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Product Development of Baked Soya and Makhana Cookies with Hypolipidemic Properties

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Abstract

Disturbed lipid profile refers to the abundance or lack of lipoprotein component which is a repercussion of ruined and impaired lipoprotein metabolism involving degraded levels of total cholesterol, triglycerides, non high density, low density and high density lipoproteins. Scientific studies have proven that nutrition has a pivotal role in the management of hyperlipidemia. Keeping this in view, a research project was planned to develop the soya and makhana baked goods with hypolipidemic properties. Present study was performed on product development, sensory evaluation, standardization and nutritional calculation of baked soya and makhana cookies enriched with hypolipidemic mixture so as to nutritionally improve the disturbed lipid parameters. Hypolipidemic nutritional mixture was developed using chia seeds, almonds, wheat bran and mango seed powder. Baked soya and makhana cookies were enriched using developed hypolipidemic nutritional mixture at different incorporation levels. These products were tested for their suitability using 9 point hedonic scale and nutritional value was calculated using RDA 2020 and IFCT 2017. The most acceptable mean sensory scores of baked soya and whole wheat cookies enriched with hypolipidemic mixture at 12 and 15% incorporation levels were 7.75±0.75 and 7.59±0.91 respectively. Statistically, baked cookies with hypolipidemic properties had significant higher content of dietary fiber, monounsaturated fatty acids and linoleic acid. Baked soya and makhana cookies with hypolipidemic properties had high level of nutrients which are scientifically responsible for nutritionally managing and improving the perturbed lipid parameters accompanied by acceptable organoleptic scores.

Keywords: *Disturbed lipid profile, hypolipidemic mixture, baked goods, organoleptic evaluation and nutritional parameters*

Introduction

Disturbed lipid profile refers to the abundance or lack of lipoprotein component which is a repercussion of ruined and impaired lipoprotein metabolism involving degraded levels of total cholesterol, triglycerides, non high density, low density and high density lipoproteins[1]. These lipid complications may be due to primary like genetic vulnerability or modifiable peril factors like diabetes, obesity or hypertension, etc[2,3]. Problem of perturbed lipid profile is extremely likely to be linked with the high pervasiveness of atherosclerosis and other cardiac disorders where unrestrained and unrestricted atherosclerosis is responsible for leading the complication of highly burdened cardiovascular disease which is exceedingly prevalent in several developing countries accounting for 80% of mortality rate[4,5]. Numeral review studies have depicted that 25-30% of urban and 15-20% of rural population of India is being negatively impacted with elevated levels of total cholesterol. Whereas other studies have reported that not only total cholesterol but LDL and triglycerides levels are also getting perturbed in past two decades[6]. Various systematic review studies were performed where lipid profile patterns of Asians and non Asians were compared and results presented that the pervasiveness of disturbed lipid profile was found to be higher among Asians as compared to non Asians. These studies also highlighted that issue of hyperlipidemia especially among Asian Indians bear the atherogenic property with elevated levels of triglyceride, low levels of HDL and LDL cholesterol whereas western countries have shown the patterns of high LDL cholesterol and triglyceride levels[7-9]. Indian studies have depicted that rural and urban population have raised triglycerides interlinked with low HDL levels[10,11]. Above studies derived that metabolically inter linkage of combination of hypertriglyceridemia with low HDL cholesterol levels is referred and termed as atherogenic dyslipidemia[12,13]. Occurrence and prevalence of this dyslipidemia is due to the increased level of small LDL particles[14,15] which is accountable for elevating the several diseases and disorders like type 2 diabetes mellitus, coronary heart disease, hypertension, etc[14-16].

Scrutinizing this complex present scenario of perturbed lipid patterns among rural and urban population of India, the necessity of nutrition has become extremely pivotal and should be acknowledged as a first approach in managing and improving the derelict lipid parameters[17]. Diet is considered as a crucial role in curbing the pervasiveness of non communicable disorders like hyperlipidemia. There are several healthy and balanced eatable goods like whole cereals, whole pulses, vegetables, fruits, nuts and seeds which are consumed as part of casual and normal diet and have shown to improve the ruined lipid patterns[17,18]. These types of eatable goods are considered as elemental

