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BEET PULSE BITES- A MODIFIED FOOD PRODUCT FOR CARDIOVASCULAR DISEASE PATIENT

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ABSTRACT

Aim: The study aimed to develop protein-rich beet pulse bites (sev puri) for people with CVD.

Objectives include the formulation of products which can be consumed by all strata of people with Cardiovascular disease (CVD).

Introduction: Sev puri is popularly consumed as a snack in various ways. Due to its popularity and demand, it was modified using pulses flour (Tur dal, moong dal, chana dal) Rava, beetroot, spices, and maida for binding to increase its nutritional composition. The cooking method was altered; air fried was done instead of deep frying. Pulses are high in fibre plant protein, and various other micronutrients and low in fat and Glycemic index benefit the prevention and management of CVD. The dietary nitrate and polyphenols like betanin, Saponin present in beetroot resist the synthesis of Reactive Oxygen Species and improve endothelial function, reduce partial stiffness, and decrease systolic and diastolic BP.

Methodology: The study was conducted through various phases including standardization, sensory evaluation- 5 hedonic scales, microbial analysis, and evaluating nutritional and shelf life parameters.

Results and discussion: A crispy, bright pink, aroma of fenugreek, beet pulse bite (sev puri) was obtained. The product was made using lab technique, the beet pulse bites are high in protein. The inclusion of mixed dal powder increased the nutritional benefit of the product. The microbial analysis revealed that it can be stored in an airtight container for a month.

Index Terms: pulses, beetroot, bites, CVD, shelf life.

I. INTRODUCTION

FAO defined street food or road food as “ready-to-eat foods and beverages prepared and or sold by vendors and handlers, especially in streets and other similar places for immediate intake or consumption or at a later stage without further processing or preparation (Food and Nutrition Paper No. 46, 1989). Indian delicacy strongly influenced the culture and tradition of the originated state. Indian cookery's sev puri is a chaat-style snack. It's an Indian cuisine that dawned in Pune, Maharashtra. It's one of the most important constituents of Maharashtra road food and is consumed throughout India. Unlike pani puri, Sev puri does not have several names.

Due to its advanced demand, supermarkets have started stocking up on packets ready to eat, frozen also. It's crispy papdi and consumed in varied forms. It's consumed as Dahi sev puri, masala sev puri, corn masala sev puri, batata sev puri, mixed veg sev puri, sprouted sev puri, and only puri as a snack. In Maharashtra, it is even used as a scoop or spoon for eating bhel and chaat. The study conducted by Buscemi et al., 2012, set up that road food is dense in saturated fat, with inadequate or low fibres, vitamins, and antioxidants which affect metabolic health through endothelial dysfunction. The studies also indicate that excessive consumption of Saturated fat connects with endothelial dysfunction in normal individuals, implying such food consumption should be limited(Buscemi et al., 2019).

In 2013, Data collected from 639 papers revealed that everyday energy consumption ranges from 13% to 15 % and 13 % to 40% in adults and children respectively. The consumption of fat and carbs in terms of simple sugar and trans fat is advanced whereas protein input is half of RDA. According to researchers, street foods are prepared instantly and can be eaten by anyone; it's common in both urban and rural because of their appealing taste, and accessibility(Prasad et al., 2021).

The increasing consumption of street food raises several concerns for public health. It is a major challenge faced by healthcare professionals especially nutritionists to fit street food into dietary guidelines and RDA. Since traditional road food is made from refined flour, deep-fried and trans-fat rich is extremely dangerous to health. The transition of the population from home-cooked food to road food is escalating which directly correlates with the adding number of Non-communicable conditions, especially CVD, diabetes and obesity (Prasad et al.,2021). To overcome these deleterious health effects after consumption of road food the current study has been done to modify the unhealthy version of sev puri to a healthy version of “ Beet Pulse Bites ”, with a marginal difference in cost, tastier than traditional sev puri and shelf life nearly comparable (Maheshwari et al., 2022).

In a typical sev puri recipe, refined flour (55.41%), refined palmolein oil (27.71%), wheat flour (12.79%), semolina (2.13%), and iodised salt (1.96%) are used. We modified it by replacing refined flour with pulse flours (chana dal, moong dal, and toor dal), which increases the protein content of the recipe. To make it appealing we used beetroot pulp. Also, we air-fried the puri instead of deep frying it to save fat. The product is cholesterol and trans-fat-free.

