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ASSESSMENT OF THE SENSORY ACCEPTABILITY OF WHOLE TOMATO (*Lycopersicon esculentum*) GUMMY CANDY AND IDENTIFICATION OF ITS PHYSICO-CHEMICAL CHARACTERISTICS

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ABSTRACT

Tomato (*Lycopersicon esculentum*) is widely cultivated in the Philippines as a secondary crop, particularly in Northern Mindanao and Zamboanga regions. However, seasonal oversupply often results in postharvest losses that reduce farmer and market seller profitability. Concurrently, malnutrition and other health issues remain prevalent among Filipinos, especially children, highlighting the need for innovative, nutrient-enriched food products. This study aimed to develop matured whole tomato gummy candy and assess its sensory acceptability and physicochemical characteristics. Three formulations containing varying unflavoured gelatin concentrations (60 g, 45 g, and 30 g) were prepared and evaluated using a modified 7-point hedonic scale by 50 randomly selected panelists from Western Mindanao State University. Sensory attributes assessed included taste/flavor, color, aroma, texture, and general acceptability. Results revealed no significant differences ($p > 0.05$) among formulations in terms of taste, color, aroma, and overall acceptability; however, texture showed a highly significant difference ($p < 0.05$), indicating that gelatin concentration significantly influenced product firmness. Formulation 1 (60 g gelatin) ranked highest in overall preference and was selected for further analyses. Proximate composition, pH, moisture content, and microbial analyses confirmed product stability and compliance with acceptable quality standards. The shelf-life study demonstrates that room temperature storage maintains quality for only six months, as microbial spoilage occurs by the seventh month, whereas refrigeration effectively extends shelf life to twelve months by inhibiting microbial proliferation. While citric acid serves as a natural preservative, as essential to maintain the structural integrity

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

and safety of the tomato-based gummies over an extended period. Cost analysis further demonstrated its potential market feasibility. The findings suggest that whole tomato, including seeds and peel, can be successfully incorporated into gummy candy as a value-added product, contributing to waste reduction, enhanced farmer income, and the development of a nutrient-enriched confectionery alternative rich in lycopene and antioxidants. This study supports sustainable food innovation aligned with responsible production and improved nutritional options.

Keywords: Cost Analysis, Microbiological, Physico-chemical, Sensory Evaluation, Shelf-life Study, Tomato Gummy Candy, Value Addition, Zamboanga Region

1. INTRODUCTION

Tomato (*Lycopersicon esculentum*) is one of the most widely cultivated fruit-vegetables in the Philippines and plays an important role in local cuisine and agricultural livelihood. Tomato production contributes significantly to regional agriculture, particularly in Mindanao [13], [20]. However, seasonal oversupply, postharvest losses, and improper waste management practices remain persistent challenges among farmers and public markets, resulting in reduced profitability and increased food waste [4], [25]. Inadequate storage facilities, handling practices, and market fluctuations further aggravate these losses, limiting the economic return of tomato producers [4]. These conditions highlight the need for value-adding strategies to utilize surplus and low-graded tomatoes before spoilage occurs.

At the same time, nutritional concerns remain prevalent in the Philippines. Studies show that Filipino children and adolescents have suboptimal fruit and vegetable intake and are prone to unhealthy snacking behaviors [22], [23]. Excessive consumption of sugar-rich but nutrient-poor snacks contributes little to dietary adequacy and may increase health risks [31]. Moreover, prolonged screen exposure among children has been associated with visual and health concerns [6]. These dual issues of agricultural waste and nutritional inadequacy underscore the importance of developing innovative, nutrient-enriched snack products that can both reduce food loss and promote healthier consumption.

