Formulation and nutritional evaluation of plant based gluten free vegan nuggets

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Abstract

The development and commercialization of plant based vegan nuggets have increased in the market, as a result of increase demand of meat analogues. The standardization of formulation of plant based gluten free vegan nuggets was conducted. The formulation of developed nuggets contained potato, tofu and banana as main ingredients and corn flour, rice flour, breadcrumbs and corn flakes were used for layering of developed nuggets, before frying. Eight formulations of plant based gluten free vegan nuggets were prepared and evaluated for nutritional and sensory characteristics. The results of sensory evaluation revealed that formulation S5 was found to be most acceptable in comparison to other seven formulations.

Keywords*: Vegan, Gluten free, Tofu, Nuggets, Plant-based.*

Introduction

The interest in plant protein based meat substitute or alternatives has increased globally, specifically in Western countries, as a result of growing health conscious population. In past few years, the consumers following flexitarian diet along with vegetarians has also increased. Flexitarian diet refers to reduced consumption of meat through daily diet (Rohrmann, 2013). This shift in food choices of customers can be attributed to environmental, ethical, health reasons and variations in food interests (Kole, 2010). Therefore, the food manufacturers develop meat alternatives in order meet the growing demand. The food business operators are also innovating novel protein products (Elzerman *et al.*, 2011). Moreover, according to the German Nutrition Society (DGE) it is recommended to decrease consumption of meat to 300 – 600 g meat / week (2-3 servings per week) (Deutsche, 2008).

A broad range of ingredients can be used for development of meat alternatives or vegan products which, compared to TVP, provide strong differentiation in shapes and flavours as well as products that fulfil attributes such as “vegan”, “organic” and “gluten-free” (Cheftel *et al.*, 1992). Besides textural properties, an attractive flavour is a key prerequisite for consumer acceptance and market launch of new meat alternatives (Sadler, 2004). Soy protein and wheat gluten have been the dominant raw materials for meat analogues (Trinci, 1992).

Plant based diet reduces the environmental footprint and promote health and animal welfare. Along with increased number of vegan people, the utilization of non-animal food products has increased (Alcorta *et al.*, 2021). According to the United Nations report, a vegan diet may reduce the risk of

zoonotic diseases and ultimately feed more people with fewer resources. Therefore, the manufacturers focus on development of vegan food with strong physicochemical and sensory profile (Keerthana *et al.*, 2022). The present study was conducted with the aim to standardize formulation of plant based vegan nuggets and analyse nutritional and sensory characteristics of developed product.

Materials and Methods

Materials

Tofu, banana and potato were procured from the local Loni Kalbhor market to develop plant based gluten free vegan nuggets. Moreover, corn flour, rice flour, breadcrumbs and spices were acquired from a local market in Pune. LDPE, HDPE and butter paper are the materials required for packing of developed product.

Chemicals required for the analysis were of analytical grade and procured from departmental laboratories at the MIT School of Food Technology, Loni Kalbhor, Pune.

Methods

Product development and standardization of formulation

The gluten free vegan nuggets were formulated by varying proportions of raw materials during the trials, as tabulated in table 1. The proportion of tofu:banana:potato was found to be 65:20:10. The grated raw materials (tofu, banana, potato) were mixed and roasted with oil. The spices were added to the mixture and the mixture was rolled into sheet. The uniform shaped nuggets were cut and refrigerated at 4 ^{o}C for 140 minutes. The mixture of 10 g of corn flour, rice flour each with water was layered on nuggets, following with the layering of breadcrumbs. The gluten free vegan nuggets were fried in oil at 180 ^{o}C for 4-5 minutes, till it attained optimum golden brown color. The developed product was cooled at 22 ^{o}C for 2 minutes and packed.

Table 1: Formulation trials for developed product

Formulation	Tofu (g)	Banana (g)	Potato (g)
S1	70	20	10
S2	70	15	10
S3	70	20	15
S4	70	15	15
S5	65	20	10
S6	65	15	10
S7	65	20	15
S8	65	15	15

Analysis of nutritional characteristics

The energy, moisture content, total ash content, protein, total fat content, carbohydrates, iron, calcium and magnesium content of the developed plant based vegan gluten free nuggets.

The developed product was assessed for sensory profile including taste, flavor, color, texture, appearance and overall acceptability, using 9-point hedonic scale.

Result

Eight variations of developed plant based gluten free vegan nuggets namely, S1, S2, S3, S4, S5, S6, S7 and S8 were evaluated for sensory characteristics. The S5 formulation acquired maximum score (7.7), whereas S7 formulation acquired lowest score (7.4). The nutritional analysis data revealed the moisture content to be 24.5% and energy value to be 379.5 kcal. In the study by Mousavi *et al.,* 2019, the calorific value of sausages was found to increase with respect to increase in amount of tofu, whereas negligible changes were observed in the values of ash content, with the increase in the amount of tofu content. Tofu is considered as good source of calcium, according to the literature by Pal *et al.*, 2019. Thus, addition of the same provides significant calcium content to the developed product. Whereas, banana is the rich source of minerals (potassium, phosphorus, calcium), as supported by the report by Ranjha *et al.*, 2020. The values of nutritional content including the protein content, fat, carbohydrates, calcium, iron and magnesium content was tabulated in table 2.

Table 2: Nutritional analysis of the developed product

Parameters	Results
Energy (kcal)	379.5
Moisture (%)	24.5 ± 0.44
Total ash (%)	2.02 ± 0.02
Protein (%)	5.5 ± 0.18
Total fat (%)	6.88 ± 0.39
Carbohydrates	58.02 ± 0.49
Iron (mg)	1.8 ± 0.01
Calcium (mg)	1.0 ± 0.02
Magnesium (mg)	0.32 ± 0.01

Conclusion

The major component of the developed plant-based gluten free vegan nuggets was tofu. The fermented soy food, contains soy peptides that exhibit antioxidant and anti-inflammatory properties, which could help protect the blood vessels from oxidative and inflammatory damage. Various researches indicate that consumption of soy products have potential to prevent breast cancer, osteoporosis and cardiovascular disease. The sensory characteristics were evaluated for developed product that are color, taste, appearance, texture, flavor and overall acceptability of developed product was performed using 9-point hedonic scale. The results of sensory evaluation revealed that formulation S5 of developed plant-based gluten free vegan nuggets was found to be most acceptable in comparison to all other seven other formulations.

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