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# Development of Healthy Gummies Containing Millet Flour and Natural Fruits Which Enhances the Nutritional Value

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**ABSTRACT:** The increased consumer interest on natural based products such as chemical free, free of synthetic additives, natural colorants, minerals, vitamins, low cholesterol, low fat and antioxidant rich. Therefore, the aim of our study is to develop a healthy gummies using natural ingredients, no additives and no refined sugar. Our gummies are healthier alternatives for market candies. It developed using passion fruit juice mixed with maple syrup and xylitol. Mostly market gummies are made with gelatin as a thickening agent. Gelatin is made up with animal fat it is allergic to some peoples. So we come with agar agar powder as a thickening agent. Our gummies mainly added with foxtail millet flour, helps to improve glycemic control and reduce insulin, cholesterol and helps to control type 2 diabetes for diabetic patient. It also enriched with antioxidant property and vitamin-D. In addition, the healthy natural gummies are healthier alternatives for market candies. Because of its lower caloric value and antioxidant rich.

**KEYWORDS:** Gummies, passion fruit, maple syrup, agar agar, gelatin, antioxidant rich, foxtail millet.

## I. INTRODUCTION

In the 21st-century, the interest in natural ingredients based-food supplements, pharmaceuticals, and functional ingredients has amplified. Gummy Vitamins or Vitamin Gummies are chewable vitamins with a texture and taste similar to gummy candies in various colours, shapes and sizes. Passion Fruit (*Passiflora Edulis*), Many Value added products are Processed from passion fruit, Jam, jelly, syrup, Biscuits, Pickles, Passion Seed oil are some of the processed food products from Passion fruit. Jams, Jellies and fruit Juices are the most common uses for passion fruit. Agar (agar agar) is a gelatinous substance that is extracted from seaweed and processed into flakes, powders and sheets. It is commonly used in Asian cuisines and as a flavorless vegan substitute for gelatin[1]. Agar helps gel, stabilize, texturize and thicken beverages, baked goods, confectioneries, dairy products, dressings, meat products and sauces. Maple syrup is a syrup made from the sap of maple trees. In cold climates, these trees store starch in their trunks and roots before winter; the starch is then converted to sugar that rises in the sap in late winter and early spring. Maple trees are tapped by drilling holes into their trunks and collecting the sap, which is processed by heating to evaporate much of the water, leaving the concentrated syrup[2]. Foxtail millet is a member of the Paniceae tribe (subfamily Panicoideae of the Poaceae) and came from green millet domestication in northern China about for 8000 years ago. Foxtail millet is extensively cultivated in the developing countries in semiarid and arid regions of Africa, Americas, Asia[3]. Because of its health benefits (a particular balance of nutrients, e.g., starch, protein, dietary fibers, fat, vitamins, and low-glycemic and hypolipidemic effects), good yield with minimal agricultural inputs, and adaptation to different biotic and abiotic stresses such as salinity, drought and fungal diseases. Regular consumption of confectionery products leads to obesity, type-2 diabetes, tooth cavity. Most of the confectioneries contain digested carbohydrate such as refined flour and sugar. Sweets are easily digestible in nature. This nature allow your body to rapidly absorb the sugar after you eat which may result in a spike in your blood sugar levels, followed by a subsequent rapid decrease, or blood sugar crash. It leads to imbalance of sugar in the bloodstream damaging the ability of liver to process sugar and increase the risk of type-2 diabetes[4].

## II. RELATED WORK

Ugne Cizauskaite et al., (2019) studied that Based on the obtained texture analysis results, it can be concluded that the optimal composition for the gummy bear's base contains 4.3 g gelatin and 6.3 g agave syrup. The proposed gummy bear

base can be supplemented with various active ingredients, such as calcium carbonate, a solution of vitamin D3, and food additives to enhance the acceptance of the product by the consumers. However, the selected color and taste modifier (acai berry extract) did not result in significant improvement of all the organoleptic properties according to the data achieved by the in vivo study[5]. The moisture loss within time was significant as well, so further studies are needed to investigate the other natural sources of food ingredients, which could mask the unpleasant taste of active ingredients if needed and help to avoid water loss (plasticizer effect) [6]. The results of the current study indicated that experimental texture analysis is a more accurate technique compared to the in vivo evaluation. The proposed analytical methods could be further used for the gummy bear quality evaluation.

Xirui He et al., (2020) studied that the passion fruit is most popular for its attractive nutritional and sensory qualities to the health and well beings of the worldwide consumer. Secondary metabolites in passion fruit have been attracting considerable attention because these compounds exert numerous health benefits and economic value, and thus have been used in nutrition, cosmetics and medicine. Passion fruit and its by products full of various chemical constituents and phytonutrients including polyphenols, dietary fiber, pectin, carotenes, and vitamin. The chemical constituents and properties of different kinds of passion fruit are diverse. Yellow passion fruit presented higher water and relatively lower nutritional components, while purple fruit presented higher content of vitamin C, vitamin A, fiber and calcium. Different plant parts (leaves, buds, peels, and pulp) and Passion fruit is most popular for its attractive nutritional and sensory qualities to the health and well beings of the worldwide consumer. Secondary metabolites in passion fruit have been attracting considerable attention because these compounds exert numerous health benefits and economic value, and thus have been used in nutrition, cosmetics and medicine. Passion fruit and its by products full of various chemical constituents and phytonutrients including polyphenols, dietary fiber, pectin, carotenes, and vitamin[7].