Tomatoes are recognized for their high nutritional and functional value, particularly due to their lycopene content, a carotenoid with strong antioxidant properties [21], [27]. Lycopene has been associated with reduced risk of cardiovascular diseases, certain cancers, and other oxidative stress-related conditions [21], [27]. Whole tomato utilization, including peel and seeds, may further enhance nutritional value because these components contain dietary fiber, essential fatty acids, and bioactive compounds [21]. Despite these benefits, tomato processing is largely limited to traditional products such as sauces, paste, and ketchup, with limited exploration in confectionery applications.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Gummy candies are popular confectionery products composed primarily of sugar, glucose syrup, gelatin, acids, and flavoring agents [26]. The quality and texture of gummy candies are strongly influenced by gelatin concentration and sugar interactions, which determine gel strength, elasticity, and chewiness [1], [12], [29]. Recent innovations have explored the development of functional gummy candies fortified with plant extracts, prebiotics, or fruit-based ingredients to enhance nutritional value [28], [24]. Research has demonstrated that gelatin ratios significantly affect gelation kinetics and structural properties in concentrated sugar systems [1], [16], [29]. Additionally, physicochemical parameters such as water activity, pH, and soluble solids are critical in ensuring product stability and microbial safety in confectionery products [11], [18].

Sensory evaluation using hedonic scales and statistical tools remains a standard approach in determining consumer acceptability of newly developed food products [5], [28]. Furthermore, microbiological requirements for sugar confectioneries must comply with regulatory guidelines to ensure product safety [9].

Despite advances in functional gummy development, limited studies have focused on incorporating matured whole tomato into gummy candy formulations while simultaneously evaluating sensory acceptability, physicochemical characteristics, microbiological safety, and economic feasibility.

Therefore, this study aimed to develop matured whole tomato gummy candy using varying gelatin concentrations and to assess its sensory acceptability, physicochemical properties, microbial stability, and production cost. By utilizing the entire tomato, including seeds and peel, this research contributes to value addition, reduction of postharvest waste, and the development of a potentially healthier confectionery alternative. The findings provide practical insights into formulation optimization and sustainable food innovation within the local agricultural context.

2. MATERIALS AND METHODS

2.1 Study sites

The study was conducted at Western Mindanao State University, specifically at the College of Agriculture, Department of Food Technology, San Ramon Campus, Zamboanga City. The processing and preparation of the tomato gummy candy were carried out in the Food Technology processing laboratory, which is equipped with standard food preparation and analytical tools necessary for experimental product development. Sensory evaluation was conducted within the campus premises using randomly selected students and faculty members as panelists. Laboratory analyses, including proximate composition and microbial testing, were performed in collaboration with the Department of Science and Technology (DOST) Region IX laboratory facilities to ensure standardized and reliable results.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

2.2 Schematic Diagram:

The schematic diagram presents the sequential procedure for developing and evaluating whole tomato gummy candy. The process begins with the preparation of the tomato mixture, followed by the incorporation of gelatin into every 270 g of tomato puree using three different concentrations (60 g, 45 g, and 30 g) to determine the effect of gelling agent variation on product quality.

After formulation, sensory evaluation is conducted using a 7-point hedonic scale and analyzed through One-way ANOVA to identify the most acceptable formulation in terms of consumer preference. The most acceptable variant is then subjected to microbial, proximate, and physicochemical analyses to assess safety, nutritional composition, and product stability. Finally, a production cost analysis is performed to evaluate the economic feasibility of the selected formulation. Overall, the schematic diagram highlights a systematic approach integrating product development, quality assessment, and market viability evaluation.

