



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

A futuristic digital interface with a glowing Earth globe in the center. The background is dark blue with various data visualizations including bar charts, line graphs, and network diagrams. Text elements like 'BUSINESS', 'NETWORK SEARCH', and 'WORLD' are visible. A person's hand is seen at the bottom, interacting with the interface.

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 13, April 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

 9940 572 462

 6381 907 438

 ijrset@gmail.com

 www.ijrset.com

Development of Value Added Candy by Valorization of Black Grape (*Vitis Vinifera*) Pomace

C Selvamurugan¹, Muhammed Shaham P S², Syed Mohammed Afnan³, Nashil M S⁴

Associate Professor, Department of Food Technology, Dhaanish Ahmed Institute of Technology, Coimbatore, Tamilnadu, India¹

U.G Student, Department of Food Technology, Dhaanish Ahmed Institute of Technology, Coimbatore, Tamilnadu, India^{2,3,4}

ABSTRACT: Grape Pomace is the main by-product from the wine industry, consisting of remaining skin, seeds and pulp. Extremely rich in flavonoids, anthocyanins and tannins. This study evaluated the use of grape pomace for the development of a nutritious candy. The grape pomace was sun dried and tray dried, and the drying rates and moisture content loss were analyzed. Central Composite Design (CCD) was conducted to study the effects of liquid glucose and black grape pomace powder on the overall acceptance of the candy. The candy's stability and shelf life were tested under various storage conditions, and aluminum foil was identified as the ideal packaging material. The results suggest that the combination of liquid glucose and black grape pomace powder in Trial 5 and Trial 8 resulted in a preferred flavor, texture, taste, aroma, and overall acceptability among the internal panelists. The highly nutritious candy made in Trial 10 showed a promising potential for further development and commercialization. The study demonstrates the potential use of grape pomace for the development of a nutritious candy, and aluminum foil was identified as the ideal packaging material for the grape pomace candy.

KEYWORDS: Grape Pomace, Candy, drying, Central Composite Design, storage, packaging.

I. INTRODUCTION

Grape is one of the largest and most significant fruit crops cultivated all over the world. Although many grape-based food products can be found in the market, studies have shown that around 75% of the world grape production is destined for the wine industry. In countries such as Italy, France and Spain, where wine production is more relevant, the annual grape pomace generation can reach nearly 1200 tonnes per year which represents a challenging waste disposal problem for the winery and grape juice industry [1-2].

Grape pomace (GP) is an abundant by-product from the wine industry, which consists of the remaining skin, seeds and stalks and represents around 25% of total grape weight used in the winemaking process. It is a promising source of nutrients and compounds with functional properties and also rich in anthocyanin, flavonol and procyanidin [3]. The main components of grape pomace are moisture (50%–72%), while in case of red grape pomace phenolics represent about 9 kg per tonne. Considering its phenolic content, grape pomace has demonstrated a high antioxidant capacity and therefore it is a valuable source of natural antioxidants [4]. Peptic substances, cellulose and lignin are also present in important amounts in grape pomace. It contains a considerable amount of condensed tannins (up to 52% dry weight). Protocatechuic acid is determined to be the most dominant hydroxybenzoic acid in grape pomace from some red varieties [5].

Over the past few years, utilization of grape pomace has been inefficient. It is used as a fertilizer, fodder, feedstock for biorefineries and animal feed. Some wineries sell their pomace to silage processors who turn the oil and fiber-rich grape skins, as well as other agricultural “waste,” into feed supplements for cattle [6]. Still other wineries choose to recycle their pomace as compost in the vineyard. Sometimes when the above options aren't feasible, pomace just ends up in the local landfill. The main aim of the project is to present the primary benefits of winemaking by-products to new products focusing on grape pomace, as a source of healthy and technological compounds that could be utilized in the way of production of value added products (candy) [7].

II.RELATED WORK

Beres,C et al., (2017) reported that grape pomace as a source of healthy and technological compounds that could be applied in animal feed, pharmaceutical, cosmetic or food industry to improve stability and nutritional characteristics, and in cosmetic industry, where grape seeds oil is widely used. This review aims to approach the recent winemaking scenario and the benefits achieved when a waste management policy is implemented, as well as to compare available extractive technologies and a wide alternative of uses for grape pomace[8-9].

Bordiga,M et al., (2019) explained that this paper aims to give an overview about the recent insights and results related to valorisation of grape pomace and how this approach, considering the number of dedicated studies, is now reaching its maturity. By - products valorisation, a concept increasingly consolidated in the field of industrial residues management, holds immense potential for prospective production. In this regard, the valorisation of grape pomace is proving its effectiveness, obtaining remarkable results[10-12].

