INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY: APPLIED BUSINESS AND EDUCATION RESEARCH
2026, Vol. 7, No. 1, 200 – 209
http://dx.doi.org/10.11594/ijmaber.07.01.18

Research Article

Sensory and Nutrient Analysis of Watermelon Pilipit

Desa D. Abaya[1]*, Anna Marie D. Barroga[2], Francisco N. Divina[3], Milagros L. Liberato[2], Zosimo O. Liberato[2], Jennifer C. Chavez[1]

[1]College of Teacher Education, Ilocos Sur Polytechnic State College, 2705, Philippines
[2]College of Graduate Studies, Ilocos Sur Polytechnic State College, 2705, Philippines
[3]College of Agriculture, Forestry and Engineering, Ilocos Sur Polytechnic State College, 2705, Philippines

Article history:
Submission 11 November 2025
Revised 30 December 2025
Accepted 23 January 2026

**Corresponding author:*
E-mail:
desabaya08@gmail.com

ABSTRACT

This study was conducted to improve or develop food products and processing technologies, specifically those that will enhance value addition. The creation of new marketable forms from watermelon rind and skin is usually discarded. The study used an experimental design, employing a completely randomized design with four treatments, each replicated three times. Different measurements of watermelon rind and skin puree were used to represent the treatments of the study.

The products were evaluated by 50 respondents composed of ten (10) trained faculty on sensory evaluation of products, 35 student evaluators who know food preparation and evaluation of products, and five (5) selected bakery owners from the Municipality of Sta. Maria Ilocos Sur. Results showed that 400ml of watermelon rind and skin puree, combined with basic ingredients, was best across all sensory evaluations and had the highest return on investment (ROI).

Based on the study, the watermelon pilipit is considered healthy, acceptable, and nutritious. It contained ash of 1.12g, moisture content of 12.96g, crude fat of 11.0g, and 10.37g of crude protein. The technology should undergo further testing, including shelf-life and physicochemical tests. This study recommends using watermelon skin and rinds as an enhancer in making pastry products such as chips and pilipit

Keywords: *Watermelon pilipit, Puree, Watermelon rind, Enhance*

Background

Man is always in search of food to supplement whatever resources he has already discovered. Through the ages, he has been aided by science and technology to augment his means of sustenance. As society becomes more complex and competition for food becomes much tougher than before, he explores his surroundings in search of food. Since he knows that the plants around him can provide him

How to cite:
Abaya, D. D., Barroga, A. M. D., Divina, F. N., Liberato, M. L., Liberato, Z. O., & Chavez, J. C. (2026). Sensory and Nutrient Analysis of Watermelon Pilipit. *International Journal of Multidisciplinary: Applied Business and Education Research*. *7*(1), 180 – 189. doi: 10.11594/ijmaber.07.01.18

with the necessary subsistence, he only has to dig deeper and discover more that can be utilized for food.

The Philippines, being endowed with fertile soil and rich coastal waters, is a veritable source of agriculture and marine resources. Millions of hectares of land are planted with various crops, including sugarcane, rice, corn, bananas, pineapples, mangoes, watermelons, and others.

Many foods are wasted if not consumed or used after the harvest season; hence, to avoid this, they must be used either in their natural or processed form. In this era where food shortages are a pressing concern, new products and recipes are produced from indigenous resources available within the local community, and the seemingly nuisance litter is.

Watermelon is abundant throughout the year. However, not all harvested watermelons can be sold. Moreover, not all parts of the fruit are consumed, such as the seed, rind, and skin. Some people are unaware that all parts of the watermelon are edible and can be a source of healthful nutrients. Since the watermelon skin and rind are edible, the community folks seem uninterested in processing them as food. Thus, the utilization of watermelon waste in various recipes helps minimize market glut and may eventually lead to the commercialization of the products, here and abroad.

People nowadays are very fond of snacks, and snacking trends have changed over the years. However, unlike in past years, consumers are very conscious of their health, and their perception of food has shifted from being mainly influenced by taste and appearance to considering optimal nutrition, avoiding foods associated with nutritional inadequacy. (Maota, 2019). There is a strong demand for nutritious snacks in the market. It is where watermelon rind and skin can be used as ingredients in snack preparations to help eradicate malnutrition.