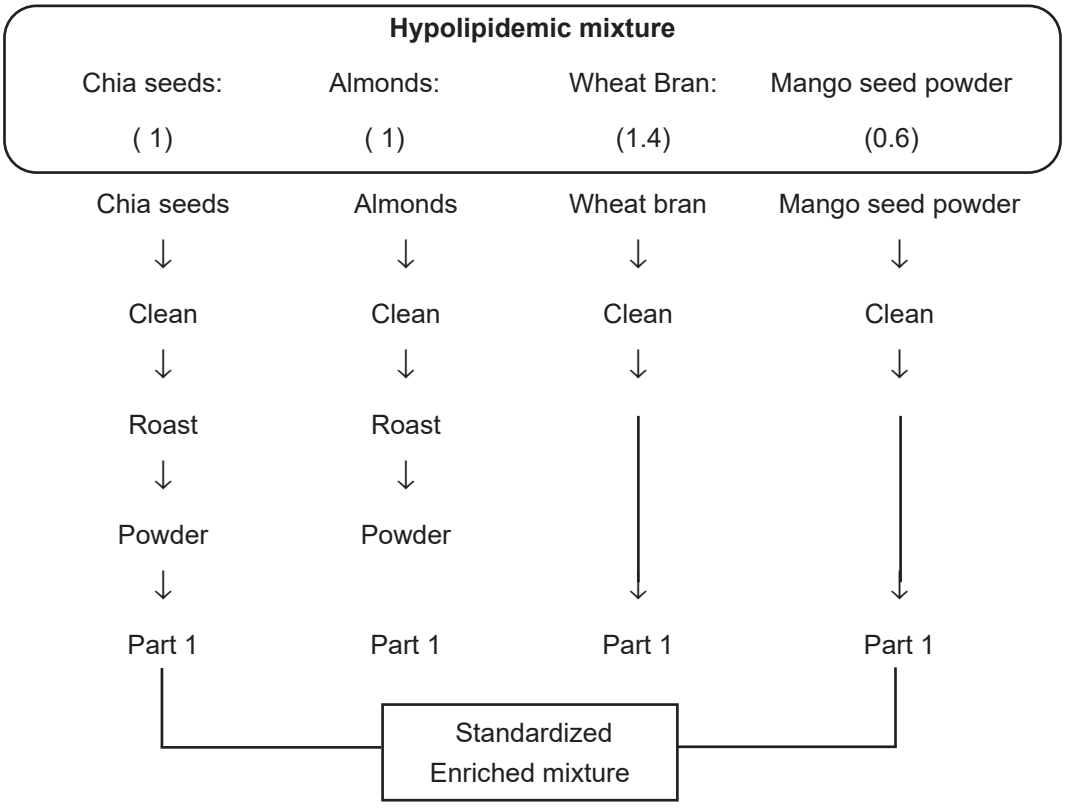
therapeutic food items which are enriched with several nutrients like high protein, dietary fiber, MUFA, PUFA and other antioxidants which are empirically and medically responsible for enhancing the disturbed lipid parameters[17-19].

Analyzing and considering the complicated circumstances of pervasive disturbed lipid profile among Indians and significance of diet and nutrition in its management, a research project was planned to develop the baked food products with hypolipidemic properties so as to manage and enhance the complication of prevailing dyslipidemia. Present study was performed on the development, organoleptic sensory evaluation, standardization and nutritional calculation of baked soya and makhana cookies enriched with hypolipidemic properties so as to realistically initiate the hypolipidemic effect among subjects suffering from high prevalence of disturbed lipid profile.

Materials and Methods

Hypolipidemic properties

Hypolipidemic nutritional mixture was developed consisting of chia seeds, almonds, wheat bran and mango seed powder.



Procurement of raw materials

Materials required for hypolipidemic mixture were purchased from local market of Kurukshetra and Yamuna Nagar (Haryana).

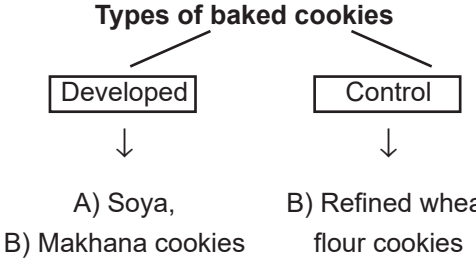
Processing of raw materials and development of hypolipidemic mixture

The raw materials purchased for hypolipidemic mixture from local market were subjected to cleaning, grinding and roasting process. All roasted ingredients were standardized properly keeping in view the nutritional and cost parameters. These roasted food ingredients were again processed so as to make a fine powdered standardized hypolipidemic mixture.

Development of baked cookies by enrichment process

Baked soya and makhana cookies were enriched using developed hypolipidemic nutritional mixture at different percent incorporation levels.

Standardized hypolipidemic mixture was enriched at 12% and 15% of incorporation levels in baked soya and makhana cookies respectively.