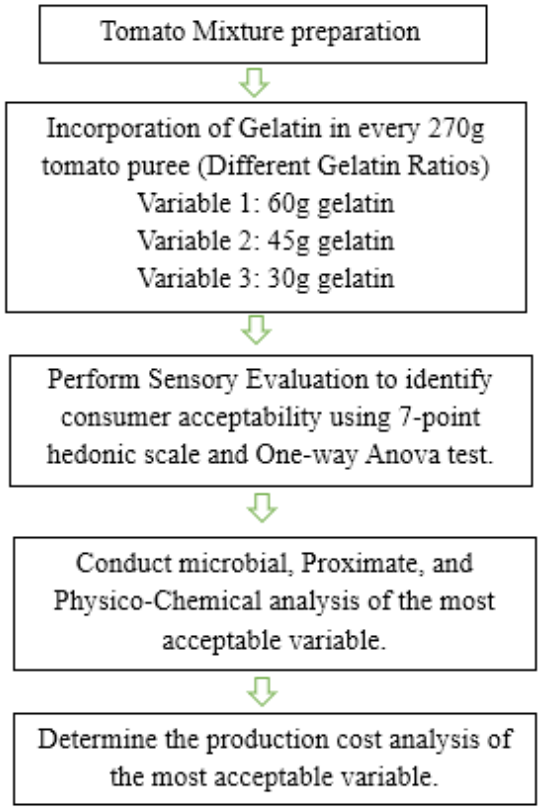

Fig 1: Tomato gummy candy schematic diagram

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

2.3 Preparation

Whole matured tomatoes were thoroughly washed, weighed, and blended to produce a smooth puree. Measured amounts of gelatin based on the formulation (60 g, 45 g, and 30 g), sugar, corn syrup, and citric acid were prepared separately. The blended tomato puree was combined with water, sugar, and corn syrup in a cooking vessel and heated over medium heat with continuous stirring. The bloomed gelatin (10mins) in warm water was gradually incorporated to prevent lump formation. The mixture was heated until complete dissolution and uniform consistency were achieved. Citric acid was added toward the final stage of heating to enhance flavor balance and regulate pH. The hot mixture was then poured into pre-sterilized candy molder and allowed to cool at room temperature, then air-dry for several hours until firm. Once firm, the gummy candies were removed from molds, optionally coated with confectioner sugar, and packed in appropriate multi-layered pouches for sensory evaluation, physicochemical analysis, microbial testing, shelf observation, and cost computation. The preparation method ensured product uniformity and reproducibility across all formulations.

2.4 Shelf-Life Study methods

The tomato gummy candies were packed in Single-serve sachet low-density polyethylene (LDPE) plastic pouches, a commonly used moisture-resistant packaging material for confectionery products. Samples were stored under controlled ambient conditions at 25 °C and 50% relative humidity (RH), and a refrigerated condition at 5 °C and 50% relative humidity (RH) within a period of six (6) months.

A digital hygrometer was used to continuously monitor temperature and relative humidity throughout the storage period, ensuring that environmental conditions remained within the specified range.

3. RESULTS AND DISCUSSION

Below was the summary of the research and findings, incorporating a thorough analysis and interpretation of the gathered data. Statistical analysis was used to determine if there are any significant differences were present among the three formulations.

3.1 Sensory Evaluation

Results showed that there were no significant differences ($p > 0.05$) among the three formulations in terms of taste, color, aroma, and general acceptability. This indicates that variation in gelatin concentration did not significantly affect the flavor profile or visual appeal of the product. The incorporation of whole tomato puree, including seeds, did not negatively influence consumer

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

perception, suggesting that tomato can be successfully utilized in confectionery applications without compromising palatability.

However, texture showed a highly significant difference ($p < 0.05$) among the formulations. Variable 1 (60 g gelatin) obtained the highest mean score for texture and was described by panelists as firmer, more elastic, and comparable to commercial gummy candies. Variable 3 (30 g gelatin) exhibited a softer and less cohesive structure, which may be attributed to insufficient gel network formation. Gelatin concentration plays a critical role in forming a three-dimensional protein matrix that traps water and sugars, thereby influencing firmness and chewiness. These findings are consistent with previous studies indicating that higher gelatin levels increase gel strength and improve structural integrity in gummy confections.