Dwyer,K et al., (2014) says that during wine production, approximately 25% of the grape weight results in by-roduct/waste (termed 'pomace' which is composed of skins and seeds). Currently, most pomace is being composted to be reintroduced into the vineyards to complete the carbon cycle[13]. Due to the increasing consumer demand for the use of natural over synthetic compounds, and because of increased attention to sustainability of agricultural practices, there is a vast array of applications for grape pomace bioactives including: functional foods. To date, there has been no assessment as to the market potential for value-added usage of grape pomace. This paper seeks to address this gap. The annual production of grape pomace along with its multitude of applications, create an opportunity to discover an unexploited market with great commercial potential[14].

Gaita,C et al., (2017) explained that the purpose of this work was to review several studies about the valorisation of grape pomace as an innovative functional ingredient to develop food products with health benefits. The idea to exploit the potential of this wine industry by-product has been focused on its high content of dietary fiber and polyphenolic compounds. Several food classes have been successfully enriched in polyphenols by incorporating grape pomace products. The wine pomace products have been also used in the meat and fish products industry. Other food products, such as marmalade and candies, tomato puree and seafood sausage have also been improved by addition of grape pomace products.The reviewed studies prove that it is possible to exploit the grape pomace to design innovative value-added foods[15-17].

Iora,S.R et al., (2015) defined that grape pomace is an agro - industrial residue produced worldwide and mainly employed for animal feed or as a fertiliser. Several studies have shown that grape pomace is a rich source of bioactive compounds, such as phenolic compounds, polysaccharides, fatty acids and others. Three varieties of grape pomace were evaluated in this study. Fatty acids and phenolic compounds were identified, respectively, by gas and liquid chromatography[18]. Results showed that grape pomace is a rich source of polyunsaturated fatty acids and phenolic compounds and thus a higher antioxidant activity among the samples analysed[19].

III.METHODOLOGY

- Step 1:preparation of grape pomace powder
- Step 2: Boiling Water
- Step 3: Addition of Liquid Glucose
- Step 4: Addition of Sorbitol
- Step 5: Addition of Grape Pomace Powder
- Step 6: Stirring Mixture
- Step 7: Pouring Mixture into a Mold
- Step 8: Cooling and Hardening
- Step 9: Removing the Candy from the Mould
- Step 10: Grape Pomace Candy

The grape pomace candy was prepared by different proportion of ingredients to find the best trial run combination. 40 ml of water was boiled in a saucepan. Once the water gets boiled, the heat was reduced to a simmer.60ml of liquid glucose

Organized by

Dhaanish Ahmed Institute of Technology, KG chavadi, Coimbatore, India

was added to the boiling water and stirred until the glucose was fully dissolved. Liquid glucose is a syrup that is used to sweeten candy and give it a chewy texture[20]. 24 gm of sorbitol was added to the mixture and stirred until it was fully dissolved. Sorbitol is a sugar that is commonly used in candy-making as a sweetener and a humectant, which helps to keep the candy. Further, 16gm of grape pomace powder was added to the mixture and stirred continuously until the powder was fully incorporated. Grape pomace powder is made from the skins, seeds, and stems of grapes that are left over after the wine-making process[21-23].

It is high in fiber and antioxidants, making it a healthy addition to candy. The mixture was stirred continuously until it reached the crack state. The crack state is when the candy has reached a hard and brittle consistency, which is the desired texture for grape pomace candy. Once the candy had reached the crack state, the mixture was poured into a greased mould. The mould could be any shape or size, depending on the desired final shape of the candy[24]. The candy was left to cool and harden in the mould. It took 4-6 hours for hardening. Time frame for hardening is also depended on the size of the mould and the room temperature. Once the candy had cooled and hardened, it was removed from the mould. A knife or a spatula was used to loosen the edges of the candy from the mold, then it was gently popped out. The grape pomace candy has been prepared. The candy was stored in an airtight container at room temperature for up to several weeks[25].

Test Methods**INITIAL AND FINAL NUTRITIONAL ANALYSIS**

The highly nutritious candy made of Trial 10 was subjected to Initial nutritional test and final nutritional test. The analysis conducted on day 1 and after 30 days of preparation, providing evidence that this trial had a more significant and evident nutritional composition compared to other trials. The results of the study suggest that trial 10 samples have a promising potential for further development and commercialization[26].

