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# Watermelon Rind

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**SUMMARY**

Fruit and vegetable waste is a serious problem globally, often caused by improper food handling, storage techniques, disposal of inedible portions of produce. According to the Food and Agriculture Organization (FAO), approximately one-third of worldwide production is lost or wasted at some point in the food chain. One of the FAO's major challenges for 2050 is achieving the Sustainable Development Goal (SDG) of reducing food waste by 50%. Waste is increasingly being recognized as a raw material for a circular economy, which is based on the concept of a "zero waste" society. By-products from fruits and vegetables can be used as innovative ingredients or food fortifiers, as they are rich in bioactive components. Reducing food waste and optimizing the extraction of health-promoting compounds can contribute to food security, better nutrition, and more sustainable farming systems. Out of nine essential amino acids, seven have been identified in watermelon flesh and rind. The rind has a lower content of essential amino acids than the flesh, indicating lower overall nutritional quality.

## INTRODUCTION

Watermelon (*Citrullus lanatus var. lanatus*, family *Cucurbitaceae*) is a vine-like (scrambling and trailing) flowering plant, originally from southern Africa to Bangladesh. It is a rich source of vitamins and phytochemicals (Perkins-Veazie and Collins, 2004). Watermelon is grown worldwide, from tropical to temperate regions, for its fruit. Botanically, the fruit of watermelon is a pepo, composed of rind, flesh, and seeds. The flesh is the main edible part, consisting primarily of water (nearly 91%), along with carbohydrates, sugars, minerals, and vitamins. It is also rich in natural antioxidants such as lycopene and ascorbic acid. The rind, which contributes about 30% of the fruit, is edible. However, after consuming the pulp, the rind and seeds are often discarded as waste and rarely fed to animals. This waste eventually rots, becoming a source of microbial contamination and contributing to environmental pollution. Watermelon is a widely consumed fruit known for its sweet, juicy, and refreshing pulp. However, its rind, which makes up almost 40% of the total fruit weight, is often discarded due to its unappealing taste, adding to agricultural waste. Watermelon is an essential and globally popular fruit, occupying 7% of the agricultural space dedicated to fruit and vegetable production. Despite being edible, the rind is often discarded before serving or processing, causing biomass loss. Currently, this waste is sent to landfills, incinerated, used for animal feed, or composted, all of which are low-value, costly, or have additional negative environmental effects.

The potential value of watermelon rind has been recognized and explored. Researchers have investigated converting rind polysaccharides into bioethanol, biosorbents, and biochar. The rind is also a source of food ingredients such as pectin and citrulline. Among the 16 free amino acids quantified, watermelon rind contained higher total amino acid levels (165 mg/100 g fresh weight) compared to the flesh (146 mg/100 g). The rind had significantly higher amounts of citrulline and arginine (61.4 and 53.8 mg/100 g, respectively) than the flesh. However, the rind contained significantly lower amounts of essential amino acids. Volatile analysis showed that watermelon rind accounted for only 15% of the total volatile compounds found in the flesh. It has been processed directly through pickling and incorporated into jams. In powdered form, watermelon rind has been used in cakes, cookies, noodles, and even beef and pork patties. Watermelon rind (WMR) contains a wide range of nutritional components and bioactive compounds such as dietary fiber, polyphenols, carotenoids, and saponins. Due to its rich nutritional profile, it exhibits several therapeutic properties, including antioxidant, anti-diabetic, anti-tumor, cardioprotective and hepatoprotective effects, reduce agricultural waste while promoting consumer health and well-being, it is essential to utilize WMR in various industries, including food, pharmaceuticals, and cosmetics. Large amounts of food waste are generated worldwide and often end up in landfills. As food waste decomposes, it emits greenhouse gases that pollute the environment and contribute to climate change. After removing the thin exocarp, the crisp, white mesocarp is often used for pickling. In some regions, they are used as a vegetable. Watermelon contains protein, fat, carbohydrates, crude fiber and ash in notable amounts. The fruit's flesh is composed of 91% water, 6% sugar, and very little fat. It is also a good

source of micronutrients such as vitamins A, B, and C, as well as minerals like potassium, magnesium, iron, and calcium. The rind is the white or light green layer of the fruit, accounting for almost 40% of the total weight. However, due to a lack of awareness regarding its nutritional composition and its unappealing taste, it is mostly discarded as a by-product or used as animal feed. It has been estimated that one-third of the edible portion of food produced for human consumption approximately 1.3 billion tons globally is wasted. Watermelon rind can be converted into value-added products by drying and incorporating it into bakery products. The bakery industry is one of the largest organized food industries globally, and cakes are among the most popular products. Bakery products are often used to incorporate various nutritionally rich ingredients to enhance their value.