Organoleptic evaluation and nutritive value

Thirty panel judges tested the acceptability of enriched baked soya and makhana cookies using 9 point hedonic scale and nutritive value of baked cookies was calculated using RDA 2020 and IFCT 2017. Nutrients calculated were energy, protein, dietary fiber, omega 3, omega 6 and vitamin E.

Anti cardio lipid properties

Due to replacement of refined wheat flour with soya (nutree) and makhana flour and incorporation of hypolipidemic mixture, these developed cookies were considered to be enriched with anti cardio lipid properties.

Several scientific studies have ascertained that soya and makhana have anti cardio lipid characteristics which succors in reducing the high incidence of lipid parameters like total cholesterol, LDL cholesterol, triglycerides, etc[20-25]. Hypolipidemic ingredients of mixture enriched in cookies also have several advantageous effects on lipid parameters[26-29]. So these developed cookies have twofold anti cardio lipid properties.

Results and Discussion

Organoleptic scores evaluation

Out of all four variations highlighted in Table I and Table II, it depicts that the most acceptable mean sensory scores of

TABLE I

Baked Soya Cookies

Types of recipes	Appearance	Color	Taste	Smell	Texture	Overall acceptability
Variation 1 (% incorporation level- 3%)						
Developed	7.60±1.08	7.54±1.12	7.48±1.20	7.78±1.11	7.54±1.12	7.51±1.03
Control	8.43±0.50	8.62±0.49	8.84±0.36	8.78±0.42	8.81±0.39	8.90±0.29
t test	0.00612*	0.00028*	0.00047*	0.00147*	0.0038*	0.00023*
Variation 2 (% incorporation level- 8.5%)						
Developed	7.90±0.91	7.90±0.91	7.81±0.95	7.87±0.96	7.72±1.03	7.66±0.85
Control	8.43±0.50	8.62±0.49	8.84±0.36	8.78±0.42	8.81±0.39	8.90±0.29
t test	0.10965*	0.02117*	0.00019*	0.00838*	0.000188*	0.00052*
Variation 3 (% incorporation level- 12%)						
Developed	7.84±0.833	7.87±0.89	7.84±0.833	7.93±0.82	7.93±0.788	7.75±0.75
Control	8.43±0.50	8.62±0.49	8.84±0.36	8.78±0.42	8.81±0.39	8.90±0.29
t test	0.1245*	0.08634*	0.06017*	0.4433*	0.07664*	0.000501*
Variation 4 (% incorporation level -19.5%)						
Developed	8.06±0.899	8.03±0.88	7.96±0.95	7.93±0.82	7.93±0.788	7.75±0.75
Control	8.43±0.50	8.62±0.49	8.84±0.36	8.78±0.42	8.81±0.39	8.90±0.29
t test	0.7444*	0.31076*	0.18653*	0.14284*	0.005145*	0.0003215*

*Scores significant at 95% significance where P≤0.05 (paired t test)

baked soya and makhana cookies enriched with hypolipidemic mixture at 12% and 15% incorporation levels were 7.75±0.75 and 7.59±0.91 respectively as highlighted in Table III. Statistically on applying t test, these scores were found to be significant at 95% significance level.

Acceptable scores of baked refined wheat flour cookies were 8.90±0.29. These results were closely agreeable and comparable with studies conducted on baked cookies[30-33] and ingredients of hypolipidemic mixture[34-37].

Table IV highlights about the nutritive value of baked soya cookies with hypolipidemic properties where it is clearly evident that significant nutritional improvement has been observed in proteins, dietary fiber, MUFA and PUFA whereas energy, cholesterol and saturated fats have been significantly decreased and no significant improvement has been

TABLE II

Baked Makhana Cookies

Types of recipes	Appearance	Color	Taste	Smell	Texture	Overall acceptability
Variation 1 (% incorporation level- 6%)						
Developed	7.35±0.70	7.5±0.80	7.15±0.72	7.31±0.85	7.31±0.780	7.40±0.66
Control	8.43±0.50	8.62±0.49	8.84±0.36	8.78±0.42	8.81±0.39	8.90±0.29
t test	0.00605*	0.02548*	1.472*	1.3356*	0.9609*	1.6337*
Variation 2 (% incorporation level-10 %)						
Developed	7.46±0.87	7.59±0.79	7.43±0.75	7.56±0.84	7.34±0.787	7.5±0.71
Control	8.43±0.50	8.62±0.49	8.84±0.36	8.78±0.42	8.81±0.39	8.90±0.29
t test	0.00907*	0.01110*	0.00026*	0.02432*	0.00230*	0.01382*
Variation 3 (% incorporation level- 15%)						
Developed	7.56±0.98	7.68±0.89	7.40±0.91	7.46±0.98	7.5±1.04	7.59±0.91
Control	8.43±0.50	8.62±0.49	8.84±0.36	8.78±0.42	8.81±0.39	8.90±0.29
t test	0.06296*	0.17384*	0.00026*	0.00586*	0.00261*	0.06181*
Variation 4 (% incorporation level- 26%)						
Developed	7.21±0.55	7.35±0.15	7.11±0.81	6.98±0.56	7.23±1.03	7.28±0.45
Control	8.43±0.50	8.62±0.49	8.84±0.36	8.78±0.42	8.81±0.39	8.90±0.29
t test	0.00873*	0.00570*	0.01096*	0.003649*	1.00458*	0.03697*

