

Preparation of Cupcake Using Whey Powder as Egg Replacer

^[1] Mane K. A., ^[2] Khandekar V. B

MIT College of Food Technology, Rajbaug Educational Complex, Loni Kalbhor, Taluka Haveli, Dist. Pune, Pin- 412201.
(M. S.) INDIA

Abstract— In present study cupcakes were prepared by using three different combinations of maida and whey powder as egg replacer. For preparation of cupcake all ingredients such as maida, sugar, shortening, milk, baking powder and whey powder were mixed to form batter. This batter was poured in moulds and baked in oven at 170 °C for 15 min. Three samples were prepared using three different combinations of maida and whey powder (100:15, 100:25 and 100:35). Protein content of cupcake using whey was found in the range from 12.09 to 17.80%. The protein content was found maximum i.e. 17.80% in sample containing 100:35 proportion of maida and whey powder followed by sample containing 100:25 proportions (15.10%). Carbohydrates in cupcake were found in the range from 44.00 to 47.10%. Fat content were found 27.00 to 27.80%. Organoleptic properties were evaluated by using 9 point hedonic scale. Better colour and taste were observed in case of cupcake containing 100:15 and 100:25 proportions of maida and whey powder. The overall acceptability of cupcakes with 100:15 and 100:25 proportions was 7.9 and 7.4, respectively.

Key words: Cupcake, wheat flour, whey powder, egg replacer.

I. INTRODUCTION

Wheat (*Triticum* spp.) is a cereal grain, originally from the Levant region of the Near East and Ethiopian Highlands, but now cultivated worldwide. Wheat is grown on more land area worldwide than any other crop and is a close third to rice and corn in total world production. Nearly 36% of the world's wheat production is in Asia, 17% is in Europe and 16% in North America. World leaders in wheat production are, in order: China, India, United States, France, and Russia. Wheat is used mainly as a human food. It is nutritious, concentrated, easily stored and transported, and easily processed into various types of food. Unlike any other plant-derived food, wheat contains gluten protein, which enables leavened dough to rise by forming minute gas cells that hold carbon dioxide during fermentation. Wheat is grown on more than 216,000,000 hectares, larger than for any other crop. Wheat is the most important source of carbohydrate in a majority of countries. Wheat protein is easily digested by nearly 99% of human population. Wheat also contains a diversity of minerals, vitamins and fats (lipids). With a small amount of animal or legume protein added, a wheat-based meal is highly nutritious (Vinay D. et. al., 2016).

Raw wheat can be ground into flour or converted into semolina, germinated and dried creating malt, crushed or cut into cracked wheat, parboiled (or steamed), dried, crushed and de-branned into bulgur also known as groats. Wheat is a major ingredient in such food as bread, crackers, biscuits, pancakes, pies, pastries, cakes, cookies, muffins, rolls, doughnuts, gravy, boza (a fermented beverage), and breakfast cereals.

Whey is byproduct of cheese making and casein manufacture in the dairy industry (Bulut Solak and Akın 2009). In cheese processing, there are two basic types of whey. These are sweet whey and acid whey. Sweet whey is derived from the manufacture of rennet-produced cheeses. Acid whey is obtained from the manufacture of acid-produced cheeses. The composition of whey products varies according to the milk source, type of cheese, the methods of production, purification and concentration, and manufacturing process (Walzem et al. 2002; Anonymous 2003; Harper 2004). On an average, whey contains about 65 g/kg solids comprising 50g lactose, 6g proteins, 6g ash, 2g non – protein nitrogenous substances and 0.5g fat (Zadow, 1994). Whey solids for human nutrition are being produced in a variety of forms such as dried whey, condensed whey, partially delectated whey, partially dematerialized whey, whey protein concentrate, whey protein isolate. Bakery products in India have become increasingly popular due to an increased demand for convenience foods. The demand for bakery products is bound to increase further in the country due to an increasing demand for convenience foods, shift in eating habits and better transportation and distribution methods. Most wheat flour has a protein content of only 12 to 16%, and is too deficient in lysine and essential amino acids, and so the quality and content of bakery items is far below that of proteins in the milk – meat class (Saxena, 2003). The addition of whey solids to biscuits, cakes or bread, which will not only increase the protein content, but also help to substantiate claims like increased branched chain amino acids content and others (Parchure, 2002).

Whey protein offers numerous benefits for food and beverage manufacturers working to meet consumers' demand for higher-

protein diets. Foremost among them is a potential cost savings, especially during times of short egg supply. Further, substituting dry whey powder eliminates many microbial issues associated with fresh or liquid eggs. Upon use in finished food applications, whey protein brings additional functional benefits. Whey protein improves food texture, as it binds water, boosts freezing and thawing stability, and delivers a fine and even crumb structure. Shelf life increases, too, as whey protein helps stabilize emulsions and minimizes oiling off ([https : // www . thinkusadairy . org /](https://www.thinkusadairy.org/)).

II. MATERIALS

Ingredients

Maida which is a major ingredient and other ingredients such as corn flour, sugar, shortening, milk, baking powder and pineapple essence were obtained from local market. Whey powder which is a byproduct of dairy industry performs the function of livening agent to improve volume of cupcake was taken from local market. Eggs were also obtained from local market to prepare control sample.

Equipments

Equipments such as weighing balance, grinder, hand mixer, baking oven and baking moulds were used for preparation of cupcake.

Packaging material

Polyethylene bags of 300 gauges and paper cups were used for packaging of cupcakes.