Components	Initial test (Day 1)	Final test (Day 30)
Energy (Kcal)	116	116
Carbohydrate (g)	59	59
Protein (g)	0	0
Fat (g)	0	0
Fibre (g)	2.9	2.9
Sugar (g)	22	22
Sodium (mg)	1	1
Polyphenols (mg)	175	163

From the initial and Final nutritional test, it is observed that parameters such as Energy, Carbohydrate, Protein, Fat, Fibre, Sugar, Sodium have no nutritional loss and remain constant. The losses occurred only in Polyphenols. The decrease in polyphenol content from 175 mg to 163 mg could be due to various factors such as oxidation, enzymatic activity, or degradation during the 30-day period[27]. The reduction of polyphenols is a natural process that occurs over time and is influenced by factors such as temperature, moisture, and storage conditions. Therefore, it is important to store the product in a cool, dry place to preserve its nutritional value[28].

It is worth noting that the nutritional values of the sample remained relatively stable after 30 days of production, indicating that the product has good stability and can be stored for an extended period without significant nutrient loss.

SENSORY EVALUATION**The sensory evaluation was done by 7 Point hedonic scale.**

The evaluation was carried out by Ten internal panelists who provided their scores for each characteristic of the samples.

The analysis of the results indicated that Trial 5 and Trial 8 received the highest overall acceptability scores among all the trial samples. This implies that these samples were the most favoured by the panelists based on their combined scores for all the characteristics evaluated[29].

Response Surface Methodology

Based on the tabular column values, central composite design (CCD) was conducted to study the effects of liquid glucose and black grape pomace powder on the overall acceptance of RSM black grape pomace candy. The response (overall



Organized by

Dhaanish Ahmed Institute of Technology, KG chavadi, Coimbatore, India

acceptance) data for 10 trials have been collected and analyzed. Out of the 10 trials, Trials such as 2, 5, 8, and 10 had good acceptance. However, trial 8 had the highest acceptance out of all the trials. Based on the graph, it can be inferred that the combination of liquid glucose and black grape pomace powder used in trial 8 resulted in a better overall acceptance of the candy compared to the other trials[30].

SHELF LIFE ANALYSIS

The grape pomace candy made of Trial 10 was tested for a shelf life of 7 days and there was no evidence of microbial growth, indicating that the candy was microbiologically stable. The shelf life study is still ongoing, and the candy will be monitored for an additional 3 weeks to complete the cycle

S.No	PARAMETERS	TEST METHOD	UNIT	RESULT	REQUIREMENTS as per IFSA
1	Coliforms	IS 5401 (Part 1) : 2012 (RA : 2018)	CFU/g	<10	<10/gram
2	Staphylococcus aureus	IS : 5887 (Part 8) : Sec 1 : 2002 (RA : 2018)	CFU/g	<10	<100/gram
3	Salmonella	IS 5887 (Part 3) : 1999 (RA : 2018)	CFU/g	<10	<100/gram

IV. EXPERIMENTAL RESULTS

The grape pomace candy was prepared by different proportion of ingredients to find the best trial run combination.

Trial 1 had a crunchy texture, which indicated that the candy was too dry and hard..

Trial 2 had found to be optimum in condition, formation of shape was better than trial 1

Trial 3 had a watery structure, which indicated that the candy didn't bind together well and resulted in an uneven texture

Trial 4 had a holey texture as well as a gritty mouthfeel, which indicated that the ingredients wasn't blended evenly.

Trial 5 had a good shape, felt tasty and mouthfeel was good.

Trial 6 had a crunchy and gritty texture, which showed that the candy was too dry.

Trial 7 had a grainy texture, which indicated that the grape pomace powder wasn't blended evenly with the other ingredients.

Trial 8 had a good combination of flavor, shape and texture

Trial 9 had a grainy and crunchy texture, which may indicate that the candy is too dry and the grape pomace powder wasn't blended evenly with the other ingredients.

Trial 10 had a well defined shape, crystal like candy texture, good aroma and flavour.

