

Fortification of Cake with Soy Flour as a Functional Food

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ABSTRACT

The present study aimed to identify some physical & chemical properties (moisture, pH, water activity and specific volume) and descriptive specification/features (texture, taste, color and smell) of butter cake, through exchanging different amount of soy flour for wheat flour as well as using water and guar gum in its formulation. Accordingly, the approved cake was analyzed upon nutrition criteria for evaluation the rate of fortification resulted from added soy flour. The derived results were analyzed in the form or array of three factors factorial within a full random plan frame. The descriptive features (texture, taste, color and smell) of the treatments were also evaluated by four skillful panelists upon 5 – point hedonic test. Considering the fact the soy flour 25% adding along with the gum causes the quality fixing of the product so the treatment approved as the optimum treatment. Therefore, according to nutrition analyzes the amounting of protein 1.4, calcium (ca) 106, Fe 2.3 and vitamin E 2.58 were equal to the cake.

KEYWORDS: Soybean, Soya flour, cake, fortification

1. INTRODUCTION

purposes, dairy products including milk, yoghurt and cheese as well as meat products. Nowadays, Soya as a strategic product is not only as fulfillment agent toward various food consumption requirements in the range of food chain but is being used enormously in industrial production. Soya is highly potential to be used daily in food products because of its, high quantity of top quality protein as well as its applied nutritious properties. one of the significant application of Soya would be for fortification of those products having cereals (grains) base such as bakery products for instance cakes, biscuits, macaroni and pasta etc. The key reason for application soy as fortification agent is that it contains essential amino acids not found in wheat. Essentially, the Soya protein contains nine essential amino acids necessarily should be used and applied in human food products.

According to the available data, the Soya and the relevant products consumption to the nutritious properties specially related to fortification process. Moreover, it has important and vital properties to prevent diseases. Then, usage of Soya because of high content protein in addition to highly nutritious values causes special functional features due to bakery products such as texture improvement, increment of residue humidity, color of the crust and enhancing the retention time. Meanwhile, Soya containing protein, isoflavon and dietary fiber considered as healthy foods since it has no cholesterol while having low content of saturated fatty acids and high amount of unsaturated fatty acids. Consequently, it plays a key role to reducing the rate of cardiovascular.

Additionally, soya considered as iron resource, so it is desirable option for fortification. Adding Soya to the bread led to volume reduction of the bakery products since different amounts of water absorbed by the compound elements of Soya while pertaining probably to the gluten fraction dilute. Riaz et al, in 2000, added Soya fiber amounting 1-2 % to the flour and observed increment due to retention capability of the bread and humectants' rate of the dough in the table the nutritious value in relation with difference between wheat flour and pontificated flour containing low fat Soya flour 10% have been indicated.

Table 1. analysis of wheat flour and soya pontificated wheat flour

analysis	Wheat flour	Soya pontificated wheat flour
Protein(gr)	11.5	17
Fat(lipid)-(gr)	1.9	1.8
Ash (gr)	1.6	2.2
Carbohydrate (gr)	73	69
Fiber(gr)	12.2	12.7
Calcium (ca)mlg	34	55
Iron(fe) mlg	4	4.5
Phosphorus (p)mlg	364	380
Zinc(zn)mlg	2.9	2.9

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The Soya pontificated wheat flour is capable of supplying the required amino acids because of having a great deal of amino acids.

1.1 Cake Definition

Cake is a kind of pastry having special softness and texture; the main ingredients of cake are flour, oil, sugar and egg. for texture enhancing and increment of shelf life some certain additives would be used as emulsifier, sorbitol, invert, glucose, baking powder and so on.

