IJCRR
Vol 04 issue 23
Section: Heathcare
Category: Research
Received on: 15/10/12
Revised on: 23/10/12
Accepted on: 05/11/12

STUDIES ON DEVELOPMENT OF HIGH PROTEIN-LOW CALORIE COOKIES

Dayanand Peter, Pagar Nitin Yashwant, M.Revathy

Department of Food Processing and Engineering, Karunya University, Tamil Nadu, India

E-mail of Corresponding Author: dayanandpeter@gmail.com

ABSTRACT

Cookies rich in protein and low in calories were developed by substituting wheat flour (Maida) with defatted soy flour (DSF) and cane sugar with Stevia leaves powder (SLP). Standardisation of Maida: DSF ratio was done by evaluating the physicochemical parameters and sensory quality of the cookies prepared from the various blends. Once standardisation of blends was completed, the standardised flour mix was used to manufacture cookies by replacing cane sugar with SLP at levels of 0,10,15,20 and 25%. These cookies were then packed in LDPE, HDPE and PP films and stored for a period of 90 days under ambient conditions to assess the quality of the cookies based on sensory and storage parameters. Cookies containing 20% DSF and 20% SLP resulted in 109.36 % increase in proteins and 10.18 % decrease in calories. Storage studies revealed that cookies stored in HDPE package to have good sensory acceptability. In conclusion, DSF and SLP can be incorporated at 20% level in formulation of high protein and low calorie cookies without affecting the overall acceptability of cookie.

INTRODUCTION

In recent years, there has been a considerable shift in the consumers' perception of foods due to changing lifestyle, modernization, increased women employment, increased per capita income and newer marketing strategies employed by major food manufacturers. Most consumers demand convenience food, ready to eat snacks or food which add bulk and satisfy appetites without taking up preparation times. On the other hand consumers have increasingly shown interest in a trend of healthy life-styles which has created demand for health oriented convenience foods and products.

Global Industry Analysts, Inc., (GIA), in a recently concluded off-the-shelf market research stated that the global baking industry is currently facing opportunities as well as challenges created by the economic crisis. Demand for bakery products have always been growing over the years worldwide. Cookies are ready to eat, convenient, inexpensive and one of the most popular and widely consumed processed food products in India. The cookies industry has been growing at an average rate of 6-7 percent during the past 5-6 years and this is expected to maintain in the coming years (Alagh, 1990).

Cookies contain wheat flour and sugar as the major ingredients. Wheat is an important part of cookie manufacture because it has the inherited property to form dough and retain gases. However, the protein content of wheat varies from as low as 8 to 15% therefore supplementation of wheat flour with protein rich sources are been explored in recent times. Sugar, the other major ingredient of cookies has high calorie content making it a source of concern for inclusion in the diets of diabetic and obese persons. Therefore there is need of a natural substitute for sugar.

Stevia has been reported to have several beneficial characteristics as a natural sugar substitute because it is natural, contains zero percentage calories, do not affect blood sugar levels like common sugar, is 250-300 times sweeter than table sugar, is heat stable up to 200^0C, non-fermentable, prevents cavities and can be easily used in cooked or baked food (Panpatil and Polasa, 2008).

The present study investigates the use of DSF as the protein rich supplement for wheat and stevia leaves powder as a substitute for sugar. The investigation had the following objectives:

1. Standardising Maida : DSF blend and Sugar : SLP ratios without affecting the quality of cookies based on chemical and sensory parameters.
2. To study the effect of DSF and SLP in incorporating on protein and reducing the calorific contents of cookies.
3. To study the changes in the sensory quality of the developed cookies during storage.

METHODOLOGY

Preparation of DSF and Maida: DSF blends:

The deoiled cake of soy (DOC) was cleaned manually and milled in a flour mill. The flour thus obtained was sieved through 80 mesh size sieve to obtain fine DSF. The DSF was mixed with Maida at the substitution levels of 0,10,15,20 and 25 % (w/w). In the standardized Maida: DSF blend, the sugar was replaced with SLP at the substitution levels of 0,10,15,20 and 25 percent (% sweetness basis).

