ISSN: 2348-2079

International Journal of Intellectual Advancements and Research in Engineering Computations (IJIAREC)

IJIAREC |Vol.14 | Issue 1 | Jan - Mar -2026

www.ijiarec.com

DOI : https://doi.org/10.61096/ijiarec.v14.iss1.2026.1-9

Review

From Nature to Chewable the Rising Role of Natural Gummies in Healthcare

G. Surekha*[1], M. Sriya[2], B. Megahana[2], K. DivyaBharathi[3]

[1,2,3]*Department of Pharmacy, Mallareddy Pharmacy College, Maisammaguda, Dhullapally, Secunderabad, Telangana 500100.*

*Author for Correspondence: G. Surekha
Email: surekhapharma@gmail.com

Published on: 26.01.2026

Published by:
Futuristic Publications

Abstract

Natural gummies have emerged as a transformative trend in healthcare and nutraceutical delivery, bridging the gap between traditional medicine and consumer-friendly supplementation. Originally designed as chewable multi vitamin options for children, gummy supplements have evolved into versatile delivery systems for a wide range of health-promoting Concurrently, research on natural ingredient-based formulations highlights the potential for gummies enriched with antioxidants, herbal extracts, and other bioactives to deliver measurable health benefits while maintaining favorable sensory profiles. Studies developing functional jelly gums with natural sweeteners like honey and blueberry concentrate demonstrate enhanced phenolic content and antioxidant activity, underscoring the nutritious potential of these chewable products beyond traditional confectionery roles. Compounds including probiotics, botanical extracts, phenolics, and functional lipids driven by advances in formulation science and growing consumer demand for palatable, convenient alternatives to pills and capsule. The palatability and ease of consumption associated with chewable gummy formats have been shown to significantly enhance patient adherence, particularly among populations struggling with pill fatigue or dysphagia, including older adults and children. Overall, the transition from nature-derived ingredients to chewable gummy health solutions underscores a significant trend in modern healthcare: making wellness supplementation more accessible, enjoyable, and effective for diverse user groups, thereby potentially improving health outcomes and patient compliance in both preventive and therapeutic contexts.

Keywords: Natural gummies; nutraceuticals; chewable gummy; herbal formulations; modern healthcare.

INTRODUCTION

In recent decades, consumer demand in the field of food production has changed significantly, as they have become increasingly aware of food quality and the health benefits associated with different food products. Nowadays, foods are intended not only to satisfy hunger and provide necessary nutrients for humans, but also to prevent diseases related to nutrition and improve the physical and mental health of consumers. In this regard, it is necessary to develop novel functional foods to meet these demands[1]. Gummy candies, being hugely popular across all age groups, are suitable matrix for the addition of functional ingredients [2]. However, to improve candy formulations, there are several common techniques employed such as substituting the gelling agent for gelatin, utilizing natural colorants, incorporating plant extracts, vitamins, or fruit derivatives, and substituting sugar with other sweeteners [3] One of the most often consumed varieties of soft confections is gummy candy (GC), also referred to as Gummy, pastille, jelly candy, chewy jelly, and so forth [4]. From its 2023 estimate of 23.93 billion dollars, the worldwide gummy market is expected to increase at an average yearly growth rate of 11.8% between 2024 to 2030. Demand is likely to be increased during the anticipated time frame by factors related to to development such as a developing need for nutritional and enriched Gummy candy, as well as the supply of gummy medicines in a variety of flavours for customers seeking taste and health advantages. the rising requirements for natural items, and the growing interest in vegan gummies. Additionally, gummies are a practical and user friendly way to administer a various active component, such as vitamins, mineral, and supplements. Thus, one of the main drivers propelling the expansion of the worldwide gummy industry is the Gummies' increasing significance as a delivery approach.

Food and supplement tastes are changing among consumers. Increasing well-being consciousness and concerns about the negative impacts of synthetic ingredients and processed meals have led to a significant increase in the requirement for nutraceutical products among consumers in the past years. Customers are searching for goods that provide extra health advantages in addition to delicious flavours. Consumers are looking for beneficial and fortified candies that include vitamins, minerals, and other nutrients, which is a particularly prominent treto development such as a developing need for nutritional and enriched Gummy candy, as well as the supply of gummy medicines in a variety of flavours for customers seeking taste and health advantages. the rising requirements for natural items, and the growing interest in vegan gummies.