The chemical constituents and properties of different kinds of passion fruit are diverse. Yellow passion fruit presented higher water and relatively lower nutritional components, while purple fruit presented higher content of vitamin C, vitamin A, fiber and calcium. Different plant parts (leaves, buds, peels, and pulp) and growth stages of *P. edulis* contain a variety of bioactive components such as total dietary and polyphenols. The yellow passion fruit presented higher content of pectin in peels, high content of carotene, quercetin, and kaempferol in pulps and higher values of total dietary fiber in seeds. The purple fruit was highlighted by a great value of anthocyanins in peels and seeds. Passion fruit peels as food waste account for 50% of the total fruit has also a high potential to obtain functional ingredients because it rich in biological active ingredients. Because of the unique bioactive constituents in passion fruit, diversenutritional and medical benefits have been watched and recorded. The various extracts from different parts of *P. edulis* exhibited numerous pharmacological activities including antioxidant, analgesic and anti-inflammatory, antimicrobial, anti-hypertensive, hepatoprotective and lung-protective, anti-tumor, antidiabetic, hypolipidemic, antidepressant and anxiolytic-like capacities, and thus are used in phytotherapeutic remedies. In particular, acute toxicity and subacute toxicity studies have shown that a rationalized daily dose of passion fruit is probably safe for consumption. These outstanding results suggest that passion fruit may offer a range of health benefits, such as managing inflammatory and neurological disease, and also preventing some chronic diseases like hypertension and hyperlipidemia[8].

Mohammed, O.J. and Mahmood, Sh.J., (2021) the results obtained revealed that the replacement of sugar by maple syrup improved the taste, body, texture, colour and overall liking scores significantly ( $p < 0.05$ ), with maple syrup percentage while the control treatment was less liked due to the whey sour taste. Iced drinks with high nutritional value, good physical and organoleptic properties can be successfully prepared by using whey and replacing sugar with maple syrup. The obtained products can be considered functional ice milk varieties[9].

Jatin Gupta and Kanupriya Gupta., (2018) this review shows that the xylitol has been shown to reduce dental caries when mixed with food, chewing gums and milk. Dental caries are prevalent in acidic pH where *Streptococcus mutans* (MS) ferment resulting in demineralization of tooth, where as *Streptococcus mutans* cannot ferment xylitol thus it reduces MS by altering their metabolic pathway and enhance remineralization and helps arrest dental caries. Reduction in caries rate is greater, when xylitol is used as the sugar substitutes. This review discusses the taste acceptability of xylitol in milk as a step towards measuring the effectiveness for the reduction of dental caries.

Jill Frank., (2022) this review provides that the guar gum act as a thickening agent in food products. Guar gum is one of the few gums manufactured manually, it produces a uniform, high viscosity gel that aids in thickening a variety of food categories.

A. Sangeetha et al., (2021) the present study was carried out to develop a pilot equipment for sugar balls and use of response surface methodology to find the most effective and optimized process in the manufacturing of millet-based sugarball (theanmettai).



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W.M.D.A. Wijesinghe et al., (2019) this review proposed that the most of the people in rural areas in Sri Lanka are suffering from malnutrition due to lack of nutritious especially protein, energy, fibre and minerals. Nowadays, there are many problems with the consumption of wheat flour. The protein in wheat is Gluten. Many people are unable to properly digest gluten. It is very low in essential amino acids and also prevents the absorption of minerals into the body like calcium, zinc, iron and magnesium. Finger millet forms the staple food for a large segment of the population in South Asia and African countries and it contains 65-75% starch, 11-12% dietary fibre and has high levels of calcium. Millet-based preparations are believed to elicit a lower glycaemic response and are therefore recommended for individuals with diabetes. Finger millet is full of minerals. Calcium, Phosphorus, Iron and Potassium is found in it. The use of millet flour is becoming more and more common in baked products especially in bread, cookies and crackers that are targeted at consumers who are gluten sensitive or diabetic.

Rachael link, MS, RD., (2018) this article proposed that the agar agar is a gel-like substance derived from red algae that is a popular vegan alternative to gelatin as a thickening agent. It’s commonly used to enhance the texture of recipes like puddings, ice creams, jellies, gummies, soups and sauces. In addition to containing plenty of fiber, agar agar is also high in micronutrients like manganese, magnesium, folate and iron.