1.2 Utilization of Soya for Cake Fortification

American Soya association (ASA) like Japanese organization under the title of (USB) recommended using Soya for bread fortification as baguette , special breads , cakes , doughnut , fermented Russian dumplings (PIROZHKY) and muffin amounting differently from 2% up to 5%. In conjunction with phytoestrogens available in Soya causes cancer risk reduction, several experts as Pamela horn – Ross, Marion lee, Stephen Barnes and others preceded a series of studies on some 118 persons Africans and American then succeeded to measure phytoestrogens amount contented in Soya and the relevant products and monitored the significant role of Soya and its products via evaluating on the relation between the consumption and cancer risk reduction probability. American expert, M.N RIAZ, has conducted a series of research related to Soya flour and the application in bread, cake and other bakery products and concluded that the low fat Soya flour is an economical and available low cost products considering the protein content .The application of Soya flour sue to bread and bakery products causes texture enhancement, improvement on dough condition, the crust properties, color improvement and bakery conditions. The Soya flour is capable of banding a lot of water in the baking process while adding it to the dough capable of increasing hydration in dough so resulting to increment of the remaining of residue humidity in the product, on the average, along with increment of Soya flour amounting 1% within the bakery products; the humidity rate will be increased form 0.3 up to 0.5 while the humidity content in the dough cause reduction on staling rate. The Soya taste depends on the baking process. Another American expert, e. Stauffer, carried out other studies on the Soya protein in the bakery products. Upon his research the Soya flour containing lecithin will add emulsification property within cake dough, it added , amounting 3% to 6% to the yellow cake so led to 25 up to 5% of on reduction egg and powdered milk amounts while the consumed water will be increased in the cake baked with Soya flour content to fix the dough viscosity . Finally the cake was baked and produced with humid crust. SURESH ITAPO et al also conducted some studies on fortification of wheat content products with Soya. He/she concluded that the Soya flour can be added to baking products as fortifier agent upon usage and nutrition requirements. In all substitution, the Soya flour is capable of adding amounting up to 3% without any necessary formulation changing except for water to which per one kilogram of Soya flour, it should be added 1 kg to 1.5 kg to the flour since the Soya portion will be cap able of absorbing water. Nowadays some of the bakers use Soya flour amounting to 1%, while its enzymes are active, to improve the bread quality. Related to the bread and biscuits, the Soya flour can be used as substitute for low fat powdered milk and cost reduction due to raw material expenses. Adding the Soya flour will not only increment on hydration rate and the property has certain role to enhancement of fats (lipids) emulsification and the elements. The legitimated Soya flour can be used as complete substitute for egg in cakes and doughnuts. The research and studies proceeded in America baking institute indicated the legitimated Soya flour as egg substitute led to cost reduction up to 25% for raw material. in conjunction with noodles and vermicelli (a kind of pasta) to which the main raw material is purified wheat flour , having low nutrition quality , the Soya flour adding up to 10% to 12% WI; enhance not only the usage properties but also would be capable of nutrition quality.

Some studies on such breads, the first routine and ordinary bread baked with wheat flour and the second type the bread containing Soya flour. They analyzed the isoflavon of the Soya bread by HPLC. in the test the Soya bread containing 26.5% of Soya ingredients while it has been baked in 32°c for 50 min the findings indicated the Soya added flour has no impact on freezable water content of the bread while the fresh baked Soya bread having higher humidity (44.7%) then fresh baked wheat bread (36.9%) so indicated the extra humidity will be as un freezable water.

1. MATERIAL AND METHODS

Raw materials (ingredients) of the cake were flour, soya flour, sugar, oil, egg, extender, emulsifier, vanilla, gum.

Flour: the flour generally used for bonding different elements of the flour as well as main substance for shaping it. In the project the flour produced by central flour Co which is soft and null.

Soya flour: it was provided by MECSOY packed in 25 kg sank. The Soya flour is derived from soybean to which provided upon such processes as peeling, winnowing, rendering and finally milling.

Table 2. analyses of consumed low fat Soya flour

Humidity	8.12%	Calcium	948
Protein	48-50%	Phosphorus	679
Fat(lipid)	6.5%	Sodium	4
Fiber	16.69%	Potassium	2130
Carbohydrate	27.72%	Magnesium	275
Calorie	360	Iron (Fe)	6.9
Isoflavons (mg/g)	4/71	Manganese	2.6

Sugar: in the study, the sugar, white and fine granular crystals, used as produced in KARAJ factory.

Oil: the oil was shortening type made by ladan factory.

Egg: as the main ingredient in pastry baking industries while the pasteurized eggs produced by TALAVANG co have been used.

Extender: for extending the baking powder produced by HAMAYESH co has been used.

Emulsifier: monoglycerids are as common emulsifier's commonly populated as reckless agent produced by Kerry co.

Vanilla: the trade mark is as vanilla made by aroma co.

Gum: hydrocolloids participate in different ways due to emulsion stabilizing. Mainly Stabilizing included as increment and thickening of water phase viscosity. In this way, the distributed lipid cells (corpuscles) tendency to bond each others will be prevented or to reduce it up to minimum rate. In this respect the guar gum that produced by RODIA, used while available in form of crème colored powder.

