

**DEVELOPMENT OF VALUE ADDED BISCUIT FOR PEOPLE LIVING WITH HUMAN IMMUNO DEFICIENCY VIRUS****DEVIKA.I¹ AND THAHIRA BANU.A²**¹Research scholar Department of Home Science, Gandhigram Rural Institute-Deemed university, Tamilnadu, India.²Assistant professor, Department of Home Science, Gandhigram Rural Institute-Deemed University, Dindigul district, Tamilnadu, India.**ABSTRACT**

The study was undertaken to formulate a biscuit incorporated with whey protein and banana flour to find its suitability for PLWHIV. The ingredients namely white flour (Maida), wheat, whey protein banana, carrot, sweet potato and powdered nuts were collected based on each of the ingredients functional properties for development of the biscuit. Four variations of the biscuit with a difference in proportion of ingredients were selected and coded as A, B, C and D. Among the four, variations C had the highest overall acceptability. Thus variation C was taken for analysis of the nutrients namely carbohydrate, protein, and fat, fractions of fat, selenium, zinc, iron, beta carotene and vitamin C using standard procedures. The shelf life of the biscuit was also evaluated on the 30th day of storage. The findings of the study were very promising in terms of the nutrients present in the biscuits. The biscuit had carbohydrate-65g, protein-13g, fat-22g, MUFA-1.02g, PUFA-2.53g, selenium-8.9µg, zinc-3.37mg, vitamin C-9.6mg, betacarotene-1220 mcg and iron -20mg per 100gm of the product. Thus from the study it is found that the whey protein, sweet potato and banana flour incorporated biscuit has substantial quantity of protein, PUFA, vitamin C and other nutrients required for a PLWHIV.

KEY WORDS: Multi nutrient biscuit- Formulation, Nutrient analysis, Shelf life**I.DEVIKA**

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INTRODUCTION

Eating a healthy balanced diet is the first essential component of a comprehensive HIV management. The goal of nutrition support for people living with HIV is to stabilize nutritional status and improve nutritional status during Anti Retro Viral Therapy (ART) treatment. Poor nutrition has been shown to impair immune response that accelerates the progression of disease, and can even serve as a mortality predictor in paediatric HIV cases¹⁻². Macronutrients, micronutrients, antioxidants and immune boosters have an important role to play on the nutritional status of the people living with HIV. A nutritional supplement which contains excellent physiochemical properties, antioxidants, detoxifying, anti carcinogenic and antifungal properties are of great benefit to PLWHIV. ³Maia-Leite *et al.*, 2010 and ⁴Tapam *et al.*, 2008 observed that significant relationship between BMI and duration of commencement of Anti Retroviral Therapy (ART). This association may be explained by the ability of the drugs to decrease resting-energy expenditure in the respondents which is reported as 10 and 20 percent higher in asymptomatic and symptomatic HIV patients respectively. The ART interacts with nutrition in many ways. ⁵Irlam *et al.*, 2010 conducted a study based on micronutrient supplements with vitamins, trace elements and combinations and supplemented to 22,120 participants and they found that supplemented groups had reduced mortality and morbidity risk. ⁶Eliot *et al.*, 2008 observed that HIV infected patients were treated with whey protein powder for a period of six months and found that plasma glutathione level was elevated after supplementation and ⁷Delmas- Beauvieux *et al.*, 2006 conducted a study on selenium and beta-carotene supplementation in human immunodeficiency virus (HIV)-infected patients, who are known to have deficiencies of selenium and vitamin A. These patients on supplementation with beta-carotene and selenium had improved CD4 counts. The need for micronutrients has been emphasized in many studies that have been carried out on people living with HIV/AIDS to improve their immunity status⁸. Banana plant have medicinal applications and at the same time banana lectins exhibit the potential of inhibiting HIV-1 reverse transcriptase activity, suppressing cancer cell proliferation and stimulating macrophage activities. Therefore in the present investigation an attempt has been made to formulate and analyse the nutrient composition and consumer acceptability of whey protein and banana based value added biscuit and its suitability for PLHIV⁹.

MATERIALS AND METHODS

Selection of the ingredients

Whey protein and banana incorporated biscuits were prepared with measured quantity of ingredients based on their specific functional properties like immune enhancer, anti inflammatory, antioxidant and anti cancerous. The ingredients used were white flour (Maida flour), wheat flour, sweet potato flour, banana powder, carrot powder, whey protein powder, dried fruits and nuts (raisins, dates, walnut, pumpkin seed),

palm sugar candy and butter. The selected each ingredients were purchased from the local market, cleaned, blanched, dried and powdered. The ingredients like sweet potato, carrot and banana were cleaned with water and blanched at 70°C for 2 to 5 minutes then sliced; sun dried and powdered using a mixer grinder. The other ingredients namely pumpkin seeds, walnut and dried fruits (dates and raisins) were grated and used.

Formulation of the biscuit

Four variations of the biscuits were prepared along with a standard and were coded as A, B, C and D. The quantity of ingredients used in different variation and standard biscuit are given in Table 1. Biscuit was developed with incorporating ingredients that could supply both micro and macronutrients. Micronutrients are important for effective immune function and deficiencies associated with increased risk of HIV disease progression including increased risk of opportunistic infection¹⁰.