Additionally, gummies are a practical and user friendly way to administer a various active component, such as vitamins, mineral, and supplements. Thus, one of the main drivers propelling the expansion of the worldwide gummy industry is the Gummies' increasing significance as a delivery approach. Food and supplement tastes are changing among consumers. Increasing well-being consciousness and concerns about the negative impacts of synthetic ingredients and processed meals have led to a significant increase in the requirement for nutraceutical products among consumers in the past years. Customers are searching for goods that provide extra health advantages in addition to delicious flavours. Consumers are looking for beneficial and fortified candies that include vitamins, minerals, and other nutrients, which is a particularly prominent trend in the gummy market. Increasing consciousness of the need of keeping better health through sufficient nutrition is the reason behind the rising demand for these kinds of gummies. People are searching for easy and fun methods to add additional nutrients to their diets as they become more aware of what their bodies require. Because they are simple to eat and may be made with a variety of active components, gummies are an ideal way to give different nutrients. Some candies, for example, may be manufactured with heart- healthy omega-3 fatty acids, while others may have vitamins and minerals that boost immunity.

Probiotics and prebiotics, which support intestinal health, are also present in some gummies. In order to enable the targeted release of the active chemicals in gummies, manufacturers are creating innovative delivery technologies. Certain candies, for example, are made to gradually release their active contents over time, offering long-lasting advantages. The market for gummies among adults is expanding due to manufacturers' continuous introduction of novel and inventive gummies candy formulations, such as those made for certain disorder or aimed at different age people. For example, introduced a vegan gummy vitamin to improve adult gastrointestinal and immune health. Bacillus coagulants Unique IS-2 is a probiotic strain found in the product. In addition, gummy bears' distinct texture, delicious flavours, and adorable bear-like look make them well-liked in the gummy industry. Gummy bears are fun to eat because of their chewy, gummy texture, and they are available in a variety of flavours to suit a broad range of palates. Furthermore, gummy bears appeal to both kids and

adults because to their entertaining and vibrant qualities. Their popularity as a snack or treat is further influenced by their portability and convenient size. Overall, because of their delightful flavour and fun. appeal, gummy bears have become a cherished classic in the gummy industry.[5]

Traditionally, GCs are created by combining large volumes of sugar syrup with gel forming agent, and artificial flavourings and colourings. After being heated, the raw components are poured into variously shaped and sized moulds. GCs are cooled and dried after moulding to produce a sticky texture in the minimum time period[6] Additionally, the high sugar content and low nutritional value of these common foods can raise the risk of a number of long-lasting medical conditions, including such as type 2 diabetes, obesity, tooth decay, and hyperglycaemia. Additionally, children's overindulgence in low-nutrition confections is steadily rising, which has their parents extremely concerned [7]

MATERIALS AND METHODS

Gummy jellies preparation:

In this study, some recipes were tested with different combinations of fruits (including apple, orange, strawberry and a mix of berries) with other ingredients, but after initial screening, some of the formulations were not considered satisfactory either in terms of texture, appearance, consistency, or taste (basic qualitative evaluation made only by the developers). Hence, the two formulations considered with the best characteristics were produced for the following evaluation. a gummy jelly with orange juice and honey (ORH) and one with a puree made from a mixture of berries (BEM). We used multifloral honey produced by the Agrarian School of Viseu. All other raw materials used in these experiments were purchased from local supermarkets. The orange juice used in the formulation was freshly squeezed, and the red fruit puree was obtained from a mix of frozen berries (cultivated blackberries [22%]; raspberries [22%]; strawberries [25%]; cassis [14%]; wild blueberries [16%]). Experiments included two kinds of gummy jellies, with the use of agar (NATALI Biologique) and pork gelatin (ROYAL, Portugal) as thickening agents. Figure 1 shows the procedure for the gum preparation, which is summarized as follows: thickeners were dissolved slowly in hot liquids. The formulation remained in a water bath, reaching a temperature of 70–75°C, long enough for the complete dissolution of the ingredients. After complete homogenization, the formulation was transferred to heart-shaped tray molds, resulting in gums of approximately 5g. These trays remained at room temperature for about 30 min until cooling to achieve an equilibrium with the kitchen temperature. Then, they were placed in the refrigerator (+4°C) for 24 h. After 24 h, they were removed from the molds and stored in a closed container that was kept in the refrigerator until further analysis. No overall appearance changes have been noticed for 1 week. [8]

