

UTILIZATION OF ALMOND SEED CAKE

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Almond seed cake syrup was prepared and the material left after water extraction was used in the preparation of biscuits. The syrup contained 1.4% protein and was organoleptically acceptable up to storage of 60 days. 10% addition of the extracted cake to normal formula constituents of biscuits increased protein content of the biscuits considerably without affecting the acceptability of the product. The storage of biscuits up to 60 days did not affect their organoleptic acceptability.

INTRODUCTION

Almond seeds are a rich source of oil, protein, carbohydrates minerals and vitamins [1, 2]. These constituents render them of high nutritional and medicinal values [3]. Their characteristic flavouring components are regarded as a delicacy and a variety of confectionary products are, therefore, based on almond seeds [4-6].

Almond seed cake, left after extraction of oil, has been found to have high proportions of protein, carbohydrates and minerals. No product of any significant use is currently being prepared from the almond seed cake. Therefore, this valuable material mostly goes as wasted. Its major use in the olden days has been as a cleansing agent for such skins that would not tolerate conventional soaps. Even today, a small portion of the meal is used, as such or in combination with fine sea-sand, for cleaning skins, particularly on special occasions [7].

Wittka and Tomajoli [8] studied the processing conditions for the production of almond seed cake to be used as flour in confectionary. Studies on almond seed cake have revealed that its protein fraction consists of amando-globulin, amando-albumin and amando-emulsin [9].

Present laboratory scale studies were aimed at the total utilization of almond seed cake in the production of conventional and novel food products. Subjective and objective evaluations of the prepared products have been reported in the present communication.

Materials and Methods

Cold pressed almond seed cake was supplied by Choice Industries, Garden Town, Lahore.

Chemical Analysis of the Cake. The cake was analysed for moisture, protein, fat, ash and fibre content [10].

Preparation of Almond Seed Cake Syrup. To develop a more practicable and efficient procedure for the production of syrup, various methods were initially tried. On the basis of the data obtained with these studies a final procedure was worked out, a detailed study on which was subsequently carried out. Given below are the procedures which were used for initial preparation. Almond seed cake of 60 mesh was used during the present studies. (a) The meal was mixed directly with cane-sugar and 75° Brix syrup was prepared. (b) 75° Brix sugar syrup was prepared and the meal was added to it. (c) The meal was suspended in water and filtered at zero hour or left for 5, 10, 15, 20 and 25 min and then filtered through muslin cloth and 75° Brix syrup was prepared. (d) The meal was suspended in water for varying time (as in 'c' above) and each of the samples was simmered for 1, 2, 3, 4 and 5 min, cooled, filtered through muslin cloth and 75° Brix syrup was prepared. (e) Final Procedure of Almond Seed Cake Syrup: The meal (60 g) was suspended in 300 ml water. The suspension was left for 10 min and then simmered on a low flame for 3 min. The suspension was cooled, filtered through a coarse muslin cloth, the extract thus obtained was 220 ml. This extract was added to 600 g sugar and placed on a medium flame with continuous stirring till the sugar crystals were totally dissolved and 75° Brix syrup was obtained. One gram citric acid dissolved in water, one cardamon seed and 0.04 ml almond essence were added to the prepared syrup. The syrup was filled into a 725-ml (26 fl oz) sterilized bottle and corked immediately.

Preparation of Almond Seed Cake Biscuits. Almond seed cake, left after extraction for the preparation of almond seed cake syrup, was dried to 10% moisture content, ground in a laboratory grinder and added to the normal formulae [11] ingredients of biscuits at the rate 10, 20, 30 and 40% (dry weight basis) of the total formulae weight

and baked.

Physicochemical Analysis of the Products: Chemical Analysis. Almond cake syrup was analysed for °Brix and protein [10] and almond seed cake biscuits were analysed for dry matter, protein and fibre contents [10].

Physical Analysis: Almond Seed Cake Syrup. The syrup was stored at ambient temperature in the ordinary day light and analysed organoleptically for separation, colour, flavour and taste at 0, 15, 30, 45, and 60 day intervals by a panel of 5 expert judges [12].

Biscuits. Almond seed cake biscuits along with a control were subjected to organoleptic evaluation [12].

RESULTS AND DISCUSSION

Chemical Analysis of the Cake. Almond seed cake and

Table 1. Chemical analysis of almond seeds and almond seed cake.

| Constituent estimated | Almond seeds (%) | Almond seed cake (%) | Almond seed cake after water extraction (%) |
|-----------------------|------------------|----------------------|---|
| Dry matter | 94.3 | 85.5 | 37.2 |
| Protein | 25.6 | 43.8 | 19.8 |
| Fat | 61.1 | 20.7 | 10.2 |
| Fibre | 3.3 | 7.2 | 13.4 |

Table 2. Effect of suspension time on the extractability of almond seed cake water-soluble nutrients.

| Suspension time (min) | 0 | 5 | 10 | 15 | 20 | 25 |
|-----------------------|---|---|----|----|----|----|
| °Brix of the extract | 5 | 8 | 10 | 12 | 12 | 12 |

Table 3. Effect of simmering time on the extractability of almond seed cake water-soluble nutrients (°Brix of the extract).