Standardization and acceptability of the developed value added biscuit

All variations A, B, C and D were standardized for one serving to get consistent result. Different variation of the biscuits and the standard were then subjected to acceptability test. Sensory analysis is a scientific discipline that applies principles of experimental design and statistical analysis to the use of human sense (sight, smell, taste, touch, and hearing) for the purpose of evaluating a product. A score card is defined by Potter and Hotchkiss, 2002¹¹ as an evaluation card coded with letter or numbers with descriptive terms such as excellent, very good, good, fair and poor. A maximum score of five was given for each attribute. The variation with the highest score for overall acceptability was taken for further analysis.

Estimation of nutrient analysis and shelf life

Nutrients namely carbohydrate (Bulsosis, *et al.*, (1956), protein (Lowrys, *et al.*, (1951), fat (Freeman, *et al.*, (1957), fatty acid fractions (Reaff, 2006), iron (Raghuramalu, *et al.*, (2003), vitamin C (Sadasivam and Manikam, *et al.*, (1981), crude fiber (Raghuramalu, *et al.*, 2003), zinc (Raghuramalu, *et al.*, 2003), selenium (Raghuramalu, *et al.*, 2003), and beta carotene (Raghuramalu *et al.*, (2003), moisture (Association of official Analytical Chemist (2001) and ash (Govindaraju, *et al.*, 2001) were analysed and the developed biscuits were stored in a High Density Poly Ethylene (HDPE) covers/pouches/bags. The shelf life for the developed value added biscuit was carried out by testing its microbial load using serial dilution method (Robert Koch, 1981). The biscuits were stored in HDPE packs for 30 days and were subjected to sensory evaluation. The sensory evaluation was done with the help of thirty semi trained panel members selected for sensory analysis including the students and staff members of Department of Home Science in Gandhigram Rural Institute. The members selected were based on their willingness to participate in the study.

Table 1
Ingredients used in the different variation of biscuit and standard biscuit

Ingredients (Amount in grams)	Variations				Standard
	A	B	C	D	
White flour (Maida flour)	25	40	25	30	50
wheat flour	25	10	25	20	50
Banana flour	7	5	5	3	-
Sweet potato flour	3	5	5	7	-
Walnut	5	10	10	5	-
Dates	10	3	5	10	-
Raisins	5	7	5	10	-
Whey protein powder	5	5	5	5	-
Pumpkin seed	10	5	5	5	-
Carrot powder	5	10	10	5	-
Powdered Palm –sugar candy	10	10	10	10	Cane sugar10
Butter	10	10	10	10	10

RESULTS AND DISCUSSION

Standardization

Total of four variations namely variation A, B, C, and D were prepared in the laboratory for standardization. Standard and developed four different variations of the biscuit were standardized taking in to consideration the factors like baked weight, preparation involved,

equipment and time taken for cooking. Table 2 describes the preparation methods involved, equipment used and time taken for preparation of the biscuit. It is also clear from the table that all the four variations A, B, C and D had the same cooked weight and the baking time of ten minutes for all the variations and the standard.

Table 2
Standardization of the biscuits

Variations	Cooking weight	Preparation involved	Equipment used	Time taken	Temperature
Standard	120	Baking	Oven	10 minutes	205 ^o C
Variation A	120	Baking	Oven	10 minutes	205 ^o C
Variation B	120	Baking	Oven	10 minutes	205 ^o C
Variation C	120	Baking	Oven	10 minutes	205 ^o C
Variation D	120	Baking	Oven	10 minutes	205 ^o C

Acceptability

The four variations were subjected to sensory evaluation using a score card. Scores obtained for sensory evaluation of the developed value added biscuit is presented in Figure1. The overall acceptability score was above four for variation C 4.32 ± 0.87 followed by standard 3.84 ± 0.32 , variation D 3.39 ± 0.37 variations, B 2.73 ± 0.96 and variation A 2.28 ± 0.32 . Variation C had the highest overall acceptability and was selected for further study.

Nutrient composition and shelf life of the selected variation and standard biscuit

Nutrient composition

Among the product variation C had the highest consumer acceptability and it was selected for analysis of nutrients. The result of the nutrient composition of the variation C and standard biscuit is presented in Table 3 and 4 and found to have (65g and 83.5g) of carbohydrate, (13g and 9g) of protein, (22g and 7.50g) of fat, (510 kcal and 437kcal) of energy, (9.5g and 7.40g) saturated fatty acids, (1200mcg and 332mcg) of β carotene, (20mg and 3.3mg) of iron, (8.9 μ g and 0.9 μ g) of selenium. Selenium is a micronutrient with antioxidant and immunoregulatory properties. Zinc is of