Table 1: Sensory Evaluation Results of Tomato Gummy Candy in Terms of Taste and Flavor

Formulation	Mean	Adjectival Rating	P-Value	Significant Value At 0.05 Level
1	5.50	Moderately sweet-tomato	0.057355511	Not Significant
2	5.58	Moderately sweet-tomato		
3	5.96	Moderately sweet-tomato		

Legend: Extremely Sweet-Tomato (6.17-7), Moderate (5.31-6.16), Slight (4.45-5.3), Neither (3.59-4.44), Slightly Sour-Tomato (2.73-3.58), Moderate (1.87-2.72), Extreme (1-1.86)

Table 2: Sensory Evaluation Results of Tomato Gummy Candy in Terms of Color

Formulation	Mean	Adjectival Rating	P-Value	Significant Value At 0.05 Level
1	5.06	Slightly orange	0.102731	Not Significant
2	4.52	Slightly orange		
3	5.08	Slightly orange		

Legend: Extremely Orange (6.17-7), Moderate (5.31-6.16), Slight (4.45-5.3), Neither (3.59-4.44), Slightly Red (2.73-3.58), Moderate (1.87-2.72), Extreme (1-1.86)

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Table 3: Sensory Evaluation Results of Tomato Gummy Candy in Terms of Aroma

Formulation	Mean	Adjectival Rating	P-Value	Significant Value At 0.05 Level
1	5.64	Moderately Fresh Tomato	0.84310336	Not Significant
2	5.52	Moderately Fresh Tomato		
3	5.52	Moderately Fresh Tomato		

Legend: Extremely fresh tomato (6.17-7), Moderate (5.31-6.16), Slight (4.45-5.3), Neither (3.59-4.44), Slightly roasted tomato (2.73-3.58), Moderate (1.87-2.72), Extreme (1-1.86)

Table 4: Sensory Evaluation Results of Tomato Gummy Candy in Terms of Texture

Formulation	Mean	Adjectival Rating	P-Value	Significant Value At 0.05 Level
1	3.22	Slightly hard	1.82222E-34	Significant
2	5.64	Moderately soft		
3	6.48	Moderately soft		

Legend: Extremely soft (6.17-7), Moderate (5.31-6.16), Slight (4.45-5.3), Neither (3.59-4.44), Slightly hard (2.73-3.58), Moderate (1.87-2.72), Extreme (1-1.86)

Table 5: Sensory Evaluation Results of Tomato Gummy Candy in Terms of Overall Acceptability

Formulation	Mean	Adjectival Rating	P-Value	Significant Value At 0.05 Level
1	5.64	Moderately like	0.057	Not Significant
2	5.58	Moderately like		
3	5.30	Slightly like		

Based on overall sensory ranking, Variable 1 (60 g gelatin) was identified as the most acceptable formulation and was selected for further laboratory analyses. The findings confirm that gelatin concentration is a critical determinant of texture while maintaining acceptable taste and aroma across formulations.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

V1 V2 V3

Fig 2: Tomato Gummy Candy Formulation

3.2 Profiling of the Most Acceptable Tomato Gummy Candy

The most acceptable formula underwent microbial test, and physicochemical evaluation including pH, moisture content, TSS, and proximate composition.

Table 6: Chemical Analyses Analysis

Parameter	Result (g)	Test Method
Crude Protein, g/100 g	17.34	Kjeldahl Method (Block Digestion And Steam Distillation Aoac[1] 2001.11, 20th Ed., 2016
Total Fat, g/100 g	0.18	Randall/Soxtec/Ether Extraction-Submersion Method With Acid Hydrolysis, Aoac 922.06 And 2003.05, 20th Ed., 2016
Ash, g/100 g	0.54	Gravimetric Method (Furnace @ 525°C), Aoac[1] 900.2, 20th Ed., 2016
Carbohydrates, g/100 g	69.12	By Differences, Aoac[1] 986.25 E, 20th Ed., 2016

Proximate analysis showed that the tomato gummy candy contained measurable amounts of carbohydrates (primarily from sugar and corn syrup), minimal fat, and small but notable protein content contributed by gelatin and tomato solids. The inclusion of whole tomato puree, including seeds, contributed dietary fiber and bioactive compounds such as lycopene. Lycopene, a potent antioxidant responsible for the red color of tomatoes, has been associated with reduced risk of cardiovascular diseases and certain cancers. This suggests that the developed product offers added nutritional value compared to conventional gummy candies that contain artificial flavors and colors.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Table 7: Computed Nutritional Information of Tomato Gummy Candy