Overall the candy prepared from Trial 2,5,8,10 had better result and Trial 1,3,4,6,7,9 had average result

Trial 2, Trial 5, Trial 8, and Trial 10 were successful in forming the desired candy structure, while the remaining six trials did not form proper candy structure. It is possible that the unsuccessful trials may have involved variations in the processing conditions that negatively affected the candy formation process. That's the reason to choose these trials for nutritional analysis

- ❖ It was found that Protein and Fat were not present in any of the samples.
- ❖ The sodium level remained constant at 1 mg in all the trial samples.
- ❖ The analysis revealed that Trial 10 had the highest levels of Energy, Carbohydrate, Fiber, and Sugar. Polyphenol content followed by Trial 8, Trial 5, Trial 2 Out of the 10 trials, Trials such as 2, 5, 8, and 10 had good acceptance. However, trial 8 had the highest acceptance out of all the trials.It can be inferred that the combination of liquid glucose and black grape pomace powder used in trial 8 resulted in a better overall acceptance of the candy compared to the other trials.

V. CONCLUSION

This study aimed to investigate the potential use of grape pomace for the development of a nutritious candy. To achieve this, grape pomace was dried using both sun and tray drying methods, and the optimal drying conditions were determined.

Organized by

Dhaanish Ahmed Institute of Technology, KG chavadi, Coimbatore, India

Additionally, a central composite design was conducted to identify the ideal combination of liquid glucose and black grape pomace powder for the development of the candy.

The results indicated that sun drying at 31°C effectively reduced the moisture content of grape pomace. Tray drying, on the other hand, was more efficient in reducing the moisture content, but sun drying at 31°C was more effective in reducing the final moisture content. The combination of liquid glucose and black grape pomace powder in Trial 5 and Trial 8 resulted in a preferred flavor, texture, taste, aroma, and overall acceptability among the internal panelists, with Trial 8 being the most accepted. The highly nutritious candy made in Trial 10 showed a promising potential for further development and commercialization, as it demonstrated a significant and evident nutritional composition compared to other trials. Furthermore, the candy's stability was tested under various storage conditions, and no significant microbial contamination was observed during the shelf-life study.

Finally, the study identified aluminum foil as the ideal packaging material for the grape pomace candy due to its superior barrier properties, which help to preserve the quality and freshness of the candy. Overall, this study highlights the potential of grape pomace for the development of a nutritious and appealing food product.

REFERENCES

- [1] Beres, C., Costa, G. N., Cabezudo, I., da Silva-James, N. K., Teles, A. S., Cruz, A. P., ... & Freitas, S. P. (2017). Towards integral utilization of grape pomace from winemaking process: A review. *Waste Management*, 68, 581-594.
- [2] Bordiga, M., Travaglia, F., & Locatelli, M. (2019). Valorisation of grape pomace: an approach that is increasingly reaching its maturity—a review. *International Journal of Food Science & Technology*, 54(4), 933-942.
- [3] Dwyer, K., Hosseinian, F., & Rod, M. R. (2014). The market potential of grape waste alternatives. *Journal of Food Research*, 3(2), 91-91.
- [4] Acun, S., & Gül, H. (2014). Effects of grape pomace and grape seed flours on cookie quality. *Quality Assurance and Safety of Crops & Foods*, 6(1), 81-88.
- [5] Yu, J., & Ahmedna, M. (2013). Functional components of grape pomace: their composition, biological properties and potential applications. *International Journal of Food Science & Technology*, 48(2), 221-237.
- [6] KN, C. M., Singh, R. P., & Jayaprakasha, G. K. (2002). Antioxidant activities of grape (*Vitis vinifera*) pomace extracts. *Journal of agricultural and food chemistry*, 50(21), 5909-5914.
- [7] Sirohi, R., Tarafdar, A., Singh, S., Negi, T., Gaur, V. K., Gnansounou, E., & Bharti Raja, B. (2020). Green processing and biotechnological potential of grape pomace: current trends and opportunities for sustainable biorefinery. *Bioresource Technology*, 123771.
- [8] Theagarajan, R., Malur Narayanaswamy, L., Dutta, S., Moses, J. A., & Chinnaswamy, A. (2019). Valorisation of grape pomace (cv. Muscat) for development of functional cookies. *International Journal of Food Science & Technology*, 54(4), 1299-1305.
- [9] Altınok, E., Palabiyik, I., Gunes, R., Toker, O. S., Konar, N., & Kurultay, S. (2020). Valorisation of grape by-products as a bulking agent in soft candies: Effect of particle size. *LWT*, 118, 108776.
- [10] Tagirova, P. R., Khasikhanov, M. S., Kasyanov, G. I., Saydulaev, S. S., Masaeva, E., Malaev, R. S., & Dzhanhotov, M. D. (2018, December). Food and ecological safety of grape by-products. In *International scientific and practical conference "Agro-SMART-Smart solutions for agriculture" (Agro-SMART 2018)* (pp. 941-945). Atlantis Press.
- [11] Acan, B. G., Kilicli, M., Bursa, K., Toker, O. S., Palabiyik, I., Gulcu, M., ... & Konar, N. (2021). Effect of grape pomace usage in chocolate spread formulation on textural, rheological and digestibility properties. *LWT*, 138, 110451.
- [12] Derevenko, V., Kasyanov, G., & Pylypenko, L. (2018). Studying the properties of grape pomace as of an object of drying.
- [13] Gaita, C., & Poiana, M. A. (2017). Grape pomace as an innovative functional ingredient to design value-added food products: A review. *Journal of Agroalimentary Processes and Technologies*, 23(4), 223-228.
- [14] Nath, A., Deka, B. C., Jha, A. K., Paul, D., & Misra, L. K. (2013). Effect of slice thickness and blanching time on different quality attributes of instant ginger candy. *Journal of food science and technology*, 50(1), 197-202.
- [15] Verma, I., & Gupta, R. K. (2015). Estimation of phytochemical, nutritional, antioxidant and antibacterial activity of dried fruit of sacred figs (*Ficus religiosa*) and formulation of value added product (Hard Candy). *Journal of Pharmacognosy and Phytochemistry*, 4(3), 257.
- [16] Mishra, D. S. (2018). Enhancing income through value-addition.
- [17] Durrani, A. M., Srivastava, P. K., & Verma, S. (2011). Development and quality evaluation of honey based carrot candy. *Journal of food science and technology*, 48(4), 502-505.