particular importance for the development of T cells and the developed biscuit had (3.37 mg and 0.5 mg) of zinc, (0.50g and 0.40) of ash¹²⁻¹⁴. In a study with two-hundredand nine children were randomized and 196 (93.8%) completed six months follow-up. Iron supplementation was associated with greater increases in haemoglobin concentrations and that Iron supplementation in anaemic HIV-infected children has beneficial effects on haemoglobin, anaemia and immunity¹⁵. ¹⁶Welma Stonehouse *et al.*, 2010 absorbed that Plasma monounsaturated fatty acid (MUFA) and PUFA concentrations were significantly lower in HIV-infected subjects than in HIV-uninfected subjects, Mono unsaturated fatty acids (1.01g), poly unsaturated fatty acids (2.53g), vitamin C (9.6mg) and moisture (0.68g) were present in variation C and absent in standard biscuit. Omega-3 supplementation is safe and well tolerated in infectious disease as demonstrated in HIV-infected patients treated with antiretroviral therapy¹⁷⁻¹⁸ and anti-inflammatory action of omega-3 PUFAs may have beneficial effects on chronic chagasic cardiomyopathy, as shown for other cardiomyopathies, due to improved control of the inflammatory response¹⁹.

Table 3
Proximate nutrients, vitamin and mineral content of the biscuit

Proximate nutrients / 100 g	Variation C	Standard biscuit	Vitamin and Minerals/100g	Variation C	Standard biscuit
Carbohydrate (g)	65	83.50	Vitamin C(mg)	9.6	0.0
Protein (g)	13	9	β carotene(mcg)	1220	332
Fat(g)	22	7.50	Iron(mg)	20	3.3
Energy(Kcal)	510	437.5	Zinc (mg)	3.37	0.5
Ash (g)	0.50	0.40	Selenium(μg)	8.9	0.8
Moisture (g)	1.50	0.00			

Table 4
Fatty acid fractions

Variation C		Standard biscuit	
Tests	Results /100g	Tests	Results /100g
Fatty acid fractions		Fatty acid fractions	
Lauric acid (g)	0.06	Lauric acid (g)	0.00
Mystric acid (g)	0.34	Mystric acid (g)	0.00
Palmitic acid (g)	4.40	Palmitic acid (g)	0.00
Stearic acid (g)	1.70	Stearic acid (g)	0.00
Oelic acid (g)	1.01	Oelic acid (g)	0.00
Linolenic acid (g)	1.53	Linolenic acid (g)	0.00
Saturated fat (g)	9.50	Saturated fat (g)	7.4
Mono unsaturated fat (g)	1.02	Mono unsaturated fat (g)	0.00
Poly unsaturated fat (g)	2.53	Poly unsaturated fat (g)	0.00
Trans fat (g)	0.50	Trans fat (g)	0.00

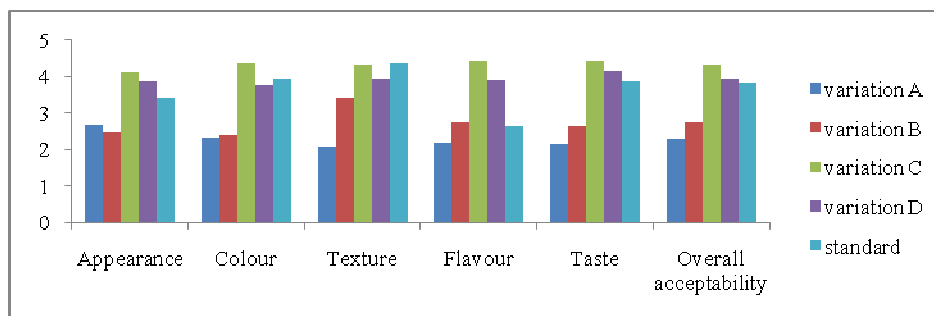
Shelf life of the (selected variation) biscuit

Microbial analysis of the biscuit
Shelf life of any processed foods stuffs depends on the nature of the foods, moisture content, preparation method, preservation and packaging material used. The selected variation C was stored in a High Density Poly Ethylene (HDPE) packs and studied for its shelf life and from the results it as found that no microbial growth was seen on 1st and 30th day of storage. High density poly ethylene (HDPE) proves to be a good packaging material for the developed biscuit.

Over all acceptability of the biscuit on 1st and 30th day of storage

First and fifteenth day the mean scores obtained for sensory evaluation was (4.12 ± 0.18), (4.12 ± 0.18) appearance, (4.36±0.53) (4.22±0.28) for colour, (4.32 ± 0.56), (4.22 ± 0.28) texture, (4.44 ± 0.64), (4.32 ± 0.35) flavour and (4.42 ± 0.74) (4.42 ± 0.74) taste. The overall acceptability score on the first and 30th day of storage was (4.32 ± 0.87) and (4.29 ± 0.44) respectively. From the results it is clear that there is only a slight change in colour, texture and flavour of the biscuit on storage.

Figure1
Sensory evaluation of the biscuits on storage



CONCLUSION

The formulated biscuit had considerable amount of nutrients namely protein, carbohydrate, fat, PUFA, MUFA, iron, calcium, zinc and selenium. The formulated biscuit had an extended shelf life. People living with HIV are severely malnourished while on ART

are six times more likely to die it undernourished. Hence this product is believed to provide essential nutrients required to the PLHIV. Thus the biscuit with its unique ingredients can go a long way as a food supplement in balancing the nutrient requirement of HIV infected people

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