Thus, the researchers aim to seek innovations that would help address nutrition and livelihood concerns of the Ilokano community, particularly the watermelon growers. The end goal was to develop products that are acceptable and highly nutritious to supplement the community's and the nation's nutritional needs and livelihoods.

This study is also perceived as an opportunity for research, especially in the food production aspect. Its results could serve as a showcase for the exploration of other economic plants in various localities. In so doing, the Filipinos would be assured of self-reliance, self-sufficiency, and self-sustainability.

Objectives of the Study

This study aimed to develop a pilipit enhanced with a watermelon rind and skin. Specifically, it seeks to:

1 Assess the acceptability of watermelon pilipit formulations in terms of appearance, aroma, and taste, thereby providing insights into sensory drivers of product preference.
2 Analyze the significant differences in sensory acceptability of the different formulations in terms of appearance, aroma, and taste
3 Determine the nutritional content of the most preferred formulation
4 Evaluate the economic value of the formulated products.

Related Literature

Characteristics of Watermelon Rind and Skin

Watermelon is generally eaten raw, and most often only the fleshy pulp is consumed, leaving the seeds and rind. It is largely consumed as a refreshing summer fruit, much appreciated by consumers for its refreshing properties, attractive color, delicate taste, and high water content, which help quench summer thirst. The rind was commonly discarded, which may cause environmental issues and biomass loss.

According to Kasim M. A. et al. Al (2021) reported that watermelon rind is edible and rich in many nutrients, but it is most often discarded because of its unappealing flavor.

The internal rind, which is generally light green or white, contains numerous shrouded supplements, is consumable, and is an alternative form of food preservatives. (Kistriyani et al., 2019).

According to Choudhary et.al. (2015), watermelon is an extremely rich source of vitamins and other bioactive phytochemicals. Various studies have reported high antioxidant activity in watermelons, attributed to phytochemicals.

Besides the medicinal uses of watermelon rind, the peel is composed of various minerals; the mineral composition (mg/100 g) in the peel: Iron 1.29, manganese 1.42, phosphorus 135.24, calcium 29.15, sodium 12.65, copper 0.45, zinc 1.29, magnesium 1.48, potassium 1.37 (Hafiza et al., 2002). It also contains a vitamin composition in mg/100 g: retinol (vitamin A) -52.13, Thiamine (vitamin B1) 1.23, Riboflavin (vitamin B2) 2.71, Niacin (vitamin B3) - 4.25, Pyridoxine (vitamin B6) - 5.34 (Int.J. Curr.Microbiol.App.Sci (2017).

The watermelon peel, or skin, is considered a good source of natural polyphenols, antioxidants, and minerals. The watermelon rind is the firm white part of the fruit that is left behind after the bright pink, red, white, and yellow flesh has been eaten or scooped away. It has a crisp texture similar to a cucumber and is versatile.

Nutritive Value of Watermelon Rind

The watermelon rinds had higher moisture, ash, fat, protein, and carbohydrates at 10.61%, 13.09%, 2.44%, 11.17%, and 56.00%, respectively. Watermelon rinds showed significantly greater free radical scavenging activity and β-carotene (39.7% and 96.44%). The citrulline in watermelon rinds provides antioxidant effects that help protect you from free-radical damage. Citrulline converts to arginine, an amino acid vital to the heart, circulatory system, and immune system. The rind is edible and can be used as a vegetable.

According to Al-Sayed, Hanan M. A.A. (2013), watermelon rind is a good source of nutrients, including antioxidants, amino acids, and pectin, especially citrulline. In processed foods, rind has been tested in pickled form and in jam. The watermelon rind can be processed into a powder and used in carbohydrate-rich goods such as cakes, cookies, noodles, beef patties, and pork patties.

El-Behairy, Usam A., et al. (2022) claimed that watermelon rind is a good source of dietary fiber (16%), nutritional minerals (especially potassium, which was more than 4%), and antioxidant compounds (phenols were 1415 ppm & flavonoids were 732 ppm). They are also valuable by-products due to their high nutrient and antioxidant content and can be used to manufacture nutritional supplements.

Furthermore, Perz, Jose, et al. (2022) claimed that watermelon rind can be used as a source of pectin extraction with citric acid as the extractant solvent, in which it was found that pH 2.0, extraction time 62.31 min, and liquid-solid ratio 35.07 mL/g. Under this optimal condition, the pectin yield, degree of esterification, methoxy content, and hydrobromic acid content were 24.30%, 73.30%, 10.45%, and 81.33%, respectively. Based on its chemical characterization and physicochemical properties, they concluded that watermelon rind waste can be an inexpensive source of high-quality, high-purity pectin and has a high potential for use in the food industry.