In the modified product the ingredients taken were beet pulp, Rava, wheat flour, moong dal, chana dal, toor dal, oil, Kasuri methi, jeera powder, black powder, amchur powder and black pepper. Beet pulp is rich in fibre and is unique in its form as it is soluble fibre and highly digestible. A regular glass of beetroot Juice can reduce signs of inflammation in blood vessels that are known to be increased in people with coronary heart disease, according to new research presented at the British Cardiovascular Society conference in Manchester.

Hence considering all these aspects in mind we modified the street sev puri into nutritious beet pulse bites.

I. OBJECTIVE

- To formulate products which can be consumed by all strata of people with Cardiovascular disease (CVD).
- To make the product cholesterol and trans-fat-free.
- To make the product better than it existed.

II. HYPOTHESIS

POSITIVE DECLARATIVE- The significant difference will be seen in the health of CVD patients who consume Beet Pulse Bites in place of traditional sev puri.

III. MATERIALS AND METHODS

Beet pulse bites product was made using lab techniques in a food product development class under the guidance of Dr Rupali Sengupta in Dr BMN College of Home Science, Mumbai. The product was compared with the traditional product available in the market and modified further to increase its nutritional value. Sensory evaluation and microbial analysis of the product were done. Sensory evaluation of the product was done using a 5-point hedonic scale by the panel members based on the taste, aroma, appearance, texture and colour of the product. Suggestions and recommendations given by the panel members were modified in the product. Microbial testing of the product was done to estimate the shelf-life of the product.

Table 1: Ingredients of the product (Beet pulse bites):

Ingredients	Quantity
Beet pulp	25g
Rava	15g
Wheat flour	15g
Moong dal	10g
Chana dal	5g
Toor dal	5g
Oil	5ml
methi	5g
Jeera powder	½ tsp

Black powder	½ tsp
Amchur powder	½ tsp
Black pepper	½ tsp
Salt	½ tsp

Ingredients of product available in the market (Brand Name: Garden Bombay Puri):

Refined wheat flour (66%), Refined palmolein oil, wheat flour, edible common salt and hydrogenated vegetable oils (vanaspati)

Table 2: Comparison between the Nutrient composition of the traditional product available in the market (Brand Name: Garden Bombay Puri- 155gm) and Beet pulse bites:

Nutritive composition of traditional market product		Nutritive composition of Beet pulse bites	
Nutrient	Amount/100gm	Nutrient	Amount/100g
Calories	540 kcal	Calories	372.5 kcal
Total fat	32.3g	Total fat	10.2 g
Total carbohydrates	55 g	Total carbohydrates	60.6 g
Protein	7.3 g	Protein	11.2 g

Table 3: Nutrient composition of the product (Beet pulse bites):

For 1 serving: (10 pieces)

Ingredients	Quantity (gm/ml)	Energy (kcal)	Protein (gm)	Carbohydrate (gm)	Fat (gm)
Beet pulp	25	84	2.5	17	0.5
Rava	15	51	3	7.5	0.3
Wheat flour	15	50	1.5	10	0.3
Moong dal	10	34	1	7	0.1
Chana dal	5	17	0.5	3.5	1
Toor dal	5	17	0.5	3.5	1
Oil	5	45	-		5
Total	80	298	9	48.5	8.2

IV. METHODOLOGY

I. MICROBIAL ANALYSIS

Introduction

Microorganisms & their activities are important for all processes on Earth. Microbiology is the Study of all living organisms that are too small to be visible to the naked eye. This includes bacteria, archaea, viruses, fungi, protozoa & algae. Collectively known as microbes.

Microbial analysis of food products is the use of biological, biochemical, molecular or chemical methods for the detection, and identification of microorganisms in a material.

Standard Procedures

Pour plating

The pour plate method is used for counting the number of colonies forming bacteria present in the liquid specimen.

Principle

- The pour plate technique also will yield isolated colonies and has been extensively used with bacteria and fungi.
- The original sample is diluted several times to reduce the microbial population sufficiently to obtain separate colonies upon plating.
- Most bacteria and fungi will not be killed by brief exposure to warm agar.
- To prepare pure cultures. Colonies growing on the surface or subsurface can be inoculated with fresh medium.