Nutritional Content	100g Portion (DOST)	Recommended Serving Size 30g (U.S FDA)	% Daily Value 30g Serving Size
Crude Protein	17.34 g	5.20 g	8%
Total Fat	0.18 g	0.05 g	1%
Carbohydrates	69.12 g	20.74 g	8%
Total Calories	350 kcal	105 kcal	

Note: The percent daily value (%DV) represents the contribution of a single serving of a food item to the recommended daily intake of a specific nutrient, based on a standard 2,000-calorie diet used as a reference for general dietary guidance

Table 8: Nutritional Comparison of Gummy Candy (USDA)

Nutritional Content	Tomato Gummy Candy Amount	Gummy Candy (USDA) Amount
Crude Protein	17.34 g	7.65 g
Total Fat	0.18 g	29.7 g
Ash	0.54 g	1.78 g
Carbohydrates	69.12 g	59.4 g

The nutritional analysis revealed the difference between the nutritional content of tomato-based gummy candy and the average level of nutritional content of gummy candy as defined by the USDA. The tomato gummy candy showed a significantly high in crude protein content of 17.34g compared to the standard 7.65g, suggesting the incorporation of protein-rich ingredients. This substantial increased in protein could transform the candy from a simple sweet treat into a more nutritionally balanced snack. The tomato gummy candy also showed a remarkably low fat content of 0.18g, a difference from the standard gummy's 29.7g, making it a potentially healthier option for those seeking low-fat snacks. Carbohydrate content was slightly higher in the tomato gummy candy, at 69.12g compared to the standard's 59.4g, likely due to natural sugars from tomatoes and added sugars. Understanding the processing methods and sugar types used, as well as providing information on the serving size, would also enhance the analysis.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Table 9: Physiological Analysis Result

Moisture Content Result

Parameter	Result (g)	Test Method
Moisture, g/100g	12.82	Gravimetric Method Air Oven Drying @ 100°C AOAC[1] 925.4B, 20th Ed., 2016

pH Level Result

Trial	Result	Average	Equipment Use
1	4.71 @29.6°C	4.68	Eutech pH700 (pHmV/°C/°F meter)
2	4.68 @30.4°C		
3	4.65 @31.4°C		

Total Soluble Solid (TSS)

Trial	Result	Average	Equipment Use
1	71.8	71.5	0-90% Brix Refractometer
2	70.3		
3	72.4		

The pH value of the developed tomato gummy candy was within the acidic range typical of fruit-based confectionery products, which is favorable for both flavor enhancement and microbial inhibition. Acidic conditions help suppress the growth of spoilage microorganisms and contribute to improved product stability. The addition of citric acid helped maintain a stable acidity level, thereby enhancing product safety and extending potential shelf life. Acidification is a common practice in fruit-based confectionery products because it improves flavor balance while providing an additional barrier against microbial growth [11], [18].

Moisture content analysis showed values consistent with standard gummy confectionery products, providing adequate softness and chewiness without compromising structural integrity. Proper moisture balance is critical in gummy candy production, as excessive moisture can lead to stickiness, reduced gel strength, and increased susceptibility to microbial spoilage, while insufficient moisture may produce an overly firm or brittle texture [18], [29]. The measured

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

moisture level suggests that the developed product maintained an appropriate balance between texture quality and storage stability.

The Total Soluble Solids (TSS) of the tomato gummy candy averaged 71.5°Brix, as measured using a 0–90°Brix refractometer. The relatively high °Brix value indicates a high concentration of dissolved sugars and soluble solids, which contributes to sweetness and supports proper gel formation. High soluble solid content is characteristic of gummy confectionery products and plays an important role in improving product stability. The minimal variation among trials indicates consistency in formulation and processing conditions.

High sugar concentrations in gummy candies bind free water through osmotic effects, thereby lowering water activity even when moderate moisture is present [29]. This sugar–water interaction limits microbial proliferation, particularly yeast and molds, and enhances product safety [11], [9]. The moisture content obtained in this study, combined with the high soluble solid concentration, suggests that sufficient water was retained to achieve desirable softness and chewiness while maintaining a reduced level of free water available for microbial growth. These findings support previous studies indicating that controlling both moisture content and soluble solids is essential for achieving desirable texture and microbial stability in gelatin-based gummy systems [18], [29].