According to a study by Yadla, A. K. et al. (2013), 100% of the watermelon rind can be incorporated into the production of nutritious and acceptable fruit butter. Thirty percent (30%) of watermelon rind flour can partially replace refined wheat flour in producing a nutritious cookie (Ashoka S, Shamshad Begum S, and Vijayalaxmi KG. 2021).

Shruti D., et al. Al (2021), the most underutilized portion of watermelon, which is the rind, possesses good efficiency and can be utilized in producing nutritious food products. According to the United Nations Food and Agriculture Organization (FAO), the fruits and vegetable processing industry estimates that losses and waste are the highest among all food types, reaching up to 60%. About 25% - 30% of by-product waste across the whole commodity group is generated by the processing of fruits and vegetables. Out of the total annual production, one-third is simply discarded as rind and peel.

Nutritive Value of Watermelon Skin/Peel

The peel or skin of the watermelon contains minerals, antioxidant activity, total phenolic content, crude protein, fat, fiber, and ash. The watermelon peels also contain protein (6.77 g/100g), fat (0.92 g/100g), ash (13.2 g/100g),

fiber (24 g/100g), sodium (53.59 mg/100g), potassium (2074 mg/100g), calcium (468 mg/100g), copper (0.59 mg/100g), iron (12.08 mg/100g), magnesium (164.48 mg/100g), zinc (0.91 mg/100g) and phosphorus (107 mg/100g). It also indicates a significant free radical scavenging activity (IC50 of 147.30 mg/kg) and total phenolic content (2.47 g/100g).

Figure 1. Characteristics of watermelon skin

Therefore, this review gathers attentions to the researchers towards more and more utilization of fruits and vegetables.

Sensory Evaluation of the Product

Product acceptability (as gleaned from the conceptual meaning given by Edradan (1995) generally means the degree to which a certain thing is accepted, approved, or considered pleasant by the individual or group. Furthermore, this can be indicated by one's liking for a particular thing or idea, which can manifest in many forms.

As Love (1994) implied, the terms 'food acceptance' and 'acceptability' are used in association with several research methodologies. For example, attitudinal studies may be conducted using questionnaires with food names as stimuli to determine the overall acceptability of foods or the relative importance of different factors or sensory attributes to overall acceptability. Other studies involve sensory evaluation of actual foods. The foods presented are chosen or manipulated by the experimenter to elicit consumers' reactions to variations of particular interest. Often, these samples vary only slightly in sensory attributes, and consumers' expectations would be similar until they had tasted them.

According to Lawless H.T. et al. (2013), sensory evaluation is a scientific discipline that studies humans' responses and perceptions evoked by stimuli through the five senses: sight, smell, touch, taste, and hearing. It also attempts to understand the relationships among sensory perception, product liking, and consumer behavior, using physiological and psychological variables that govern subjects' responses.

Sensory evaluation is an instrument that helps measure the objectivity of the product with high reliability and validity. It is also used for decision-making.

Sensory evaluation has a wide range of applications (O'Mahony, M. (2017) which include: (1) new product development, (2) product matching, (3) product improvement, (4) process innovation, (5) cost reduction through supplier replacement, (6) quality control, (7) shelf-life determination, (8) product grading/rating, (9) product performance (acceptability), (10) evaluation of consumer preference, (11) panel training, assessment, and selection, and (12) complementary insights to analysis that represent different dimensions.

The sensory qualities of foods should be systematized or classified in accordance with the sense by which the consumer perceives the various attributes of quality. The eye senses appearance.

Aroma is fragrance or odor as perceived by the nose. Odor stimuli affect only a small area of yellow brown receptor cells located in the ceiling of the inner nose.

Taste is the perception of stimuli by the taste buds, which are primarily located on the

tongue. The tongue is particularly responsive to taste, particularly its tip, sides, and upper rear surface.

Methodology

The study employed an experimental research design, specifically a complete randomized design, to focus on the procedures required to achieve the desired results. This approach emphasized collecting numerical data from evaluators who used the experimental products.