**Nutritional Composition of WMR**

| **Fresh watermelon rind** (Naknaen *et al.*, 2016; Dhakal and Pradhananga, 2017). | | |
|---|---|---|
| **1.** | Moisture content | 94% |
| **2.** | Protein | 0.63% |
| **3.** | Total solids | 5.39% |
| **4.** | Ash | 0.46%, |
| **5.** | Fat | 0.08% |
| **6.** | Vitamin C | 6.8 mg/ 100 g |
| **7.** | Carbohydrate | 4.2% |
| **Dry watermelon rind powder** | | |
| **1.** | Moisture content | 5-12% |
| **2.** | Protein | 7.5-8.95% |
| **3.** | Fat | 0.25-2.33% |
| **4.** | Ash | 8.15-11.9% |
| **5.** | Total dietary fibre | 5.-68% |

**Health Implications of Watermelon rind (WMR)**

| | |
|---|---|
| Antidiabetic effect | Sorour *et al*. reported the ameliorating effect of watermelon rind juice intake on female albino rats that resulted in improving the structural changes in the pancreas and significantly decreasing the blood glucose levels.<br>Azizi *et al.* revealed the potential effect of watermelon extract on metabolic and inflammatory parameters in diabetes mellitus. |
| Antihypertensive effect | Romdhane *et al.* WMR extract could be a potential natural remedy for hypertension, and further research in this area could provide valuable insight into the development of new treatments for cardiovascular diseases. |
| Antioxidant effect | WMR is a rich source of various antioxidants and bioactive compounds such as β-carotene, saponins, flavonoids, phenols, L-citrulline, fiber, protein, carbohydrates and fats. |
| Antihyperlipidaemic/cardioprotective/hypocholesterolemic effect | Abu-Hiamed studied the hypocholesterolemic effect of WMR. due to the presence of natural constituents including polyphenols, flavonoids, alkaloids, phytosterols, dietary fibres and several other medicinal compounds. |
| Antitumor and anticancer effect | Dammak *et al.*, revealed that polysaccharide extracted from WMR had a cytotoxic effect on human laryngeal carcinoma. |
| Hepato-renal protective effect | Michael *et al.*, WMR extract has the potential to reduce serum levels of liver enzymes and protect the liver and kidney from stress and damage. |
| Anti-nutritional compounds | WMR does contain some compounds that could be considered anti-nutrients such as alkaloids, saponins and tannins, their impact is generally negligible. |

**Watermelon rind flour**

| | | |
|---|---|---|
| 1. | Moisture | 10.72% |
| 2. | Protein | 11.21%, |
| 3. | Carbohydrates | 73.18%, |
| 4. | Ash | 12.61% |

| | | |
|---|---|---|
| 5. | Fat | 2.38% |

**Preparation of cakes incorporation with watermelon rind flour:**

Cakes were prepared as per the standard method but replacing only wheat flour with different levels of watermelon rind powder in the basic formulation of cake.

## CONCLUSION

Increasing health consciousness is driving people to shift their diets toward nutritionally rich foods, with a strong preference for products that do not compromise on taste. Watermelon rind is a valuable resource that has been largely ignored due to its unappealing taste and lack of awareness about its nutritional composition. However, it serves as an inspiring example of how agricultural waste can become an integral component of a healthy and eco-friendly diet. It is hoped that untapped potential of watermelon rind, encouraging the development of innovative and sustainable approaches to utilizing waste resources, incorporating watermelon rind into food is a promising alternative for delivering health benefits while ensuring consumer satisfaction. Ongoing research and the development of new extraction techniques are crucial for maximizing the potential of this field. A prosperous future in enhanced sustainability and comprehensive waste management in the food industry depends on innovative approaches to upcycling food waste. Transforming food waste into functional biomaterials and medical products enables food waste streams to be repurposed for manufacturing value-added products rather than contributing to greenhouse gas emissions and environmental pollution. To overcome these challenges, collaboration among governments, industries, and researchers is necessary. These three sectors must work together to realize the industrial-scale manufacturing of products through food waste upcycling.

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