Table 10: Microbiological Analyses Result

Parameter	Result	Test Method	Acceptable Limit	Remarks
Mold and Yeast Count (CFU/g)	<10	Dillution Plating Technique (Spread Plate) FDA-BAM	<10	Acceptable
Coliforms (MPN/g)	<10	Conventional MPN, FDA-BAM Online	<3.0	Acceptable
Aerobic Plate Count (CFU/g)	10^3	Conventional Plate Count (Pour Plate) FDA-BAM Online	500	Acceptable

Microbial testing focused on yeast and mold counts, coliforms, and aerobic plate count to evaluate product safety and stability. These tests were conducted in accordance with Food and Drug Administration (FDA) standards. Results showed that microbial levels were within acceptable limits for confectionery products, indicating that the heating process, reduced water activity, and acidic pH effectively inhibited microbial growth. This suggests that the product is microbiologically safe when handled and stored under proper conditions.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Table 11: Shelf Stability Test

Particular		
Real Time		0, 3, 6, and 12 Months
Storage condition	Room Temperature	25°C ± 2°C/ 50% RH ± 5% RH
	Refrigerated	5°C ± 3°C/ 50% RH ± 5% RH
Packaging	Type	Polyethylene
	Method	Single-serve sachet
Temperature Monitoring Method	Digital Hygrometer	

Note: Methodologies for this real-time shelf-life study were derived from current FDA guidance.

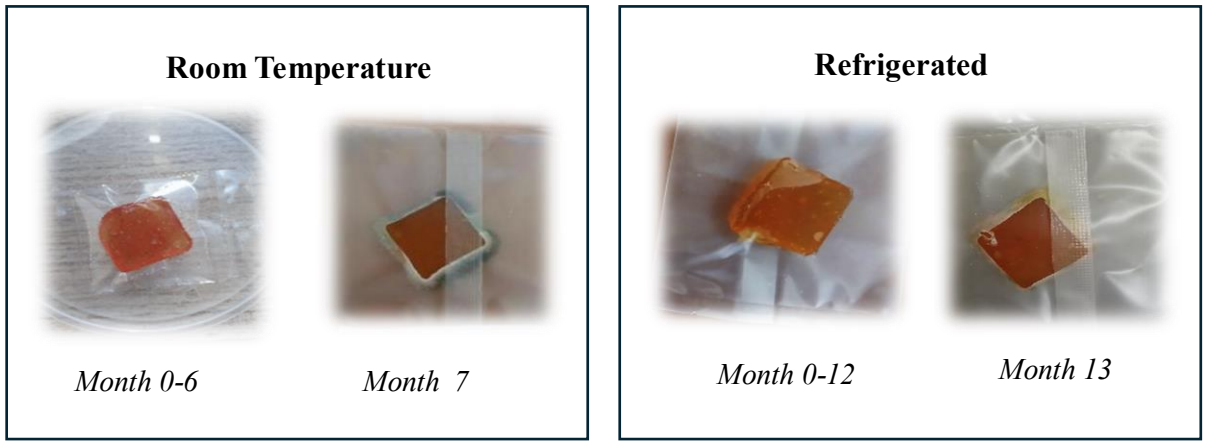

Fig 3: Real-time Shelf Stability Test

The stability and shelf life of the tomato-based gummy candy were evaluated under two distinct storage conditions to determine the impact of temperature on product quality over a twelve-month period. The results indicate that storage temperature is the primary factor influencing the physical, chemical, and microbiological longevity of the product. For the comparative stability analysis, the product exhibited significantly different degradation profiles depending on the environment.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Table 12: Observations for Real-time Shelf Stability Test