Research Design and Treatments

The study utilized an experimental research design employing a Complete Randomized Design (CRD) with a focus on product formulation and evaluation. The objective was to systematically compare the effects of varying levels of watermelon skin and rind puree on final product quality.

T_0 = Control (pilipit)

T_1 = 200 ml watermelon skin and rind pureed + basic ingredients.

T_2 = 300 ml watermelon skin and rind pureed + basic ingredients; and

T_3= 400 ml watermelon skin and rind pureed + basic ingredients.

Population and Sampling

The evaluator of the study consists of 50 respondents, composed of ten (10) trained faculty on sensory evaluation of products; 35 student evaluators who know food preparation and evaluation of products, and five (5) selected bakery owners from the Municipality of Sta. Maria Ilocos Sur. It was conducted at the Ilocos Sur Polytechnic State College, Sta. Maria, Ilocos Sur involves instructors teaching food-related subjects to students enrolled in food as a major.

Data Gathering

A. Preparation of Tools and Equipment

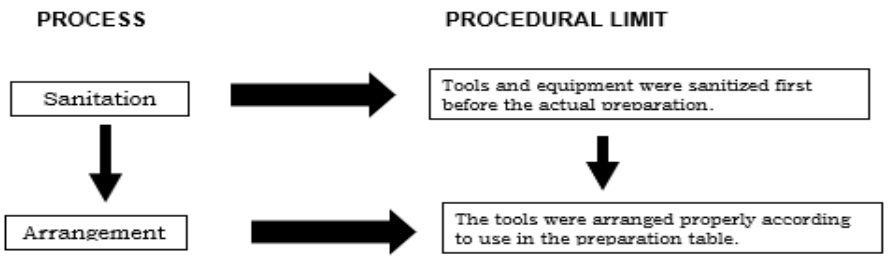

Fig.II. Preparation of Tools and Equipment

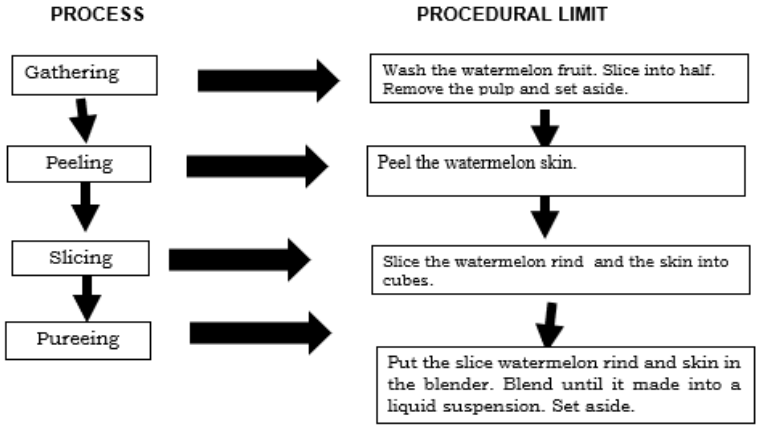

Fig.III Processes in the Preparation of the Preparation of the Watermelon Pilipit