Requirements

- Sterile Petri plates, sterile pipettes, an incubator at 37 degree Celsius, an autoclave, a test tube, Sterile saline

Procedure

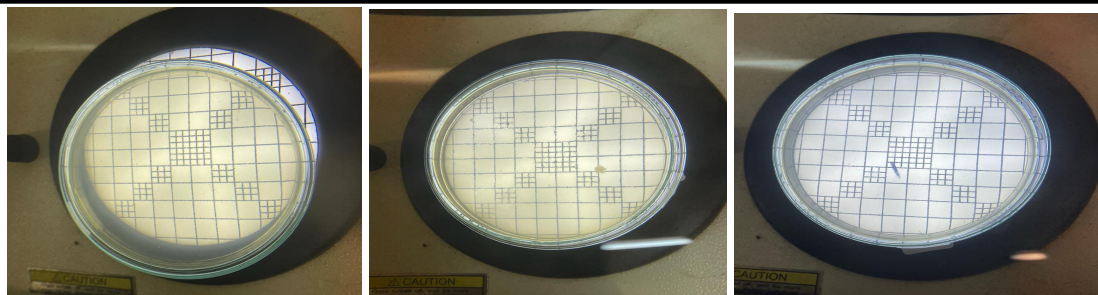
- Prepare 10-fold serial dilution of the given culture Suspension using sterile Saline
- Transfer 1 ml of 10⁻³ - 10⁻⁶ dilution into respective empty sterile Petri plates
- cool the molten nutrient agar to 45-50°C & pour it into
- Mix well by rotating in a circular motion on the bench top & allow to solidify
- Incubate the plate at 37°C for 18-24 hrs. For bacterial culture and 24-48 for yeast culture.

Disadvantage

- Reduce the growth rate of obligate aerobes in the depth of the agar.
- Loss of validity of heat-sensitive microbes.

Advantages

- Easy to undertake.
- Useful for counting viable colonies



A

B

C

- Picture A:- Petri dish 10^{-3} and 10^{-2} plates showed TLTC (Too low to count)
- Picture B:- 10^{-1} plate showed 0 or negligible colonies

From the above it can be concluded that sev puri made or produced showed very low microbial growth hence it can be said that it is safe to consume and has a shelf life of 1 month without using any preservatives or additives.

V. FUNCTIONAL FOOD

I. Beetroot

Functional foods are now defined as Natural or processed foods that contain known or unknown biologically-active compounds; which, in defined, effective non-toxic amounts, provide a clinically proven and documented benefit beneficial in preventing, managing, orating the chronic disease, the Functional Food Center (FFC). First functional foods can be either natural or processed according to these criteria. Second, food contains secondary metabolites called bioactive chemicals, which are thought to be the source of the food's usefulness. These compounds are often found in small levels and work synergistically to improve health. Bioactive substances may "exert antioxidant, cardio-protective, and chemo-preventive actions," in particular.

A significant natural colour, beetroot (*Beta vulgaris* L.) is one of the high-nutrient vegetables used in salads and drinks. It is a member of the commercially grown plant family Amaranthaceae-Chenopodiaceae. The roots of beetroot, sometimes referred to as table or garden beet, are typically grown. Due mostly to the presence of geosmin, a volatile bicyclic alcoholic chemical, it has a distinctive earthy, mushy scent and flavour. Beetroot is well known for its antioxidant properties and is frequently used as a treatment for a wide range of illnesses, including anemia stones, anemia, and disorders related to the heart and blood vessels. Additionally, some recent clinical trials have shown the value of beetroot in controlling blood pressure and maintaining cardiovascular health. Additionally, beetroot has become well-liked as a supplement to increase energy and enhance performance in athletes.