2.1 Procedure of Cake Production

To produce dough of butter cake, firstly the essential elements such as water, oil, sugar and ... are weighed according to the specified formulation. In the first phase, sugar and oil will be poured in to the mixer and stirred for 5 minutes then powdered milk, vanilla and salt added and stirred again for 30 seconds after that invert and hem octants (humid absorbent agents as additive upon the factory formulation) added to in advance creamy mixture and stir again for 1-2 minutes. In the second phase the water and egg would be added and stir for 3 to 4 minutes. At the last stage, the flour and baking powder shall be added simultaneously with Soya flour and gum upon certain ratios while the stirring time would be one minute. Finally the cake dough is ready to be injected towards the relevant moulds.

The dough conching has been done by a manual mixer (capacity 1 kg brand name as MOLINEX) during the whole passes processing. after clarification and making the dough homogenized, it will be poured in special cloth funnels then on the particular papers (80 gr per each paper), which are fireproof, set into the moulds .after putting the moulds in to the trays, they will be mounted in the oven middle roof and shall be baked for 30 minutes under the temperature 220°c the cooling phase starts after emerging the trays and finally the cakes would be packed and dispatched toward the lab for required tests.

2.2 Cake Tests

Density measurement: to specify the density of the cake samples first the samples volume were determined via substitution method with millet. Upon the method a measure (1000 millet) filled with milled up to the certain volume. Then the millets will be discharged in to another container after that a little millet poured in to the measure after that the sample put into the measure and it will be filled with millet equal to the same volume.

The volume difference of the millet in the measure, while the cake specimen put in to the measure, with the primary volume actually shall specify the volume of the cake sample.

After volume determining of the samples, the density would be calculated upon the following.

Formula:

$$\text{Total density (g/ml)} = \frac{\text{sample weight (g)}}{\text{Sample volume (ml)}}$$

Humidity measurement: a huge amount of foods contains water to which the measurement of the water or humidity content in the food is very significant for the reasons as below:

- purification
- food preserving capability

generally in humid environment the growing of micro organisms will be rapidly accomplished so one of the preserving of the food in drying process in the test the equipment hygrometer , under the trademark MB 45 OHAUS, used for measuring the samples humidity .

PH measurement; PH meter was metrohm 827 PH lab.

Water activity (aw): for measuring the water activity of the cake samples, the AW meter, lab master. Aw novasina has been used.

Measurement of total ash: The aim and performance range of this method is mainly for mineral measurement containing in foods.

Measurement of (Ca) & (Fe):

It has been done by atomic absorption.

Measurement of vitamin (E): done by HPLC

Sugar measurement done according to standard method

Protein measurement upon macro KJELDAHL method:

The method is simple at the same time accurate. Upon the method the net amount of nitrogen within the sample under test has been specified while via considering the protein coefficient, the protein rate in the food can be calculated.

Lipid (fat) measurement: in this regard we used hexane –n procedure

Crud fiber measurement: upon the method mentioned in the reference

To evaluate the descriptive features of the cake samples, some persons evaluated the produced samples initially then via preceding referee (arbitration) test, four persons among them who were more accurate selected as panelist. The panelists' evaluated five (5) samples of the cakes along with specimen relevant to color, texture, taste and smell using 5-point hedonic test at any test turn.

Project statistic model: considering the test project was factorial in the full random structure (frame), the variance analysis has been accomplished on the basis of three – factor factorial test so the Soya percentage in three levels, the gum in two and water in two levels within full random frame. The comparison of the means has been done upon multi domain procedure. since along with in cerement of Soya flour rate the hydration will be also increased; we divided the six – level test of Soya into two parts as 5, 10 and 15 % with water amounts 110, 120 gr and (the test of the first 3 %) while another 20, 25 and 30% with water amounts 120, 130 gr (the test of the second 3%) of course, the gum amount for both tests were zero (0)gr 1.4 gr .

2. DISCUSSION AND RESULTS

Considering the results and results and evaluations on physicochemical properties of the sample cakes approved as Soya flour level 25% along with gum applied (for measurement gluten system) and also water amounting 130gr (for high hydration feature of Soya). Meanwhile, the descriptive features in panel test indicated that the texture quality, related to softness and integrity, has been enhanced up to Soya flour as the level of 25% while from 25% to higher percentage, the Soya flour not only has no positive impact on softness and texture improvement but also makes the texture more harder and undesirable resulting to specimen considering the advantages due to taste, smell and scent found in the cake.

3.1 Proceeding T-Test for Selected Cake

The selected specimen has been evaluated once in the day zero (0) and once more in the day 45 by the panelists to observe the cake quality after 45- day period. Then the two – comparison (couple – comparison) test of t – test has been proceeded related to the results of the day 0 and the day 45. The quality of the cake upon t –test there has not been observed any reasonable difference, while after 45 days the cake is more or less concerning quality reduction rate due to softness, taste and color. At the same time other properties such as scent and smell has not been changed. It means the cake preserved its quality.