| Tap water suspension time (min) | Simmering time (min) | | | | | |
|---------------------------------|----------------------|------|------|------|------|------|
| | 0 | 1 | 2 | 3 | 4 | 5 |
| 0 | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 8.0 |
| 5 | 8.0 | 9.0 | 10.5 | 11.5 | 12.0 | 12.0 |
| 10 | 10.0 | 10.5 | 11.5 | 12.0 | 12.0 | 12.0 |
| 15 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| 20 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| 25 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |

almond seeds (Choice Industries) were analysed for moisture, protein, fat and fibre content. The results of the analyses showed that oil extraction process reduced the oil content from 61.1 to 20.7%, while protein increased from 25.6 to 43.8% (Table 1). Fibre content of the cake were significantly higher (7.2%) than the seeds (3.34%). Reasons for this increase were: (a) extraction of oil, (b) addition of cellulosic materials, such as wheat straw, to enhance the extraction process. Moisture content of the cake were also higher than the almond seeds indicating the absorption of atmospheric moisture by the almond seed cake. Protein and fat content values of this analysis were higher than the reported figures of Australian almond seeds and almond seed meal [13].

Almond Seed Cake Syrup. (a) Experiments 'a' and 'b' were found not to be feasible due to: (i) difficulties in filtration; (ii) the dark colour of the final syrup; (iii) a sizeable amount of sugar— an expensive item, having been remained in the supernatant and thus was wasted. Experiment 'c' indicated that 15-min suspension time was sufficient for maximum extraction of protein and other water-soluble nutrients with cold extraction (Table 2). In experiment 'd' in which the suspension time was reduced from 15 to 10 min and the simmering for 3 min. Even 5-min suspension time was enough for maximum extraction of soluble fraction, if the simmering time was increased up to 4 min. However, increase in simmering time adversely affected colour of the syrup. Therefore, a combination of 10-min suspension and 3-min simmering time was adopted for final procedure 'e' and this procedure was followed for the manufacture of syrup (Table 3).

Chemical Analysis. Protein contents of the syrup were calculated to be 1.4% while the °Brix was observed to be 75.

Organoleptic Evaluations. The results of these evaluations are reported in Table 4. No separation of almond portion from the syrup was observed during a storage period of 60 days. Average scores of the five judgements

Table 4. Organoleptic evaluation of almond seed cake syrup for separation colour, flavour and taste up to storage of 60 days.

| Variable tested | Storage time (day) | | | | |
|-----------------|--------------------|-----|-----|-----|-----|
| | 0 | 15 | 30 | 45 | 60 |
| Separation | — | — | — | — | — |
| Colour* | 9.4 | 9.2 | 9.0 | 9.0 | 8.5 |
| Flavour* | 8.5 | 8.0 | 7.6 | 7.6 | 6.8 |
| Taste* | 9.0 | 9.0 | 8.5 | 8.0 | 8.0 |

*Average of five judgements.

Table 5. Chemical analysis of biscuits.

| Constituent estimated | Control sample | Addition of almond seed cake (%) | | | |
|-----------------------|----------------|----------------------------------|------|------|------|
| | | 10 | 20 | 30 | 40 |
| Dry matter | 98.1 | 98.0 | 97.8 | 89.0 | 89.5 |
| Protein | 7.1 | 9.2 | 11.4 | 13.6 | 15.2 |
| Fibre | 1.8 | 2.8 | 3.2 | 4.0 | 4.8 |

showed that colour and taste of the syrup remained very good up to 60-day storage. Though flavour of the sample was rated lower as compared with colour and taste yet it was also good and readily acceptable.

Almond Seed Cake Biscuits. Biscuits were prepared by adding various percentages of almond seed cake left after extraction of water-soluble fraction to normal recipe of the biscuits [11]. As this material contained about 20% protein and 10% fat (Table 1) it was considered appropriate to utilize it in the manufacture of biscuits.

Chemical Analysis. Chemical analysis of the biscuits showed that protein content of the baked material increased from 7.1 (control) to 15.2% (with the addition of 40% cake), however, the fibre content increased from 1.8 to 4.8% respectively (Table 5) and this factor adversely affected the acceptability of the biscuits.

Organoleptic Evaluations. The results of subjective evaluations are reported in Table 6. It is obvious from the average scores that addition of 10% cake material did not affect the flavour and taste of the biscuits, while comparatively the colour ranking was low, nevertheless, the sample remained at good acceptability level. The colour of the biscuits with the addition of cake, beyond 20%, was not acceptable, however, the sample was acceptable on an overall basis. Biscuits, with the addition of 40% cake material, were rejected by the panel indicating that addition of cake beyond 30% was not feasible. This might be due to increase

Table 6. Organoleptic evaluation of almond seed cake biscuits for colour, flavour, taste and general acceptability.

| Variable tested | Control sample | Addition of almond seed cake (%) | | | |
|-------------------------|----------------|----------------------------------|-----|-----|-----|
| | | 10 | 20 | 30 | 40 |
| Colour* | 10.0 | 7.0 | 5.8 | 5.0 | 4.6 |
| Flavour* | 10.0 | 10.0 | 7.8 | 6.4 | 5.2 |
| Taste* | 10.0 | 10.0 | 8.0 | 5.4 | 4.2 |
| General Acceptability † | 10.0 | 9.0 | 7.5 | 5.8 | 4.7 |

*Average value of five judgements. † Average value of total scores (colour + flavour + taste).

in fibre content (Table 5) and loss of appealing colour (Table 6).

CONCLUSION

Analyses of the almond seed cake and the material left after the extraction of cake (Table 1) showed that a considerable amount of valuable nutritive constituents were present in these materials. Analytical as well as organoleptic results of almond seed cake syrup and biscuit preparations have shown that this valuable byproduct can be used in various nutritional food preparations.

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