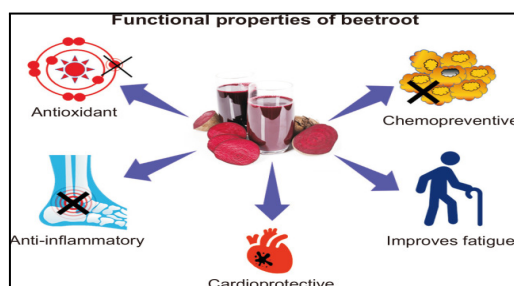
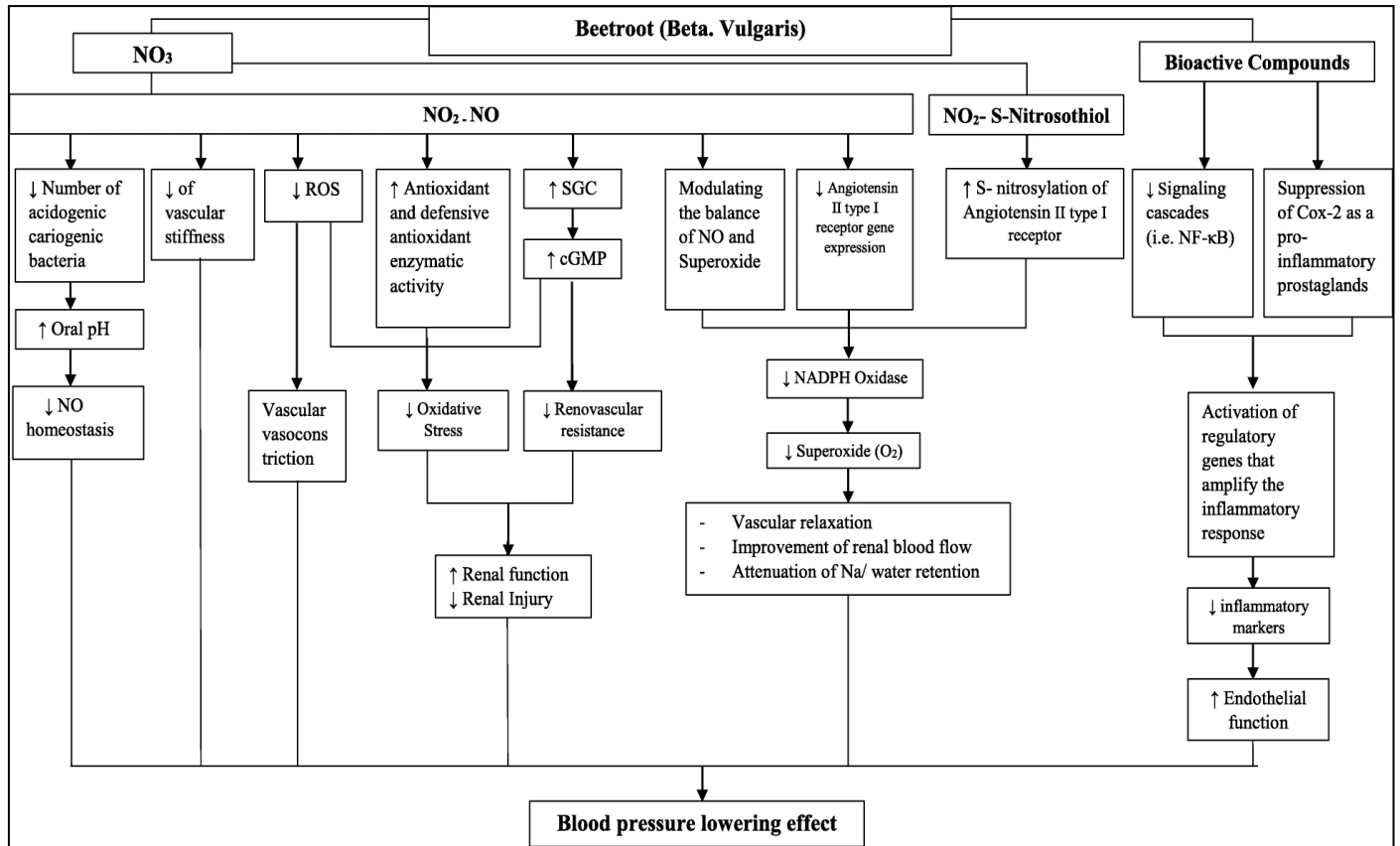


Figure 2: Functional properties of Beetroot

Beetroot (*Beta vulgaris*) is the most famous and usually grown up fruit from the Chenopodiaceae family. Beetroot contains many nutrients including vitamins (B complex, vitamin C), minerals, ber, proteins, and different kinds of bioactive phenolic substances, which are mainly composed of betalains, and other components possessing antioxidant activity, such as coumarins, carotenoids, sesquiterpenoids, triterpenes, and flavonoids (astragaloside, tiliroside, rhamnocitrin, kaempferol, rhamnetin).