The fortification rate in approved Soya cake and comparison with specimen:

Considering the whole evaluation on the features and concluding the total chemical – physical properties, finally the selected Soya cake was analyzed:

Table 3. analysis table of Soya cake 25 %

item	Analysis	Result	Unit
1	Protein as dry element	9.45	%
2	Lipid(fat)	20.68	%
3	Ca	2.41	%
4	P	0.27	%
5	Ash	1.31	%
6	Fiber	3.99	%
7	Carbohydrate	46.54	%
8	Energy	432	K cal
9	Humidity	20.88	%
10	Fe	11	ppm
11	Vitamins E	15.4	Mg/100gr

Table 4. analysis table of simple cake

item	Analysis	Result	Unit
1	Protein as dry element	6.86	%
2	Lipid(fat)	22.60	%
3	Ca	1.49	%
4	P	0.28	%
5	Ash	0.84	%
6	Fiber	3.95	%
7	Carbohydrate	49.39	%
8	Energy	460	K cal
9	Humidity	17.83	%
10	Fe	4.8	ppm
11	Vitamin E	15.4	Mg/100gr

According to the results and findings of the accomplished tests , the protein content of the fortified cake with Soya flour due to the approved sample is 1.4 as much of the protein of the simple or non – fortified cake refer to the fortification rate mentioned in the relevant tables . Too, ca rate is 1.6 as much, ash 1.55 and Fe 2.3 and vitamin e 2.85 as much of the simple cake while phosphorous and fiber of the approved sample has no considerable difference with the witness specimen.

3. CONCLUSIONS

In this research the physical – chemical and organoleptic properties of the butter cake via substitution of a part of the flour with Soya flour as well as adding guar gum along with water increment have been evaluated. Substitution of Soya flour has been done in 6 levels 5, 10, 15, 20 25 and 30%.

Due to guar in two level zero and 1.4 gr and the water in three levels as 110, 120 and 130 gr have been used. For the reason of high hydrate of Soya flour, we divided its six levels in two parts. at the first test, the Soya flour upon 5, 10 and 15 % levels and the guar upon two levels as zero and 1.4 gr along with water * levels 110 and 120 gr (test of the first 3%) and at the second test, the Soya flour with the levels of 20, 25, 30 % and the guar gum in two levels as zero and 1.4 gr along with water in 3 levels as 120, 130 % (test of the second 3%) are tested. The derived results indicated along with increment of Soya flour , the humid rate in the final product shall be increased accordingly while there is no reasonable difference due to water activity confirming that the Soya flour bonded water within it self , it means there will not be any free water increment .

The result confirmed by American expert RIAZ so humidity increment and bonding the water within the Soya flour is capable of increasing on the cake shelf life as such observed at t – test in which the selected cake specimen preserved the quality even after 45 days .

As mentioned before along with Soya flour increment, the gum used for enhancing gluten system and preserving the as within the cake texture since the flour is without gluten. Via evaluation of treatment impact on the specific volume, we found that along with Soya flour increment the specific volume will be decreased while in case of using gum along with Soya flour adding, the specific volume shall be increased indicating the gum effect for gas preservation in the cake American expert RIAZ concluded in his research that it would be preferably better to use the emulsifier and the gum (stabilizer) along with usage of Soya flour particularly in high amounts. In relation with organoleptic properties, with increment of Soya flour rate up to the level 25%, softness and texture integrity will be increased while the highest advantage was relevant to the level 25%. In the levels upper then 25%, adding of Soya flour doesn't make softness in the texture on the contrary canes hardened in the texture (the level 30% of the Soya flour). In relation with taste, scent and, again the level 25% having higher advantage compare to the others. Related to color feature, as observed before, along with Soya flour levels the color feature to be desirable would be decreased. The Soya flour having enzyme lipoxigenase capable of decolorizing (bleaching) and whitening so that American expert, RIAZ , Has confirmed the features in this regard and due to his studies . It should be mentioned this property can be effective up to the rate 5% and higher than the rate, in which the Soya flour it self shall be effective obviously along with increment of the Soya flour, the color of the cake will be more yellowish so decreases color desirability.

Finally the cake with Soya flour 25% and the water connect as 130 gr and the gum applied has been confirmed so on the selected cake, the t –test has been preceded indicating it is even after 45 days. In conclusion, it made evident that Soya flour can be assumed as an economical and available food source specially due to mineral and protein content and to be mineral and protein content and to be applied in the cake baking industry, we can produce high quality cake, better texture and more fortified, while it will be cost effective and economical product.

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