Preparation of Cookies

Fat and sugar were creamed until light and fluffy. Flour was sieved with sodium bicarbonate and ammonium bicarbonate. The cream was mixed with flour and sufficient quantity of water was added with vanilla essence to form dough. The sheet of dough was prepared having thickness of 0.5cm and the pieces were cut using cookie cutter. The pieces were placed in the baking tray smeared with fat and baked at 180-200^0C for 15 min. The cookies were allowed to cool, packed in various packages and stored at ambient temperature (Kure *et al.*, 1998).

Chemical Evaluation of Cookies

Moisture

About 5g of sample was weighed and transferred to pre-dried, covered dish. Weighed sample was then dried in hot air oven at 105 + 1^0C for 4hrs. The dish dried sample was transferred to the desiccators and cooled to room temperature. The dish was then weighed. Moisture content in percent was calculated from loss in weight (IS 1011:2002).

$$\text{Moisture (\%)} = \frac{w_1 - w_2}{w_1} \times 100$$

Where;

W_1= Weight (g) of the material before drying

W_2= Weight (g) of the material after drying

Protein

The protein content was determined by Micro-Kjeldahl's process. About 0.2g defatted powder sample was taken and transferred to the digestion flask. The catalyst mixture (1g) and 5ml each of H_2O_2 and conc. H_2SO_4 were added carefully. The sample was digested until it became colourless by frequent rotating the flask. The flask was cooled and a 5ml portion of water was slowly added with mixing. After cooling, the content was transferred to 50 ml volumetric flask with 2-3 rinsing, and the volume was made up with distilled water and mixed thoroughly. Blank digestion was carried out simultaneously. The distillation unit was cleaned by starting and sucking back the water. A beaker of 10 ml capacity containing 10ml boric acid was taken. 4 drops of indicator was added and placed under condenser with its tip dipped in solution. The digest (5 ml) with rinsing was transferred to distillation flask, 5ml NaOH was added and closed with stop cork. The digest was allowed to boil and about 50ml distillate of ammonia liberated in boric acid was collected. The distillate was titrated with hydrochloric acid until blue colour disappeared. Blank titration was

carried out simultaneously. Protein content was calculated using following formula.

$$N\ (\%) = \frac{(S-B) \times N \times 14.007}{\text{Weight of sample (g)}} \times \frac{\text{volume made (ml)} \times 100}{\text{volume taken (ml)}}$$

Where; S = ml of HCL required for sample titration
B = ml of HCL required for blank titration
N = Normality of HCL (0.02 N)

Protein (%) = N (%) x 6.25

Carbohydrates

Carbohydrates were calculated by difference method

Carbohydrates = 100 - (Moisture % + Protein %)

Calorific Value

The calorific value of cookies was estimated using the sum of the product of respective physiological fuel values and contents of protein, carbohydrate and fat. It was expressed in Kcal/100g.

Storage Studies

The cookies were packed in LDPE, HDPE and PP packages and stored at ambient temperature. The sensory quality of cookies such as colour, flavour was evaluated at an interval of 15 days for a period of 3 months.

RESULTS AND DISCUSSION

The present investigation was carried out with the objective to study the effect of substitution of Maida and sugar with DSF and SLF respectively, on the nutritional and organoleptic characteristics of cookies.

Proximate composition of Maida, DSF and SLP

Flour Type	Moisture (%)	Protein (%)	Carbohydrate (%)
Maida	11.5	12.22	73.04
DSF	6.16	43.22	43.31
SLP	8.67	5.95	78.77

It was observed that highest moisture content was noticed in Maida (11.5%) followed by SLP (8.67%) whereas lowest moisture content was observed in DSF (6.16%). The highest protein content was recorded for DSF (43.22%) followed by Maida (12.22%), whereas lowest protein content was observed in SLP (5.95%). Highest carbohydrate content was observed in SLP (78.77%) followed by Maida (73.04%) whereas lowest carbohydrate content was observed in DSF (43.31%)

Chemical parameters of cookies

(Maida : DSF substitution)

It was noticed that with increase in DSF there was increase in proteins and decrease in carbohydrate content. The increase in proteins and decrease in carbohydrate content of cookies supplemented with DSF might be due to appreciably higher contents in DSF than Maida.