*Scores significant at 95% significant level where P≤0.05 (paired t test)

TABLE III

Most Acceptable Sensory Organoleptic Scores

Name of recipes	% incorporation level	Appearance	Color	Taste	Smell/ odor	Texture/ mouth feel	Overall acceptability
Control							
Refined wheat flour cookies	---	8.43 ± 0.50	8.62 ± 0.49	8.84 ± 0.36	8.78 ± 0.42	8.81 ± 0.39	8.90 ± 0.29
Developed							
Soya cookies	12%	7.87 ± 0.89	7.84 ± 0.83	7.84 ± 0.83	7.93 ± 0.78	7.93 ± 0.78	7.75 ± 0.75
Makhana cookies	15%	7.56 ± 0.98	7.6 ± 0.89	7.4 ± 0.91	7.4 ± 0.98	7.5 ± 1.04	7.59 ± 0.91

TABLE IV

Nutritive Value of Baked Soya Cookies

Nutrients	Control (per 100 g)	Developed (per 100 g)	% improvement	t test
Energy (kcal)	353.4	290.03	17.9	0.002*
Protein (g)	7.0	14.5	107.1	0.0014*
Dietary fiber (g)	1.5	4.25	184.0	0.021*
MUFA (g)	0.5	3.008	501.6	0.0002*
PUFA (g)	0.8	6.3	687.5	0.0012*
Saturated fat (g)	5.4	0.85	84.4	2.422*
Cholesterol (mg)	51	1.8	49.2	1.162*
Vitamin E (mg)	--	2.5	254.0	NA

*Significant nutritional improvement at 95% significance level where P≤0.05

observed in vitamin E. These results were similarly comparable with various studies performed on the nutritive value of baked soya cookies[38-41] with hypolipidemic properties[26-29].

Table V features about the nutritive value of baked makhana cookies being compared with control baked cookies where undoubtedly it is conveyed about the significant improvement in proteins, dietary fiber, MUFA and PUFA whereas energy, cholesterol and saturated fats have been significantly lowered. No significant improvement has been observed in vitamin E. These results were similarly comparable with variant studies conducted on baked makhana cookies[29,42] enriched with mixture[34-37].

TABLE V

Nutritive Value of Baked Makhana Cookies

Nutrients	Control (per 100 g)	Developed (per 100 g)	% improvement	t test
Energy (kcal)	353.4	244.3	30.8	0.00172*
Protein (g)	7.0	12.5	78.6	0.0038*
Dietary Fiber (g)	1.5	5.2	246.6	0.0063*
MUFA (g)	0.5	2.107	321.4	0.017 *
PUFA(g)	0.8	5.2	550	0.0045*
Saturated fat	5.4	0.85	84.4	2.422 *
Cholesterol	51	1.8	96.4	1.47 *
Vitamin E (mg)	--	2.5	254.0	NA

*Significant nutritional improvement at 95% significance level where P≤0.05

Conclusion

Baked soya and makhana cookies with hypolipidemic properties had significant acceptable organoleptic scores accompanied by significant improvement in dietary fiber, MUFA and PUFA. Nutritional improvement was also observed in energy, saturated fats and cholesterol where they have been significantly decreased. No nutritional significant improvement was noticed in vitamin E. Thus, it depicts that baked cookies with hypolipidemic properties have elevated vegetable proteins, dietary fiber, MUFA, PUFA, decreased calories, saturated fats and cholesterol. These all nutrients persistent are scientifically responsible for nutritionally managing and improving the perturbed lipid parameters. Baked soya and makhana cookies with hypolipidemic properties were attaining and satisfying the essential requirements for the amelioration of hyperlipidemia which can be immensely beneficial and useful for patients suffering from disturbed lipid profile, prevailing in rural and urban areas of India.

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