Organized by

Dhaanish Ahmed Institute of Technology, KG chavadi, Coimbatore, India

- [18] Jahnavi, K., & Mishra, S. (2020). Studies on Physio-Chemical Properties of Value Added Herbal Papaya (*Carica papaya* L.) Candy. *Current Journal of Applied Science and Technology*, 95-101.
- [19] P. Selvakumar “Comparison of ABTS, FRAP assays for estimating antioxidant activity from *Alternanthera sessilis* extracts” in *International journal current science* 2012, 7-10. ISSN 2250-1770.
- [20] Vengaiyah, P. C., Murthy, G. N., Sattiraju, M., & Maheswarappa, H. P. (2017). Value Added Food Products from Palmyra Palm (*Borassus flabellifer* L.). *Journal of Nutrition and Health Science*, 4(1), 1-3.
- [21] Katke, S. D., Pandhare, G. R., & Pati, P. S. (2018). Studies on process standardization of sugarless amla (*Phyllanthus emblica*) candy. *J. Pharma. and Phytochem*, 7(6), 396-400.
- [22] Nayak, P., Tandon, D. K., & Bhatt, D. K. (2012). Study on changes of nutritional and organoleptic quality of flavored candy prepared from aonla (*Emblica officinalis* G.) during storage. *International Journal of Nutrition and Metabolism*, 4(7), 100-106.
- [23] Sivakumar, K. P. (2013). Standardization and Storage Stability of Amla Sweet Candy. *Madras Agricultural Journal*, 100.
- [24] Kumar, V., Kushwaha, R., Goyal, A., Tanwar, B., & Kaur, J. (2018). Process optimization for the preparation of antioxidant rich ginger candy using beetroot pomace extract. *Food chemistry*, 245, 168-177.
- [25] Take, A. M., & Bhotmange, M. G. (2012). Preparation of candy from ber-a value addition. *Food Science Research Journal*, 3(2), 217-220.
- [26] Selvakumar P, Loganathan V. In vitro antibacterial and antifungal activities of *Morinda tinctoria* leaf in different solvents. *Pharmacia* 2013;2:52-8.
- [27] Lee, N. J., Lee, S. J., & Shin, Y. M. (2006). Effect of heating conditions on physical properties of model hard candy. *Food Engineering Progress*.
- [28] Ramesh, G. S. (2015) Studies on acceleration of process of candy making from Apple Ber (Doctoral dissertation, Mahatma Phule Krishi Vidyapeeth, Rahuri).
- [29] GURAV, S. S. (2015) STUDIES ON UTILIZATION OF CASHEW APPLE (*Anacardium occidentale* L.) POMACE FOR CANDY MAKING (Doctoral dissertation, DBSKKV DAPOLI).
- [30] Hasanuzzaman, M., Kamruzzaman, M., Islam, M. M., Khanom, S. A. A., Rahman, M. M., Lisa, L. A., & Paul, D. K. (2014). A study on tomato candy prepared by dehydration technique using different sugar solutions. *Food and Nutrition Sciences*, 2014.



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details