Blood pressure lowering effect



Improvement in glucose and insulin homeostasis

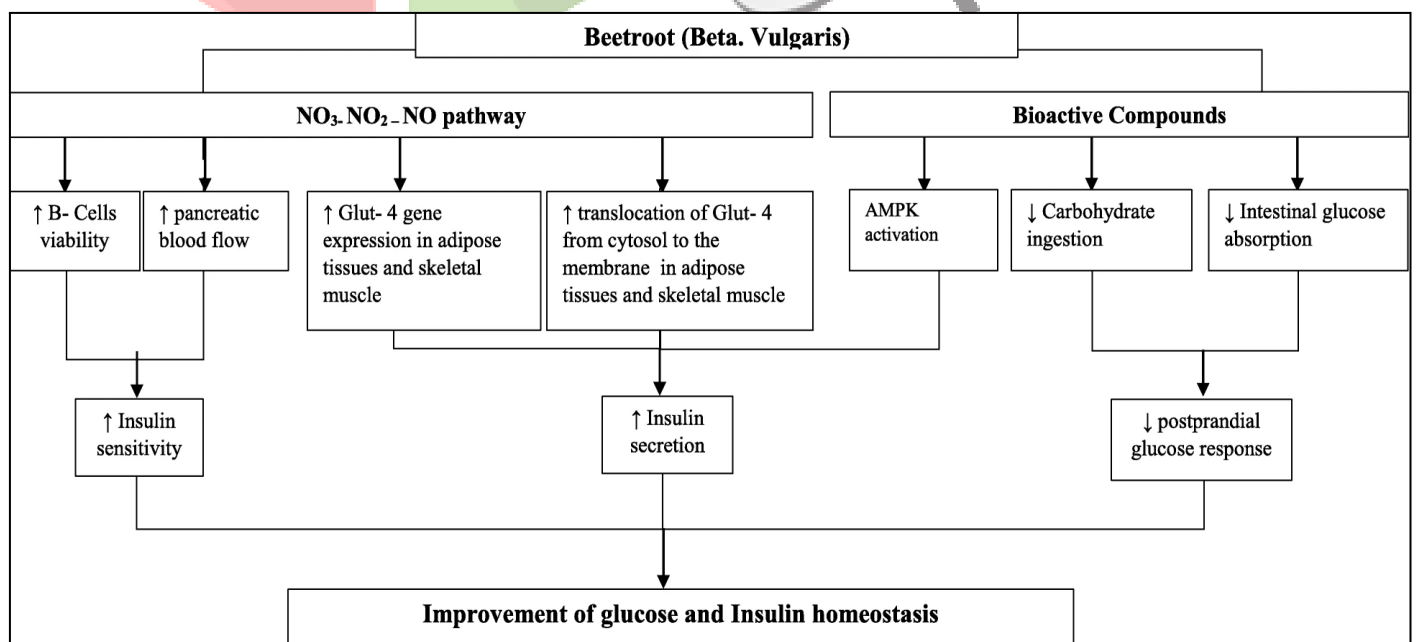


Figure 4: Benefits of Beetroot in glucose and insulin homeostasis

Hubbs, D. A., Kaffa, N., George, T. W., Methven, L., & Lovegrove, J. A. (2012). Blood pressure-lowering effects of beetroot juice and novel beetroot-enriched bread products in normotensive male subjects. *British Journal of Nutrition*, 108(11), 2066-207

CVD

Betanin is also referred to as a bioactive substance that can suppress lipid membrane and low-density lipoprotein (LDL) peroxidations, modulate ROS production and gene expression to lessen inflammatory cytokine release, and increase antioxidant enzyme activities. Thus, betanin has the potential to be used as a complementary therapy to minimize the pathophysiological consequences of oxidative stress and inflammatory processes that result in CVD disorders. Hence prevent CVD

II. Fenugreek

Fenugreek contains soluble fiber, saponins, polyphenolics, trigonelline, diosgenin, and 4-hydroxy isoleucine. Dietary fiber, flavonoids, and saponins may have hypoglycemic and hypolipidemic effects, and positive outcomes may be brought about by a reduction in inflammation. It also reduces low-density lipoproteins without a decline in high-density lipoprotein cholesterol. Fenugreek seeds work by reducing oxidative stress to quickly lower postprandial glucose and insulin levels in people. The therapeutic effect of fenugreek which is inhibiting cholesterol absorption and decreases blood sugar concentration prevents CVD.