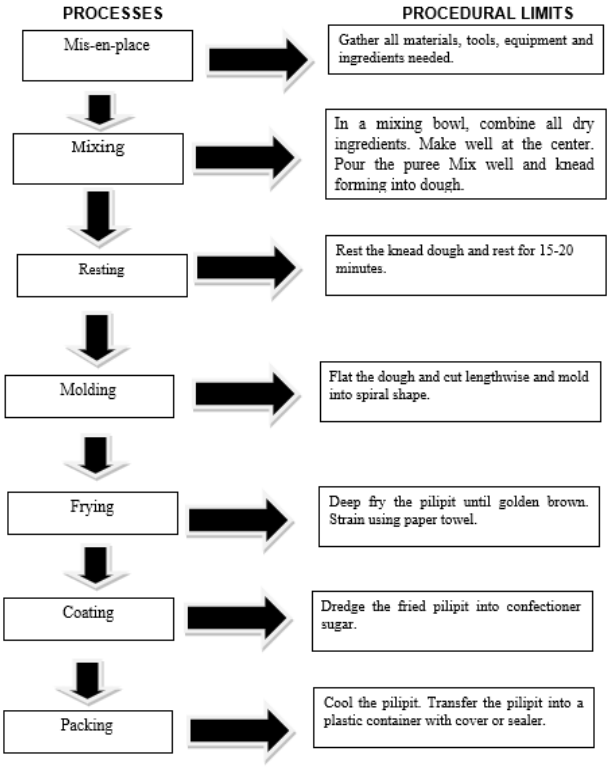

Fig. IV. Process Flow in the Production of Watermelon Pilipit

Microbial Analysis

The Microbial Analyses of the watermelon pulp using the three formulations were determined through laboratory tests at the Molecular Microbiology and Biotechnology Laboratory, Mariano Marcos State University, Batac City, Ilocos Norte. The standard operating procedures for these tests aimed to detect the presence or absence of specific test microbes to verify if the product was safe for human consumption. This analysis is crucial for establishing product safety and shelf stability.

All treatments underwent microbial analysis to detect the presence or absence of the test microbes to determine and verify if the product is safe for human consumption. The results revealed that all treatments were negative.

Proximate Analysis

Micronutrient analysis determined the nutrient content of the watermelon pulp using the AOAC Method. Proximate analysis of the samples was performed according to the AOAC standard (AOAC, 2016). Moisture content, crude fat, and ash were analyzed and calculated. It was conducted in DOST San Fernando City, La Union. Moreover, the crude protein of the watermelon pulp was analyzed and calculated at SGS Philippines, Inc., Manila. All formulations weighed approximately 300 g. The results were expressed as g/100 g of dry matter.

Return of Investment

The calculation of watermelon pilipit total expenses was used to estimate the income from the products.

Statistical Tool and Analysis

The statistical analysis tools were specifically chosen to describe the sensory data and determine significant differences between formulations:

Mean. Used as a descriptive statistic to quantify the central tendency of the sensory acceptability scores across the five attributes

Kruskal-Wallis H Test. Employed to determine if there were statistically significant differences between and among the mean ranks of the different pilipit formulations.

Tukey-Kramer Multiple Comparison Test. Used as a post-hoc test when the Kruskal-Wallis test indicated a significant overall difference.

Result and Discussion

Acceptability of watermelon pilipit in terms of appearance

Table 1 shows that T2 (400 ml watermelon skin and rind pureed) obtained the highest mean of 4.33 described as "like very much", as compared to the other treatments with a descriptive rating of "like much". One-way analysis of variance shows significant differences, indicating that the evaluators perceived differences in the product's color. When subjected to the Tukey-Kramer Multiple Range Test, the results indicate that T0 is significantly different from T3. This implies that the watermelon pulp in this research produced colors ranging from brown to mellow yellow, and the evaluators perceived that the yellow of T3 had an appealing or soothing effect on the eyes. The presence of watermelon skin and rind puree contributed to the reddish/brown color, which affects the product's acceptability.

The study corroborates the findings of Callejo (2011), Crumb color is highly related to ingredients (recipe). The most important attributes are described in terms of the processes or characteristics of the ingredients used.

Table 1. Acceptability of watermelon pilipit in terms of appearance

Treatment	Mean	Descriptive rating
T_0 – pilipit	3.71	Like Much
T_1- 200 ml watermelon skin and rind puree + basic ingredients	4.07	Like Much
T_2- 300 ml watermelon skin and rind pureed + basic ingredients	4.05	Like Much
T_3 - 400 ml watermelon skin and rind pureed + basic ingredients	4.33	Like Very Much

Acceptability of watermelon pilipit in terms of taste

Among the treatment formulations, results show that T3 has the highest mean of 4.24, described as "like very much," compared to the other treatments, which have a descriptive rating of "like much". One-way Analysis of Variance showed a significant difference; when further analyzed using Tukey-Kramer Multiple Range Test, it indicates that T3 is significantly different from T1. The results indicate that T3 is the best treatment, particularly compared to T0, in terms of taste.

Results show that 400 ml of watermelon skin and rind satisfy consumer taste preferences. The formulation with the basic ingredients makes the products a unique blend that creates an irresistible flavor profile for consumers. Liem's (2019) study supported the idea that taste plays an important role in food choice. Individuals within similar food environments respond differently, resulting in unique tastes and, subsequently, food likes and dislikes.

Melis (2017) supported the claim that taste perception varies greatly among individuals, strongly influencing food preferences and selection, and therefore nutritional status and health. Findings revealed that T3 has a balanced taste of watermelon and of the all-purpose flour, as perceived by the evaluators.