Type of gummies:

1. **Medictaed gummies:** It contains medicine of a certain dose.
Example:Biotin of 500mg

2**. Non medicated gummies:** It doesn't contain medicine. It is more likely to called jelly and is well.
Example: AlpenLiebe, Just jelly

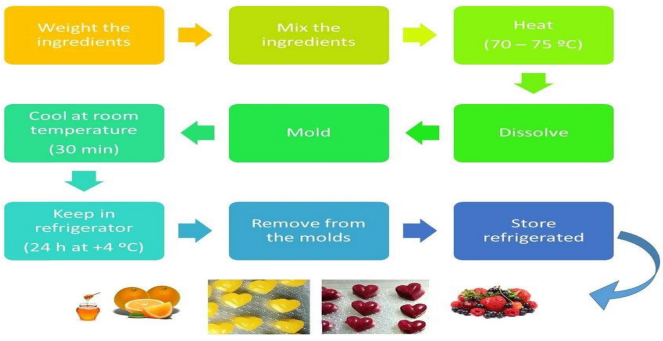

Fig 1: Flow diagram of the preparation of gummy jellies

Natural Ingredients Used in Gummy Formulations

1. **Natural Gelling Agents Gelatin** — traditional animal-derived protein forming the gummy gel network. It provides chewy texture but is limited for vegan/vegetarian products.
2. **Pectin** — plant-derived polysaccharide from citrus fruits and apples used as vegan gelling agent (requires acid to gel).[9]
3. **Agar-agar** — seaweed-derived gelling agent creating a firm gel; used in plant-based gummies.
4. **Guar gum, gums & starches** — other natural hydrocolloids used to modify texture in gummies. [9]

Organoleptic evaluation

Appearance and Clarity: Visual inspection for color uniformity, shape consistency, and the presence of any entrapped air bubbles or crystals.
Organoleptic Properties: Assessment of taste (sweetness, bitterness), odor (flavor profile), and "mouthfeel" (smoothness vs. grittiness).[10]
Weight Variation: Individual gummies are weighed and compared to the average weight. Generally, a deviation of within10 % is considered acceptable.
Texture Profile Analysis (TPA): Uses a texture analyzer or penetrometer to measure:
Hardness: The force required to compress the gummy. [11]
Gumminess/Chewiness: The energy required to disintegrate the product for swallowing.
Stickiness: Measured by rubbing the product between fingers or using a probe to ensure it doesn't adhere excessively to pack physical parameters . [12]
pH Measurement: Determined by dissolving a 10% w/v gummy solution in distilled water. Ideal pH for stability and microbiological safety is typically slightly acidic (range of 3.0– 5.5).[13]
Moisture Content: Measured by drying a crushed sample in a desiccator or using a moisture balance. High moisture can lead to microbial growth, while low moisture makes gummies brittle.
Water Activity : A critical QC parameter. The ideal range is usually 0.55 to 0.70. Values above 0.85 significantly increase the risk of bacterial growth.
Disintegration/Dispersion Time: Measures how quickly the gummy breaks down in a medium (usually purified water at 37°C) to simulate gastric conditions.[14]
Synergies (Sweating): Evaluated to see if the gel matrix "weeps" or releases liquid during storage, which can compromise shelf life.[16]

Microbiological and Stability Testing

Microbial Limit Test: Testing for pathogens like E. coli, Salmonella, S. aureus, and total yeast/mold counts.
Accelerated Stability Studies: Gummies are stored at controlled temperatures (e.g., 25–30°C or 40°C) for several weeks/months to monitor changes in color, texture, and active ingredient potency. [17]

Natural Flavors and Colorants

Natural flavors and colorants have become increasingly popular in the food industry as consumers become more conscious of what they are eating. Therefore, incorporating natural ingredients in the preparation of GCs based on novel formulations can enhance the overall flavor and visual appeal of candies [18]. However, careful attention must be paid to the selection and application of natural food flavors and colorants to ensure their compatibility with the conventional recipe and to provide the desired texture and shelf life for GCs. Fruits can create a wide variety of flavors in GCs, from strawberry and raspberry to orange and lemon. When using fruit flavors, it is important to select natural flavorings derived from the actual fruit rather than artificial or synthetic ones. Whether it is the tangy burst of citrus, the tropical sweetness of mango, or the juicy essence of berries, fruit flavors can add excitement and variety to GC offerings. Generally, consumers appreciate flavors derived from real fruits, and the overall sensory appeal of GCs is enhanced even with the addition of small amounts of fruit flavors. In this regard, Bagautdinov et al. [19] investigated the sensory attributes and consumer preference for GCs flavored with different fruits, including strawberry, orange, and pineapple. The study found that the GCs with fruit flavors were highly favored by consumers, especially strawberry- and orange-containing GCs. Overall, the natural fruit flavors contributed to the overall enjoyment and acceptance of GCs. Moreover, Ali et al. [20]