(Sugar: SLP substitution) Protein and calorie contents of cookies containing DSF and SLP

Cookies	Protein (%)	Increase in Proteins (%)	Calorific value (Kcal / 100g)	Decrease in calories (%)
Control	6.09	--	505.73	--
DSF (20%)	9.96	63.55	482.27	4.64
SLP (20%)	12.75	109.36	454.23	10.18

The effect of substitution of Maida with 20% DSF and sugar with 20% SLP on the protein and calories contents of the cookies. The protein content was found to increase from 6.09 to 12.75%.The incorporation of DSF and SLP in cookies was found to have great influence on the protein and calorie contents of cookies. Thus the % of increase in protein content of above standardized cookies was found to be 109.36% compared to control sample prepared with Maida and sugar alone.

The calorific value of cookies was found to be decreased from 505.73 to 454.23 kcal/100g with

the substitution of Maida with DSF and Sugar with SLP.

Sensory qualities of cookies during storage: Gradual decrease in colour and appearance of the cookies in HDPE followed by LDPE and PP packages for 90 days of storage. Cookies packed in PP showed more moisture gain during storage and became soft compared to LDPE and HDPE. The flavour retention was higher in case of HDPE package as compared to LDPE and PP packages. Slight change occurred in the taste of cookies packed in HDPE package. While cookies packed in PP packages showed highest change in taste. Cookies packed in HDPE package stored for 3 months at ambient temperature have better organoleptic properties compared to other packages.

SUMMARY AND CONCLUSION

The results of the study can be summarized as below;

1. Composition of DSF and SLP used for supplementation of Maida and cane sugar respectively were found to be satisfactory to enrich cookies nutritionally.
2. Cookies prepared from Maida: DSF and sugar: SLP blends were organoleptically accepted and DSF and SLP levels were standardized up to 20 percent substitution, respectively.
3. The substitution of Maida with DSF (20%) and sugar with SLP (20%) in cookies resulted in 109.36 % increase in proteins while 10.18 decrease in calories of the cookies.
4. The storage studies revealed that cookies HDPE package was most acceptable on basis of retention of sensory quality of cookies.

CONCLUSION

Thus from the results, it may be concluded that cookies high in proteins (about 109.36% increase) and low in calories (about 10.18% decrease) could be prepared by substituting Maida with DSF (20%) and cane sugar with SLP (20%) without affecting their overall quality. Also from the storage studies, it may be concluded that cookies could be stored for more than 90 days at ambient conditions without any effect to sensory quality.

ACKNOWLEDGEMENT

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

REFERENCES

1. Alagh, 1990. Biscuit industry in India-future scenario. *Indian Food Ind.*9 (3):18-19.
2. Kennelly, E.J.2002. Sweet and non-sweet constituents of *Stevia rebaundiana* (Bertoni).In: Stevia, the genus *Stevia*. Kinghorn AD (Edn.), Medicinal and Aromatic Plants- Industrial Profiles. Taylor and Francis, London. 19:68-85.
3. Kure OA, Bahago E.J, Daniel E.A (1998). Studies on the Proximate Composition and Effect of Flour Particle Size on Acceptability of Biscuit Produced from Blends of Soyabeans and Plantain flours. Namida Tech-Scope J. 3: 17-21
4. Panpatil V.V, Polasa K (2008). Assessment of stevia (*Stevia rebaudiana*)-natural sweetener: a review. J Food Sci Technol 45:467–473
5. IS 1011:2002 (fourth revision). Scheme of testing and inspection for certification of biscuits.