Feature	Room Temperature (25℃± 2℃)	Refrigerated (5℃± 3℃)
Stability Duration	Stable up to 6 months	Stable for over 12 months
Observation	Microbiological: Visible molds growth (Month 7)	Physicochemical: softening and slight off-odor detected at Month 13
Acceptability status	Rejected by Month 7	Marginal Acceptability at Month 13

In lower pH conditions, the addition of citric acid, a higher amount of gelling agent, and a higher °Brix content can stabilize the shelf life of gummy candy under room temperature [15]. In room temperature (25 °C), the gummy candy maintained its integrity for the first six months. However, the visibility of moist spots and mold growth by the seventh month suggests that ambient conditions facilitated moisture accumulation within the polyethylene packaging. This environment likely reached a water activity (aw) level conducive to microbial proliferation, rendering the product unsafe. Refrigerated storage (5 °C) effectively extended the product's shelf life, maintaining stability beyond the twelve-month mark. It was only at 12 months (1 year) that the product reached marginal acceptability, characterized by softening and a slight off-odor. This suggests that while refrigeration inhibits microbial spoilage, gradual enzymatic or chemical changes eventually impact the candy's texture and aroma.

As demonstrated by Foglia (2022), gummies typically have a shelf life of approximately two weeks, particularly for homemade products. This duration may fluctuate based on several factors, including the ingredients used, moisture content, and storage conditions. Homemade gummies lack chemical preservatives found in commercial varieties, resulting in a shorter shelf life. The preservation of the tomato-based gummy candy is largely supported by the inclusion of citric acid. The use of citric acid as a preservative helps extend the product's shelf-life stability by lowering pH and inhibiting microbial growth [15]. Based on these findings, refrigeration is the recommended storage method to ensure the candy remains within acceptable quality limits for at least twelve (12) months.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Table 13: Cost Analysis of the most acceptable tomato gummy candy

Fixed Cost (Php)	Variable Cost (Php)	Labor Cost (Php)	Other Expenses (Php)	Total Production
2950.00 (74.53%)	**144.13 (3.64%)**	**664.00 (16.77%)**	**445.83 (5.05%)**	**4,203.96**

Fixed Cost Description	Qty	Unit	Price/Unit	Amount (Php)
Equipment/Materials Expenses			**Sub-Total**	**2,950.00**
Variable Cost (Raw Materials Expenses)				
Tomato	0.500	Kg	100.00	50.00
Gelatin	0.060	Kg	1000	60.00
Sugar	0.150	Kg	80.00	12.00
Water	0.085	L	25.00	2.13
Packaging	1	Pack	20.00	20.00
			Sub-Total	**144.13**
Labor Cost				
Direct Labor	8	Hr	51.75	414.00
Indirect Labor	8	Hr	31.25	250.00
			Sub-Total	**664.00**
Other Expenses				
Utility Expenses				30.00
Transportation				70.00
Marketing And Administrative Cost				100.00
Depreciation Cost				245.83
			Sub-Total	**445.83**
			Total Investment Cost	**4203.96**

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

Number Of Goods/Rendered (Per Process)	**175 Pcs**
Break-Even Price (Total Investment Cost/No. Of Yield)	**5.76**
Selling Price Per Cubes At 20% Mark Up Selling Price	**6.91**
Market Price (For 20% Mark-Up) (100g)	**265.77**

Table 14: Material Balance

Input	Mass (g)	Process	Output	Mass (g)	Waste (g)
Raw Tomato	290g	Blend	Tomato Puree	270	20
Tomato Puree	270				
Gelatin	70	Mix			
Sugar	150	Ingredients	Mixed	495	-
Water	85		Gummy Base		
Mix Gummy Base	495	Cooking	Cooked Gummy	-	-
Cooked Gummy	-	Molding And Cooling	Gummy Candy	459	36
Gummy Candy	459	Packaging	Packaged Candy	456	3
Total Input (g)					595
Total Waste (g)					59
Total Weight Yield (g)					456
Weight Per Gummies (g)					2.5-2.6
Number Of Gummies (pc)					**175**

Cost analysis of the most acceptable formulation demonstrated that the product can be produced at a reasonable cost, making it feasible for small-scale or local commercialization. The use of locally available tomatoes and basic confectionery ingredients supports affordability and potential income generation for farmers and micro-entrepreneurs. By transforming surplus tomatoes into value-added gummy candy, the study provides an alternative processing approach that may reduce postharvest losses and increase economic returns.