investigated the effects of strawberry as a natural flavoring agent and red beetroot as a natural colorant on the textural and sensory properties of GCs. The study revealed that GCs with natural colors and flavors exhibited variations in texture, such chewiness and firmness. For instance, GC containing a large amount of beetroot was harder than the control sample, which may be related to the increase in fiber and total soluble solids (TSS) of the sample. Also, the incorporation of specific fruits allowed for tailoring the mouthfeel of GCs, enhancing the overall sensory experience for consumers. Incorporating natural colorants in the preparation of GCs can also enhance their visual appeal. Natural colorants can be derived from various sources, including fruits and vegetables [21]. For example, the extract of the Clitoria ternatea flower has been used as a natural colorant for the preparation of novel GCs. The study found that the incorporation of 30 g of C. ternatea extract improved the color and appearance of GCs, making them more appealing to consumers [22]. In another study, Casas-Forero et al. [23] showed that GCs become darker and more reddish with the addition of freeze-dried blueberry juice due to the presence of anthocyanins. Also, the enriched samples exhibited significantly higher total bioactive compounds (773.3 mg GAE/100 g) and antioxidant activity (4585.4 μM TE/100 g), compared to conventional GCs (233.4 mg GAE/100 g and 782.9 μM TE/100 g, respectively). These results indicate that fruit flavors not only improve the taste, aroma, and appearance of GCs, but also offer potential health benefits through their antioxidant properties. In another study, de Oliveira Nishiyama-Hortense et al. [25] investigated the applicability of grape juice as a natural colorant in GCs and determined their anthocyanin content and sensory properties to evaluate the quality of the GCs. The GCs presented a shiny appearance with a uniform purple color, retention of anthocyanin was 41% and sensory scores were satisfactory. Nevertheless, many natural colorants, such as betanin, are sensitive to heat and pH, and their color may deteriorate over time. Additionally, their sensitivity to oxidation and low bioaccessibility limits their applications in food products. Encapsulation is a promising approach to overcome the shortcomings of natural colorants in GCs. In this regard, Amjadi etal. [26] loaded betanin in liposomal nanocarriers to improve its stability in GCs. The antioxidant activity and stability of betanin nanoliposomes were considerably higher than those of free betanin in GCs and their sensory parameters did not show significant differences. Consequently, betanin nan liposomes can be considered a suitable natural colorant for gummy Compliance. [27]

Advantages of Natural Gummies

1. Enhanced Consumer Acceptability & Compliance

Gummies are easy and enjoyable to consume, which helps increase adherence to dietary supplement regimens, especially for children and adults who dislike swallowing Acceptability. Their palatability and chewable form often result in higher compliance compared to tablets or capsules.

2. Functional Nutritional Delivery

Natural gummies can act as effective carriers for health-promoting compounds such as vitamins, antioxidants, probiotics, prebiotics, fibre, and plant extracts, thereby transforming gummies from mere treats into functional foods.They can be formulated to support specific health outcomes such as gut health immune response, energy metabolism, and antioxidant activity.[28]

3. Clean-Label and Consumer Preference

Natural gummy formats can incorporate fruit juices, plant-derived gelling agents, and natural sweeteners, appealing to health-conscious consumers who prefer minimal artificial additives.[29] The use of natural flavourings and colourants (from fruits/vegetables) enhances sensory appeal without synthetic chemicals, aligning with the demand for clean-label products.

4. Versatile Formulation Possibilities

Functional formulations allow inclusion of bioactives (e.g., antioxidants from fruit extracts), improving the overall nutritional profile of gummies relative to conventional sugary candies.

Natural ingredients like inulin, plant fibres, and fruit polyphenols can contribute additional health benefits such as better digestion and potential chronic disease risk reduction.[30]

5. Potential Health Benefits

Enriched natural gummies may deliver nutrients supporting immunity, bone health, digestion, and metabolic well-being when properly formulated.

