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Proximate analysis of cookies prepared from whey and sucralose

Sniya Varghese, Rashmi KG and Dinker Singh

Abstract
The present investigation was carried out to develop whey fortified diabetic cookies with the best level of whey and sucralose. The prepared cookies were light brown in colour with acceptable flavor and overall acceptability. The physicochemical and nutritional analysis of the diabetic whey cookies was analyzed. The protein, total moisture, ash, fat, crude fiber content and water activity of whey fortified diabetic cookies were found 10.46, 1.78, 2.10, 26, 2.91 percentage and 0.49 respectively. The protein content of whey fortified diabetic cookies was significantly increased and there was a slight increase in fat and crude fiber percent. The formulation with 25% whey and 0.07% sucralose for whey fortified diabetic cookies was found highly suitable.

Keywords: Whey, sucralose, cookies, protein, crude fiber, water activity

1. Introduction
Among the bakery products, cookies are the most significant snack in the world for children and adults. Cookies differ from other baked product like bread and cakes because of their low moisture content and thus provide longer shelf life to the product. Cookies provide an excellent means of improving the nutritional quantity of foods through incorporation of less expensive high quality proteins, minerals, vitamins and have been employed in food product enrichment (Shikha and Yadav, 2018) [11]. Whey, the byproduct of dairy industry, is rich in lactose, whey proteins, calcium, phosphorus, essential amino acid. It is highly nutritious and many industries target upon utilizing whey as the functional food ingredient. Whey can be incorporated advantageously into various food formulations, including cookies, breads, cakes, crackers, and pasta (Perasiriyan *et al*., 2013) [9].
Sucralose, a zero calorie artificial sweetener with its sugar-like taste and stability offers a significant opportunity for the baking industry to provide consumers with a new generation of great tasting, healthy, reduced-calorie food products. As people are demanding a greater variety of low-calorie products, sucralose can be incorporated in cookies to prepare diabetic whey cookies. Grotz *et al*. (2003) [6] claimed that sucralose is considered safe for all segments of the population, including people with chronic health problems such as diabetes. The use of 40% sugar in biscuit formulation could be replaced by using a sucralose (3%) or stevia (0.1%) to give low calorie product with satisfactory properties but lower sweetness. Sucralose gives lighter colour to biscuits because these sweeteners do not take part in Maillard reaction (Deshmukh and Bhivagade, 2019) [3].
Parate *et al*. (2011) [8] reported that whey proteins are the best fortifiers for cookie protein as it improves the nutritional status of cookies by increasing the level and quality of the proteins in cookies by providing lysine and other essential amino acids.
Hence, the present study was carried out to formulate whey fortified diabetic cookies with the best level of whey and sucralose so as to improve the nutritional status of cookies. In this paper, the physico - chemical and proximate composition of developed cookies has also been reported.

2. Materials and Methods
The wheat flour, butter, sugar, Vanilla essence and baking powder were procured from local market. Sucralose was purchased from Sha Narendra & Sons, Chennai. The whey used was obtained as a byproduct during the preparation of paneer from Dairy Plant, KVASU, Thrissur, Kerala. All the chemicals used were analytical reagent (AR) grade procured from reputed firms.

The moisture, protein, fat and crude fiber content of whey fortified diabetic cookies were determined as per the method described by AOAC (2000) [2], Micro-Kjeldhal method (AOAC, 2000) [2], Soxhlet method (A.A.C.C, 2000) [1] and A.A.A.C. (2000) [1], respectively. The water activity was measured by using Aqua Lab 4TE water activity meter. Cookies were crushed into small pieces and a representative sample was placed into sample holder and measured one at a time.

2.1 Procedure for formulation of whey fortified diabetic cookies

The whey incorporated diabetic cookies were prepared by addition of 25% whey and 0.07% sucralose as per the method given by Rashmi and Varghese (2022) [10]. For physico-chemical analysis both the control and sample were compared. The control consists of cookies made with sugar and sample was whey incorporated diabetic cookies.

3. Results and Discussions

Table 1: Proximate composition of whey diabetic cookies.