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

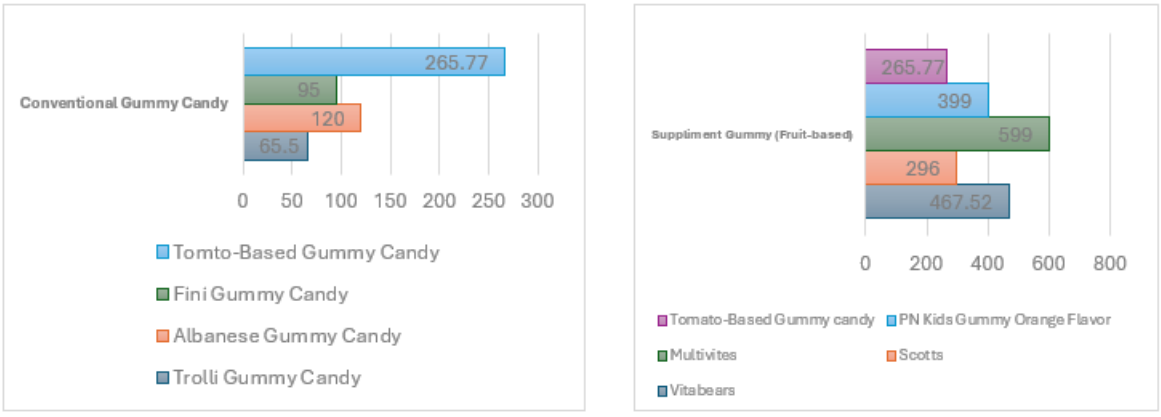

Figure 4: Comparison of Gummy Candy Market Prices

The graphs illustrated the "Gummy Candy Market Price" prevalent in the Philippines, categorized into two distinct graphs, a conventional gummy candies and fruit-based supplement gummies. The tomato-based gummy candy is more expensive due to its premium, natural ingredients, which could justify the higher price. In contrast, the right graph illustrates the pricing of fruit-based supplement gummies, indicating a predominantly higher price range. The graphs, when analyzed separately, emphasize the unique pricing dynamics and consumer preferences in the regular gummy candy and supplement gummy markets in the Philippines. The incorporation of natural colorants and fruit sweeteners in gummy supplement elevates their cost relative to conventional gummy candies, which typically utilize artificial substitutes. Natural ingredients, like fruit extracts and powders were expensive to procure and process compared to the artificial tastes and colors present in conventional gummy candies [3].

4. CONCLUSION

The study successfully developed whole tomato (*Lycopersicon esculentum*) gummy candy and evaluated its sensory acceptability, physicochemical properties, microbial quality, and production cost. Results revealed that varying gelatin concentrations significantly affected texture, while taste, color, aroma, and overall acceptability showed no significant differences among formulations. Among the treatments, the formulation containing 60 g gelatin per 270 g tomato puree obtained the highest sensory ratings and was identified as the most acceptable variant.

Physicochemical analysis confirmed that the selected formulation met acceptable standards in terms of TSS, pH and moisture content, contributing to product stability. Proximate analysis indicated the presence of carbohydrates, minimal fat, protein from gelatin, and beneficial bioactive compounds such as lycopene derived from whole tomato inclusion. Microbial analysis showed yeast and mold counts within permissible limits, indicating product safety under proper handling

ISSN: 2455-6939

Volume: 12, Issue: 02 "March-April 2026"

and storage conditions. Furthermore, cost analysis demonstrated the economic feasibility of producing tomato gummy candy using locally available raw materials.

Overall, the findings confirm that whole tomato, including seeds, can be effectively utilized in gummy candy production, providing a value-added product that supports waste reduction, farmer income enhancement, and the development of a potentially healthier confectionery alternative.

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