The presence of antioxidant compounds in fruit-based gummies can combat oxidative stress and reduce free-radical damage, offering added functional value. [31]

Regulatory Aspects

Nutraceutical/Food or Drug

Generally Nutraceutical/Food: Gummies with added vitamins, minerals, herbs are typically classified as dietary supplements or functional foods, not drugs, as they support health rather than treat specific diseases.

Drug status: If a gummy claims to prevent, treat, or cure a disease (e.g., "Cures diabetes"), it crosses into drug territory and faces much stricter FDA/FSSAI drug approval processes, which is often prohibited for supplements.

FSSAI Guidelines (India) Categories:

FSSAI regulates Health Supplements, Nutraceuticals, Foods for Special Dietary Use (FSDU).

Labelling: Must prominently display "Nutraceuticals," "Not for Medicinal Use," recommended usage, warnings for excess consumption, and ingredient details.

Claims: Prohibited from making disease cure claims.

Ingredients: Strict limits on nutrient usage levels, often tied to Indian Council of Medical Research (ICMR) guidelines.

FDA Regulations (USA)

The FDA regulates gummies under the Dietary Supplement Health and Education Act of 1994 (DSHEA).

No Pre-market Approval: The FDA does not "approve" gummy supplements before they hit the market. The manufacturer is responsible for safety.

cGMP Compliance: Manufacturers must follow current Good Manufacturing Practices (21 CFR Part 111). This ensures the product actually contains the ingredients listed and is free of contaminants.

New Dietary Ingredients (NDI): If a gummy uses an ingredient not marketed in the US before 1994, the manufacturer must notify the FDA 75 days before selling it.

Labeling Requirements

- **Product Name**: Must be clear, honest, and descriptive (e.g., Vitamin c Gummies).
- **Net Quantity**: Total weight or number of gummies must be visible.
- **Ingredients List:** Declared in descending order of predominance.
- **Nutritional Information Panel (NIP)**: Includes calories, sugars, % Daily Value (%DV) for nutrients, and serving size.
- **Allergen Information**: Must declare common allergens (nuts, dairy, gluten, etc.).
- **Serving Size & Directions**: Clear instructions on how much to take.
- **Manufacturer Details**: Name, address, contact info, batch/lot number, expiration date.
- **Language**: Required statements must be in English (or the local language) and conspicuoal [32] Leading natural gummy brands:

Leading natural gummy brands in the commercial market include Goli Nutrition, Smarty Pants, Nature's Way, Garden of Life, and MaryRuth's, which focus on natural ingredients, clean labels, and plant-based formulations.[33]

Future perspectives:

Sugar-Free & Diabetic-Friendly Gummies

Sugar-free gummies are formulated using non-glycaemic sweeteners such as stevia, erythritol, maltitol, xylitol, monk fruit, etc., instead of sucrose or glucose. These alternatives have a low or negligible impact on blood glucose levels, making these gummies more suitable for people with diabetes or those following low-

sugar/low-carb diets.

Personalized Nutrition Gummies

Personalized nutrition gummies are tailored dietary supplements designed for an individual's unique nutritional requirements based on factors such as age, gender, activity level, genetic predispositions, health goals, or diagnosed deficiencies.

Plant-Based & Vegan Innovations in Gummies

Plant-based and vegan gummy innovation focuses on replacing animal-derived ingredients (e.g., gelatin) with plant gelling agents such as pectin, agar, furcellaran, or alginate, and combining these with plant-derived flavours, colours, and functional ingredients. These formulations cater to vegan, vegetarian, ethically conscious, and environmentally aware consumers.[34, 35]

CONCLUSION

Summary of key findings:

Recent research shows that gummies formulated with natural ingredients or nutraceutical actives are increasingly studied for their functional health benefits and consumer acceptability. Natural-ingredient gummies can be successfully formulated with vitamins, antioxidants, botanicals, and plant extracts while maintaining desirable texture and sensory properties,through further optimization is often needed for taste and stability.

Role of atural gummies in modern healthcare:

Natural and nutraceutical gummies are emerging as an appealing chewable delivery platform that bridges the gap between conventional supplements and functional foods, offering enhanced palatability, ease of use, and patient compliance especially among children, older adults, and individuals with swallowing difficulties. Their flexibility also allows incorporation of plant-based hydrocolloids and botanical actives (e.g., turmeric, piperine in plant-based gummies), expanding the range of functional ingredients beyond traditional vitamins.