III. Pulses

Pulses are valuable dry grains made from a leguminous plant that have a lot of bioactive substances like phytochemicals, bioactive peptides, and fermentable fibers as well as high nutritional qualities. Pulses diminish the risk of cardiovascular disease (CVD), mostly by changing the composition of plasma lipids. According to many meta-analyses, consuming about two-thirds of a cup of pulses per day considerably lowers total and LDL cholesterol. By improving glycemic control, lowering blood pressure, and reducing inflammation, pulses also cut CVD risk. They also induce satiety, which reduces food intake and the buildup of extra adipose tissue.

VI. FINDINGS AND DISCUSSION

Beet pulse bites (modified version of sev puri) have been viewed as a successful first step toward a much greater goal. The sensory evaluation of the standardized recipe revealed that, except aroma, all other parameters received a friendly response, concluding it was well accepted. The product is completely organic. No preservatives or color additives are used. Beetroot pulp was used to enhance its color in bright pink which has made the product more appealing.

In terms of macronutrient content, the modified puri has much lesser calories as compared to the reference product (167.5 kcal difference), the carbohydrate and protein content is high in the modified product, however, fat content was drastically high in the reference product.

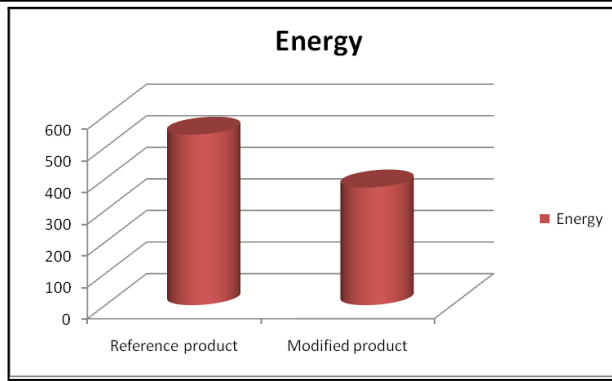


Fig 5: Comparison of Energy intake of the traditional and modified product

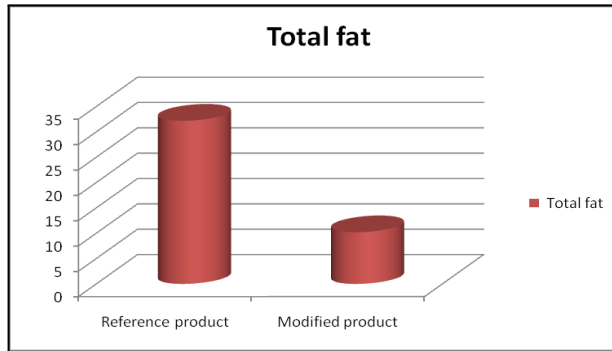


Fig 6: Comparison of Fat intake of the traditional and modified product

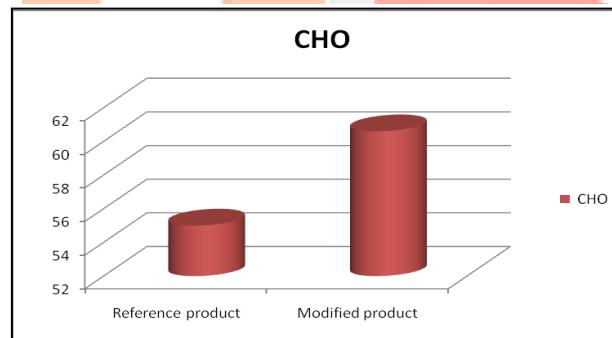


Fig 7: Comparison of Carbohydrates intake of the traditional and modified product



Fig 8: Comparison of Protein intake of the traditional and modified product

Air-frying instead of deep-frying was done to reduce the fat content and lower the calories which can produce similar kinds of products in terms of taste and texture. It requires very little oil. Thus, the saturated fat content of the product reduces. Intake of Trans fat could significantly decline which is a cause of CVD after consuming Beet pulse bites. The product is air fried for 10 mins at 180° C. A Minimum amount of good-quality fat was used in kneading.