Composition	Control cookies	Sample cookies (whey +sucralose)
Moisture	1.6±0.14	1.78±0.18
Fat	25.5±0.15	26.0±0.25
Protein(%)	6.75±0.12	10.46±0.21
Crude fibre(%)	1.15±0.02	2.91±0.08
Ash	1.65±0.06	2.10±0.05
a_w	0.45±0.02	0.49±0.01

Figures are the Mean ± Standard error of three replications.

The findings of physico - chemical analysis of control and optimized whey diabetic cookies are presented in Table 1.

3.1 Moisture

The moisture content of the food material is important to consider as it affect the physical, chemical and microbial aspects of food. The moisture content in whey incorporated diabetic cookies was 1.78% which is slightly higher than control 1.60%. This further substantiates that the new product, whey incorporated diabetic cookies offer the same longevity as control cookies. Parate *et al*. (2011) [8] reported that there is no significant change in moisture content of cookies with incorporation of different percentage of whey protein concentrate. The moisture content of whey protein concentrate (WPC) incorporated at 20%, 25% and 30% to cookies were 1.63, 1.75 and 1.84 percent respectively. There was proportionate increase in moisture content of biscuits when WPC was supplemented. Munaza *et al*. (2012) [7] found a steady increase in the moisture content of cookies with increase in the level of whey protein concentrate from 4% to 10%.

3.2 Fat

The fat percentage in whey incorporated diabetic cookies was found to be 26% and that in control was 25.52%. The slight increase in fat content may be due to addition of whey which further enhances the consistency and texture of the product. Similar to our findings, Shikha and Yadav (2018) [11] carried out a study on whey cookies in which she concluded that fat content of cookies increased slightly from 22.25 to 23.08%. The highest value of 23.08% fat was observed in 100% whey incorporated cookies and lowest value in control.

3.3 Protein

The protein present in whey incorporated diabetic cookies was 10.46% which is more than control cookies (6.75%). This may be due to addition of whey. Similar to our findings, Wani *et al*. (2015) [13] concluded from her study that protein content in cookies increased from 9.08 to 13.22% with an increase in the WPC supplementation level. The highest value for protein content (13.22%) was observed in 6% WPC supplemented cookies while lowest value of 9.08% was reported in control sample.

3.4 Ash

Ash is the non-gaseous, non-liquid residue after a complete combustion. The ash content in control and in sample was found to be 1.65% and 2.10%, respectively. Similar to our findings, Wani *et al.* (2015) [13] reported that ash content of cookies increased from 0.96 to 2.02% with the increase in whey protein from 0 to 6%. Gallagher *et al.* (2005) [4] also found increase in ash content in biscuits enriched with WPC and casein.

3.5 Crude fiber

Fiber is a carbohydrate that the body cannot digest. Fiber helps to regulate the body's use of sugar, control hunger and blood sugar level. The fiber content in whey incorporated diabetic cookie and in control was 2.91% and 1.15%, respectively. Control cookies had low crude fiber content (2.20%) as compared to 2.23-3.44% in the protein fortified cookies prepared from WPC, Bengal gram and soy flour (Giri *et al*., 2020) [5]. The above mentioned findings support our findings.

3.6 Water activity

The water activity (a_w) of food is the ratio between the vapour pressure of the food itself and the vapour pressure when the surrounding air medium is completely unchanged to the vapour pressure of distilled water under the same conditions. The water activity of the whey incorporated diabetic cookies and control was 0.49 and 0.45 respectively. Similar to our findings, Suriya *et al*. (2017) [12] observed that the water activity of cookies increased slightly on addition of protein.

4. Conclusion

The nutritional analysis of cookies fortified with whey and sucralose was done and compared with the control. The protein, total moisture, ash, fat, crude fiber content and water activity of diabetic whey cookies was found to 10.46%, 1.78%, 2.10%, 26%, 2.91% and 0.49 respectively. Protein content improved by incorporation of whey in cookies so, the protein content is higher in whey diabetic cookies. There is slight difference in values of moisture, ash, water activity, fat and fiber content of whey diabetic cookies when compared with control. From the result of present investigation it may be concluded that whey and sucralose could be successfully utilized for preparation of whey diabetic cookies. Addition of 25% whey and 0.07% sucralose on the basis of flour weight of cookies mix improved nutritional, sensorial quality and overall acceptability of the formulated product.

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