REFERENCES

1. Khan, R.S.; Grigor, J.; Winger, R.; Win, A. Functional food product development— Opportunities and challenges for food manufacturers. Trends Food Sci. Technol. 2013, 30, 27–37. [CrossRef]
2. E. Teixeira-Lemos, A.R. Almeida, B. Vouga, C. Morais, I. Correia, P. Pereira, R.P. Guiné Development and characterization of healthy gummy jellies containing natural fruits Open Agriculture, 6 (1) (2021), pp. 466-478, 10.1515/opag-2021-0029
3. H. Ge, Y. Wu, L.L. Woshnak, S.H. Mitmesser Effects of hydrocolloids, acids and nutrients on gelatin network in gummies Food Hydrocolloids, 113 (2021), Article 106549, 10.1016/j.foodhyd.2020.106549
4. U. Roobab, Z. Batool, M.F. Manzoor, M.A. Shabbir, M.R. Khan, R.M. Aadil Sources, formulations, advanced delivery and health benefits of probiotics Curr. Opin. Food Sci., 32 (2020), pp. 17-28, 10.1016/j.cofs.2020.01.003
5. Edite Teixeira-Lemos, Ana Rita Almeida, Beatriz Vouga, Cátia Morais, Inês Correia, Pedro Pereira, Raquel P. F. Guiné 2021; 6: 466–478
6. Bos JD, Meinardi MM. The 500 Dalton rule for the skin penetration of chemical compounds and drugs. Exp Dermatol. 2000;9(3):165–9.vv
7. Tarahi M, Tahmouzi S, Kianiani MR, Ezzati S, Hedayati S, Niakousari M. Current innovations in the development of functional gummy candies. Foods. 2024;13(1):76. doi:10.3390/foods13010076.
8. Aiello F, Caputo P, Restuccia D, Spizzirri UG. Gelatin-based gummy candies: formulation, texture, and functional ingredients. Foods. 2023;12(9):1704. doi:10.3390/foods12091704.
9. Genovese D, Figueroa L, Hughes MH, et al. Development and stability of low-sugar plant-based gummy candies prepared via innovative gelation techniques. Food & Humanity. 2025;5:100708. doi:10.1016/j.foohum.2025.100708.
10. Stępień A, Tkaczewska J, Nowak N, Jamróz E. Sugar-free vegan gummy jellies: influence of plant-based gelling agents on quality and antioxidant activity. Food Sci Technol. 2023;13(2):226–241.
11. Phillips GO, Williams PA. Handbook of hydrocolloids. 3rd ed. Cambridge: Woodhead Publishing; 2021.