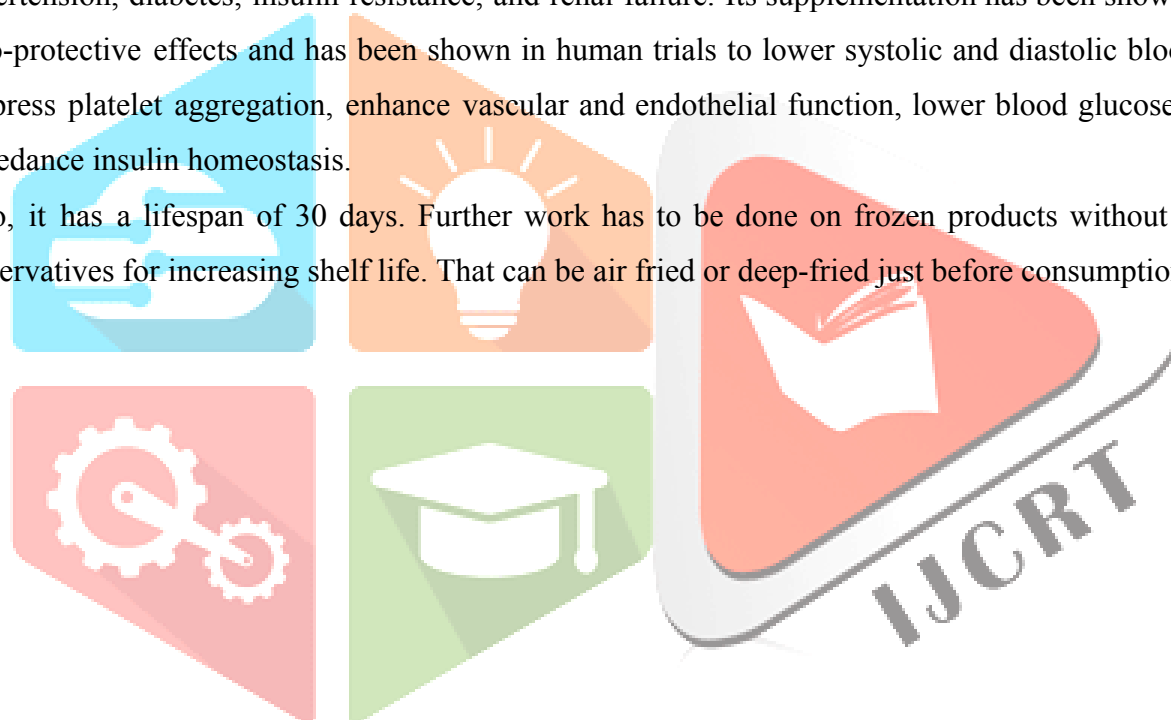
Roasted grounded pulses have been observed to increase their digestibility by decreasing antinutritional factors. This could be a good alternative for vegans or vegetarians to meet the RDA for protein. Carbohydrates, simple sugars and refined flours were completely omitted. Whole wheat flour and pulses are rich in complex carbs and oligosaccharides which play a prominent role in preventing the risk of CVD.

The product was completely dehydrated by air frying. The possibilities for microorganisms to grow and multiply were impaired due to no moisture. Hygiene issues were taken care of. All possible causes of contamination were eliminated during the development of the product. The product can be stored in an airtight container similar to that of the reference product.

VII. CONCLUSION

In terms of health, beetroot pulse bite is more beneficial than regular sev puri. Its health-promoting qualities have been linked to potential therapeutic uses for several metabolic diseases, including hypertension, diabetes, insulin resistance, and renal failure. Its supplementation has been shown to possess reno-protective effects and has been shown in human trials to lower systolic and diastolic blood pressure, suppress platelet aggregation, enhance vascular and endothelial function, lower blood glucose levels, and impede insulin homeostasis.

Also, it has a lifespan of 30 days. Further work has to be done on frozen products without adding any preservatives for increasing shelf life. That can be air fried or deep-fried just before consumption



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