomes among patients with kidney disease (Bowling et al., 2010; Acker et al., 1998; Takaichi et al., 2007). Therefore, there is a need to carry out studies to investigate how diets with high levels of potassium may affect renal function and the wellbeing of patients with kidney disease. American Society of Nephrology (2015) conducted a study to examine the effect of high-potassium diets on the speed of kidney disease progression. The researchers stated that high levels of potassium and sodium in urinary secretion were linked to a faster progression of kidney diseases. Furthermore, the author opined that most people with chronic kidney disease tend to consume high levels of potassium and sodium-containing diets daily. Wang et al. (2013) also conducted a study to examine the impact of serum potassium (sK) levels on renal outcomes among patients with kidney diseases. The study involved a population of 2500 people diagnosed with chronic kidney disease. The researchers noted that there was a significant link between the increased level of serum potassium and the severity of kidney disease. Wang et al. (2013) stated that increased dietary potassium could worsen the signs and symptoms of kidney diseases. Therefore, those suffering from renal problems must carefully assess the diets that they consume to avoid the harmful effects linked to high potassium levels in the body. Most potassium-rich foods are considered heart-healthy nutrients with high fibre, high anti-oxidant vitamins and high alkali content such as fresh fruits and vegetables; hence, the main challenge of dietary potassium management is to maintain high fibre intake and a low net fixed-acid load, because constipation and metabolic acidosis are per se major risk factors for hyperkalaemia (Cupisti, et al., 2018). In fact, there are data suggesting individuals are not consuming enough potassium in their diet. Although consumption of diets high in plant proteins, fruits, and vegetables—

which are excellent sources of potassium—is recognized as healthy and beneficial, individuals with decrements in their kidney function have been advised to avoid these foods (Palmer, et al., 2020).

DISCUSSION

Eating a healthy diet is considered to be an important part of kidney treatment. Furthermore, it is a practice that makes a patient feel better and protects from other complications that may lead to adverse health outcomes (Adedeji & Oluwalana, 2013; Kim et al., 2014). One of the fruits that are considered to be a source of important minerals and nutrients that can help improve kidney function and health is watermelon (Ijah et al., 2015; Choudhary et al., 2015; Naz et al., 2014; Romdhane et al., 2017). A systematic review of previous studies shows that researchers have provided mixed results regarding the impact of watermelon consumption on renal outcomes, including the symptoms and severity of kidney disease. In most studies, researchers have stated that watermelon is a fruit with critical phytochemicals that contribute to normal cellular function (Adedeji & Oluwalana, 2013; Bazabang et al., 2018; Atlas et al., 2011; Adedeji & Oluwalana, 2013). In particular, researchers have stated that watermelon is rich in antioxidants that are beneficial to the functioning of body organs like the kidney, brain, and the liver (Adedeji & Oluwalana, 2013; Kim et al., 2014). The antioxidant, anti-inflammatory, and antihypertensive phytochemicals that are linked to watermelon diets protect the body against free radical ions that worsen the signs and symptoms of kidney disease (Adedeji & Oluwalana, 2013; Kim et al., 2014). However, the actual mechanisms through which the changes occur in patients with kidney complications remain unclear. Another category of studies has highlighted the potential negative effect of watermelon diets on kidney disease by focusing on its potassium content (Hayes et al., 2011; Menahem et al. 1999; Chan et al., 2016). Research shows that watermelon is known for its high water and potassium content (He et al., 2015; Chan et al., 2016; Hayes et al., 2011; Wang et al., 2013). Therefore, overconsumption of the fruit may lead to the accumulation of potassium in the blood, a condition that can cause Hyperkalemia and worsen the symptoms of renal disorders.

The current study provides vital insights that can be used as the basis for making clinical decisions regarding the dietary management of kidney disease. However, the research has certain limitations that must be taken into consideration when applying and generalizing the findings. The first major limitation is that the study lacks empirical data on the subject under investigation since it entailed conducting a systematic review. Second, the study did not focus on specific components of watermelons to determine how they may affect kidney function. Finally, the study lacks quantitative data that can be used as the basis for assessing the efficacy of the watermelon diet as an intervention for managing kidney complications. The limitations notwithstanding, the study provides important data that can be used as the

basis for future investigations into the subject of watermelon consumption and kidney function.

CONCLUSION AND RECOMMENDATIONS

The kidney plays a critical role in maintaining normal cellular and body processes. In particular, the kidney is an osmoregulatory organ that helps in filtering blood and removing harmful substances from the body. People who suffer from kidney diseases face a wide range of health problems that prevent them from living a normal life. One of the avenues through which such conditions can be managed is through diet therapies. Fruits such as oranges, grapes, and watermelons are considered to be important when it comes to improving the health and wellbeing of those with renal complications. Therefore, attempts have been made to evaluate the efficacy of such diets and determine the actual effect that they have on normal body functions. In the present systematic review, the focus was on examining the way watermelon consumption may affect kidney function and health. The study entailed identifying and reviewing previous research works that have been done on the subject. The results of the review show that researchers have reported diverse findings with regard to the link between watermelon diet and kidney function. In particular, studies have shown that watermelon contains vital nutrients and chemicals that protect body organs from adverse effects of free radical ions. Other researchers, however, noted that the high potassium content in watermelon might compromise normal kidney function and worsen symptoms of renal diseases. Further investigations are required to identify the specific components of watermelon that can enhance kidney function.

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