12. Burey P, Bhandari BR, Howes T, Gidley MJ. Hydrocolloid gel particles: formation, characterization, and application. Crit Rev Food Sci Nutr. 2008;48(5):361–377. doi:10.1080/10408390701347801.
13. Safety and Standards Authority of India (FSSAI). Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food, Novel Food and Other Similar Products) Regulations, 2016. New Delhi: FSSAI; 2016. Available from: https://www.fssai.gov.in
14. U.S. Food & Drug Administration. Dietary Supplements. Silver Spring, MD: FDA; 2025. Available from: https://www.fda.gov/food/dietary-supplements
15. Kalra EK. Nutraceutical–definition and introduction. AAPS PharmSci. 2003;5(3):27. doi:10.1208/ps050327
16. Rojek S, Konopacka A. Regulatory aspects of functional foods and nutraceuticals. Crit Rev Food Sci Nutr. 2019;59(18):2943-2956. doi:10.1080/10408398.2018.1498372
17. Otálora, M.C.; de Jesús Barbosa, H.; Perilla, J.E.; Osorio, C.; Nazareno, M.A. Encapsulated betalains (Opuntia ficus-indica) as natural colorants. Case study: Gummy candies. LWT 2019, 103, 222–227. [Google Scholar] [CrossRef]
18. Scholar] [CrossRef] Bagautdinov, I.; Gusev, A.; Nigmatzyanov, A.; Chernenkov, E.; Kaluzhina, O. Development of Confectionery Products with Functional Properties Using Non-Traditional Plant Raw Materials. J. Culin. Sci. Technol. 2023, 1–20. [Google Scholar] [CrossRef]
19. Albuquerque, B.R.; Oliveira, M.B.P.; Barros, L.; Ferreira, I.C. Could fruits be a reliable source of food colorants? Pros and cons of these natural additives. Crit. Rev. Food Sci. Nutr. 2021, 61, 805–835. [Google Scholar] [CrossRef]
20. Lonez, H.; Banwa, T. Butterfly Pea (Clitoria ternatea): A natural colorant for soft candy (Gummy Candy). Indian. J. Sci. Technol. 2021, 14, 239–244. [Google Scholar] [CrossRef]
21. Casas-Forero, N.; Trujillo-Mayol, I.; Zúñiga, R.N.; Petzold, G.; Orellana-Palma, P. Effects of cryoconcentrated blueberry juice as functional ingredient for preparation of commercial confectionary hydrogels. Gels 2022, 8, 217. [Google Scholar] [CrossRef]
22. de Oliveira Nishiyama-Hortense, Y.P.; de Paula Rossi, M.J.; Shimizu-Marin, V.D.; Janzantti, N.S.; Gómez-Alonso, S.; Da-Silva, R.; Lago-Vanzela, E.S. Jelly candy enriched with BRS Violeta grape juice: Anthocyanin retention and sensory evaluation. Fut. Foods 2022, 6, 100179. [Google Scholar] [CrossRef]
23. Amjadi, S.; Ghorbani, M.; Hamishehkar, H.; Roufegarinejad, L. Improvement in the stability of betanin by liposomal nanocarriers: Its application in gummy candy as a food model. Food Chem. 2018, 256, 156–162. [Google Scholar] [CrossRef]
24. Ramesh, M.; Muthuraman, A. Flavoring and coloring agents: Health risks and potential problems. In Natural and Artificial Flavoring Agents and Food Dyes; Elsevier: Amsterdam, The Netherlands, 2018; pp. 1–28. [Google Scholar]
25. Food Safety and Standards Authority of India (FSSAI). Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food, Novel Food and Other Similar Products) Regulations, 2016. New Delhi: FSSAI; 2016. Available from: https://www.fssai.gov.in
26. U.S. Food & Drug Administration. Dietary Supplements. Silver Spring, MD: FDA; 2025. Available from: https://www.fda.gov/food/dietary-supplements
27. Kalra EK. Nutraceutical–definition and introduction. AAPS PharmSci. 2003;5(3):27. doi:10.1208/ps050327
28. Rojek S, Konopacka A. Regulatory aspects of functional foods and nutraceuticals. Crit Rev Food Sci Nutr. 2019;59(18):2943-2956. doi:10.1080/10408398.2018.1498372
29. Gan D, Xu M, Chen L, Cui S, Deng C, Qiao Q, et al. Intake of Sugar Substitute Gummy Candies Benefits the Glycemic Response in Healthy Adults: A Prospective Crossover Clinical Trial. Gels. 2022;8(10):642. doi:10.3390/gels8100642
30. Functional gummies: The snackable supplement revolution. FoodNavigator. 2025 Sep
23. Available from: https://www.foodnavigator.com/Article/2025/09/23/functional- gummies-the-snackable-supplement-revolution/
31. Genovese D, Figueroa L, Hughes MH, et al. Development and stability of low-sugar, plant-based gummy

candies prepared via an innovative ionotropic gelation technique. Food & Humanity. 2025;5:100708. doi:10.1016/j.foohum.2025.100708. ScienceDirect

32. Stępień A, Tkaczewska J, Nowak N, et al. Sugar-free, vegan gummy jellies with plant-based triple-layer films: Influence of furcellaran on quality and antioxidant activity. Food Sci Technol. 2023;13(2):226–24
33. Khan, R.S.; Grigor, J.; Winger, R.; Win, A. Functional food product developmentOpportunities and challenges for food manufacturers. Trends in Food Science & Technology. 2013; 30(1): 27-37.
34. Teixeira-Lemos, E.; Almeida, A.R.; Vouga, B.; Morais, C.; Correia, I.; Pereira, P.; Guiné, R.P.F. Development and characterization of healthy gummy jellies containing natural fruits. Open Agriculture. 2021; 6(1): 466-478.
35. Ge, H.; Wu, Y.; Woshnak, L.L.; Mitmesser, S.H. Effects of hydrocolloids, acids and nutrients on gelatin network in gummies. Food Hydrocolloids. 2021; 113: 106549.