Table 2. Acceptability of watermelon pilipit in terms of taste

Treatment	Mean	Descriptive rating
T_0 – pilipit	3.97	Like Much
T_1- 200 ml watermelon skin and rind puree + basic ingredients	3.87	Like Much
T_2- 300 ml watermelon skin and rind pureed + basic ingredients	4.10	Like Much
T_3 - 400 ml watermelon skin and rind pureed + basic ingredients	4.24	Like Very Much

Acceptability of watermelon pilipit in terms of aroma

As to the aroma of the products, T3 again showed the highest mean, described as "like very much", whereas the other treatments were all described as "like much". Significant differences were noted using the One-way Analysis of Variance. Further analysis using the

Tukey-Kramer Multiple Range test showed that T3 significantly differs from T0 and T1.

The result could be attributed to the aromatic exogenous effect of watermelon, which emits a savory aroma that stimulates appetite and increases hunger, leading consumers to enjoy the product.

Table 3. Acceptability of watermelon pilipit in terms of aroma

Treatment	Mean	Descriptive rating
T_0 – pilipit	3.96	Like Much
T_1- 200 ml watermelon skin and rind puree + basic ingredients	3.96	Like Much
T_2- 300 ml watermelon skin and rind pureed + basic ingredients	4.06	Like Much
T_3 - 400 ml watermelon skin and rind pureed + basic ingredients	4.41	Like Very Much

Proximate Analysis of the Best Product Formulated

The test results for the Watermelon Pilipit sample reveal a nutritionally dense snack with a balanced composition. With a moisture content of 12.96 g/100g, the product maintains good shelf stability, minimizing the risk of spoilage. The ash content at 1.12 g/100g reflects a modest mineral presence, contributing to its nutritional value. Notably, the crude fat level is relatively high at 11.0 g/100g, indicating a rich energy source likely due to oil-based preparation methods. Additionally, the crude protein content of 10.37 g/100g suggests a substantial contribution to satiety and muscle-supporting nutrients, possibly derived from seeds, flour, or other protein-rich ingredients. Overall, this snack offers a hearty mix of fat, protein, and minerals, making it both flavorful and filling.

Table 4: Proximate Analysis of watermelon Pilipit

Sample Number	**Test Parameter**	**Result**
CHE - 00527	Ash	1.12g/100g
CHE- 00527	Moisture Content	12.96g/100g
CHE -00527	Crude Fat	11.0g/100g
Phil23-04350-01.008	Crude Protein (N x 6.25)	10.37g/100g

Cost and return analysis of all treatments

As a result, the additives of 400ml watermelon skin and rind pureed had the highest return of investment with 99.235%.

This study concludes that watermelon pilipit is acceptable as food. It is highly available at low cost. It can also help promote better nutrition among school children. The ingredients needed are low-cost. The procedures are simple and replicable by parents, home economics teachers, and entrepreneurs. Watermelon pilipit production can be a profitable home industry to boost family income.

Table 5. Cost and Return analysis of watermelon pilipit

Particulars	**T_0**	**T_1**	**T_2**	**T_3**
Price (Php)	15	15	15	15
Total Expenses (Php)	469.37	479.37	484.37	489.37
Total Sales	600.00	675.00	825.00	975.00
Total Yields	40	45	55	65
Net Income (Php)	130.63	195.63	340.63	485.63
ROI (%)	27.83%	40.80%	70.32%	99.25%

Conclusion

The study successfully developed a novel pilipit formulation enriched with watermelon rind and skin puree. Among the treatments, T3 (400 ml puree) emerged as the most acceptable in terms of appearance, taste, and aroma. Proximate analysis confirmed its nutritional benefits, while microbial analysis established its safety for consumption. Economic analysis further revealed its profitability with an ROI nearing 100%.

Acknowledgement

Our deepest gratitude to our fellow faculties, school administrators, and the group of evaluators involved in this study.