### III.METHODOLOGY

#### Raw Materials:

The raw materials used for this product preparation are Passion fruit was purchased from agricultural land (Edavanna, Malappuram, Kerala). Foxtail Millet flour and Agar agar powder was purchased from D Mart ( Coimbatore, India). Maple syrup was purchased from Viveka Agency (Coimbatore, India). Xylitol, Guar gum, citric acid were purchased from the RK World Infocom Pvt Ltd (Bengaluru, India). Vitamin D Cholecalciferol were Purchased from a Rare Medical ( Coimbatore, India).

#### Machinery:

The Entire project process were carried out inside the college Food Technology laboratory. We use college equipments like blender, weighing machine, refridgerator, moulds etc as much as possible.

#### Extraction of Juice from Passion Fruit

The passion fruit was washed, peeled and extraction of juice from the pulp. Then using filter remove the impurities present in the juice. After filtration juice should be kept on closed container or jar.

#### Formulation of Gummy

Gummies were manufactured by molding a prepared mass in a silicone mold and cooling it down to room temperature.

The bases of the gummies were prepared by the following formulation.

Number	Agar agar	Maple syrup	Millet flour
Sample 1	4.5	10.06	4.5
Sample 2	6	9.23	5.6
Sample 3	5.4	8.02	5.4
Sample 4	5.1	6.09	5.1
Sample 5	4.4	7.5	4.7
Sample 6	4	8.3	3.3
Sample 7	3.5	9.65	3
Sample 8	13	10	2.5

Table 1 Selected variables and experimental design matrix of gummies



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IV. EXPERIMENTAL RESULTS

Analytical Report

S.NO	PARAMETERS	RESULTS	UNIT
1	Energy	480	Kcal
2	Carbohydrates	67	gm
3	Protein	3.2	gm
4	Vitamin D	0.0	mcg

Table 2 Analytical report of gummies

Microbiological Report

S.NO	PARAMETER	TEST RESULTS
1	Total bacteria count	1.21*10 <sup>4</sup> cfu/gm
2	Yeast & mould	absent
3	Coliform	absent
4	Salmonella	absent
5	Shigella	absent

Table 3 Microbiological report of gummies

Antioxidant Report

S.NO	TEST	RESULT	UNITS
1	ANTIOXIDANT ACTIVITY	11.8	%

Table 4 Antioxidant activity report of gummies

Effect of addition of passion fruit, agar agar, guar gum, maple syrup, xylitol, and foxtail millet flour on organoleptic score of healthy gummies

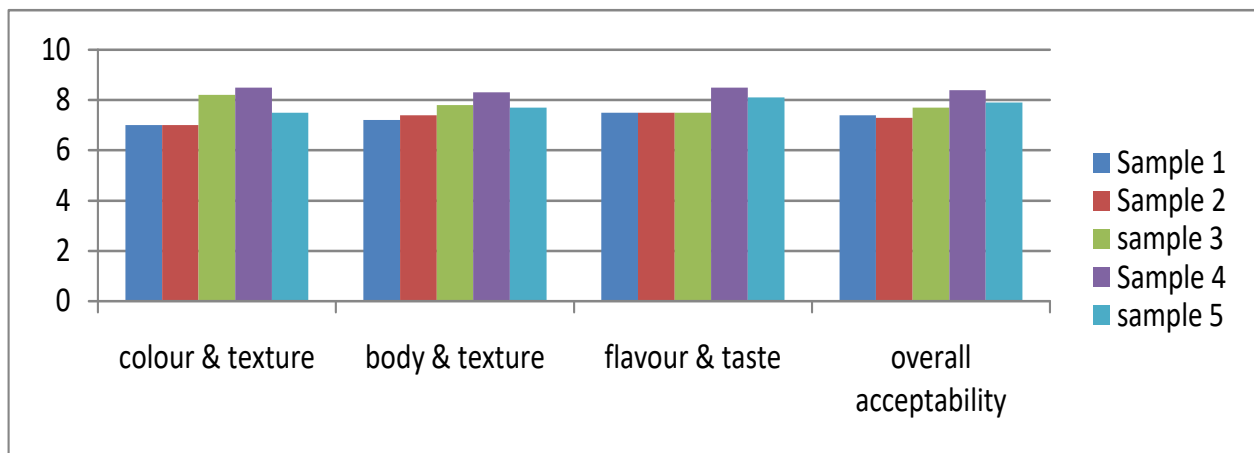


Figure 1 Organoleptic score of healthy gummies

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Figure 2 Passion fruit healthy gummies with different shapes

## V. CONCLUSION

The results of this study shows that the healthy gummies formulated with passion fruit, agar agar, guar gum, foxtail millet flour, maple syrup and xylitol act as a sweeteners have antioxidant property conferred by the ingredients included in the formulations and were safe from the microbiological point of view, attending lesser amount of moisture content. The developed product had uniform colour and textural properties, and the nutritional value of developed formulation allows good. The use of natural sweeteners also provide low glycemic index to the gummies. Our research shows that it seems possible to obtain passion fruit healthy gummies with acceptable sensory attributes, which may be marketed for diabetic patients or individuals who desire to reduce weight. However further analysis is required to understand the gummies stability and shelf life.

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