References

Al-Sayed, M. A., & Ahmed, A. R. (2013). Utilization of watermelon rinds and Sharlyn melon peels as a natural source of dietary fiber and antioxidants in cake. Annals of Agricultural Science, 58(1), 83–95. https://doi.org/10.1016/j.aoas.2013.01.012

Alam, M. A., & Hoque, M. M. (2016). Development of value-added products from watermelon rind (Citrullus lanatus). International Journal of Nutrition and Food Sciences, 5(4), 280–285. https://doi.org/10.11648/j.ijnfs.20160504.15

Choudhary, B. R., Haldhar, S. M., Maheshwari, S. K., Bhargava, R., & Sharma, S. K. (2015). Phytochemicals and antioxidants in watermelon (Citrullus lanatus) genotypes under hot arid region. Indian Journal of Agricultural Sciences, 85(3), 414–417

Duda-Chodak, A., Tarko, T., Satora, P., & Sroka, P. (2015). Interaction of dietary compounds, especially polyphenols, with the intestinal microbiota: A review. European Journal of Nutrition, 54(3), 325–341. https://doi.org/10.1007/s00394-015-0852-y

Gwana, A. M., Amoo, I. A., & Amao, O. J. (2014). Nutritional, phytochemical and antimicrobial screening of watermelon (Citrullus lanatus) rind and seed. Journal of Applied Chemistry, 7(5), 9–15

Kassim, M. A., Hussin, A. H., Meng, T. K., et al. (2021). Valorisation of watermelon (Citrullus lanatus) rind waste into bioethanol: An optimization and kinetic studies. International Journal of Environmental Science and Technology.

Kistriyani, L., Ramadhani, A. A., & Resphaty, D. P. (2019). Encapsulation of anthocyanin and flavonoid from watermelon rind (Citrullus lanatus) as a natural food preservative. Key Engineering Materials, 818, 50–55.

Kumar, P., et al. (2017). Effect of processing parameters on quality attributes of fried banana chips.JournalLakshmi, B., & Kaushal, P. (2016). Nutritional evaluation and utilization of watermelon rind in the development of products. International Journal of Food Science and Nutrition, 1(6), 39–42

Maota, S. (2019). Changing consumer perceptions on healthy snacking. Food & Beverage Reporter, 37(2), 12–15.

JournalPathak, P. D., Mandavgane, S. A., & Kulkarni, B. D. (2018). Fruit and vegetable peel waste as a novel source of dietary fiber and antioxidants: A review. Journal of Food Science and Technology, 55(10), 3979–3990. https://doi.org/10.1007/s13197-018-3227-2

Prell, P. (1977). Preparation of reports and manuscripts which include the sensory evaluation data. Food Technology.

Charley, H. (1970). Food science Philippines. Philippine Graphic Arts, Inc

Conran, C., et al. (1997). Kitchen technology. Conran Octopus/Cornell University Library.

Cunningham, M. (2008). The Fannie Farmer cookbook (13th ed.). Alfred A. Knopf

Jeremiah, F. A. (1992). Chemical evaluation and nutritional quality of almond fruits (Terminalia cattapa). In A. U. Osagie & E. U. Eka (Eds.), Nutritional quality of plant foods (pp. 93–94). Post Harvest Research Unit, University of Benin

Lawless, H. T., & Heymann, H. (2013). Sensory evaluation of food: Principles and practices (2nd ed.). Springer Science & Business Media

O'Mahony, M. (2017). Sensory evaluation of food: Statistical methods and procedures. Routledge

Philippine Food Composition Table. (1997). Philippine food composition table. Department of Science and Technology, Food and Nutrition Research Institute

Sinclair, C., et al. (1998). The international dictionary of food and cooking. Peter Collin

Campbell, M. (2006). Extraction of pectin from watermelon rind. University of California Agriculture and Natural Resources. https://ucanr.edu/datastoreFiles/608-824.pdf

Evans, C. B. (2008). Consumer preferences for watermelons: A conjoint analysis [Master's thesis, Auburn University]. Auburn University Electronic Theses and Dissertations. https://etd.auburn.edu/bitstream/handle/10415/1020/Evans_Callie_53.pdf3

Food and Agriculture Organization of the United Nations. (2019). The State of Food and Agriculture 2019: Moving forward on food loss and waste reduction. Rome: FAO. https://www.fao.org/publications

Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., & Meybeck, A. (2011). Global food losses and food waste: Extent, causes and prevention. Rome: FAO.\

Méndez, D. A., et al. (2021). Modeling. https://www.researchgate.net/figure/Composition-of-watermelon-rind_tbl1_350527293

Watermelon: Nutrition facts and health benefits. (n.d.). Healthline. https://www.healthline.com/nutrition/foods/watermelon.