III. METHODOLOGY

The detailed process for preparation of cupcake using whey powder is shown in Fig.1

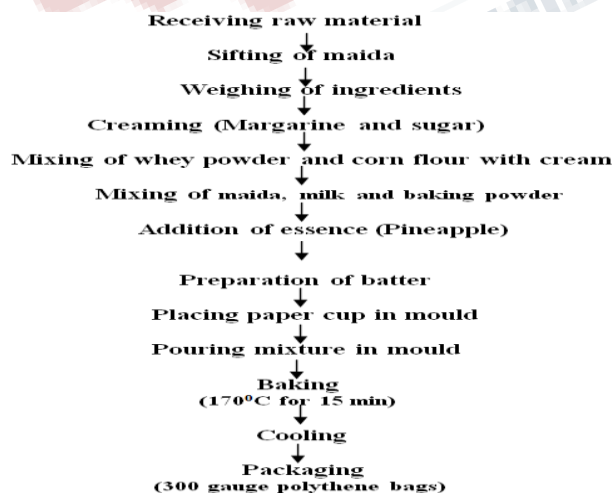


Fig. 1 Process flow chart for preparation of cupcake with whey powder

Preparation of cupcake

Preliminary operations

For preparation of cupcake with whey powder weighing of raw material such as maida, sugar, corn flour baking powder and whey powder was carried out as shown in Table 1. Sifting of maida was carried out before weighing.

Mixing of ingredients

All ingredients were mixed in appropriate proportions as per Table 1. Firstly sugar was mixed with margarine for creaming. Then whey powder and corn flour were mixed with cream. After that maida, milk and baking powder were added to above mixture. Finally pineapple essence was added in mixture and batter was prepared using hand mixture. Three samples were prepared with different proportions of maida and whey powder (100:15, 100:25 and 100:35). Control sample was prepared with eggs.

Table 1 Ingredients for preparation of cupcake using whey powder

| Sr. No. | Ingredients | Samples | | | |
|---------|----------------------------|----------------|----------------|----------------|----------------|
| | | S ₀ | S ₁ | S ₂ | S ₃ |
| 1 | Maida (g) | 100 | 100 | 100 | 100 |
| 2 | Sugar (g) | 75 | 75 | 75 | 75 |
| 3 | Shortening (Margarine) (g) | 60 | 60 | 60 | 60 |
| 4 | Milk (ml) | 25 | 25 | 25 | 25 |
| 5 | Whey powder(g) | --- | 15 | 25 | 35 |
| 6 | Corn flour(g) | 7 | 7 | 7 | 7 |
| 7 | Baking powder(g) | 2 | 2 | 2 | 2 |
| 8 | Eggs | 2 No. | --- | --- | --- |
| 9 | Pineapple Essence (ml) | 0.2 | 0.2 | 0.2 | 0.2 |

Moulding and Baking

Paper cups were placed in mould and then batter was poured in it. After that moulds were kept inside baking oven and baked at 170^oC for 15 min to obtain cupcakes.

Cooling and Packaging

Baked cupcakes were then cooled for 1 hour and packed in 300 gauge polyethylene bags.

Chemical analysis:

Raw material and final products were analyzed for moisture content, carbohydrates, protein, fat and ash content.

Moisture

For determination of moisture content standard oven method was used (AOAC, 1990). Samples were taken in petri plates

and dried in hot air oven at 105⁰C temperature until the material was bone dry. The samples were then removed from oven and cooled in desiccators for 20 min. The samples were then weighed. The moisture content was calculated by using following formula:

$$\text{Moisture content (\% w.b.)} = \frac{W_1 - W_2}{W_1} \times 100$$

Where,

W1 = Weight of sample before drying, g.

W2 = Weight of bone dry sample, g.

Carbohydrates

For determination of carbohydrates Anthrone method was used (Ranganna, 2007).

Fat

Fat content of samples was determined by Soxhlet apparatus. (Ranganna, 2007).

Protein

For determination of protein Micro-Kjeldahl method was used (Ranganna, 2007).

Ash content

Ash content of samples was determined by using Muffle furnace (Ranganna, 2007).

Determination of physical properties of cupcake

Three different samples of cupcake were analyzed for size and weight.

Size

Lengths, breadth, thickness of cupcake were measured by using vernier caliper. From this size of cupcake was determined by using formula.

$$\text{Size} = (\text{length} \times \text{breadth} \times \text{thickness})^{1/3}$$

Weight

Weight of cupcake was measured using weighing balance.

Sensory Evaluation

The Sensory evaluation of different organoleptic properties viz, colour, appearance and texture, taste, flavor and overall acceptability was carried by the panel of 10 judges of different groups and food habits on basis of 9 point hedonic scale (Anon, 1971). The average score was calculated for individual organoleptic properties. The overall acceptability score 7 to 9, 5 to 6 and below 5 were evaluated as more acceptable, acceptable and not acceptable products, respectively.

IV. RESULTS AND DISCUSSION

Chemical composition of raw material

Chemical properties of maida and whey powder were determined and tabulated in Table 2.

Table 2 Chemical composition of raw material

| Composition | Maida | Whey powder |
|------------------|-------|-------------|
| Moisture (%) | 12.8 | 4.5 |
| Carbohydrate (%) | 75.4 | 73.5 |
| Protein (%) | 9.7 | 12.9 |
| Fat (%) | 1.6 | 0.9 |
| Ash (%) | 0.5 | 8.0 |

Chemical composition of cupcakes prepared with whey powder

Chemical composition of cupcakes prepared with whey powder was determined and shown in Table 3.

Table 3 Chemical composition of cupcakes prepared with whey powder

| Composition | Samples | | | |
|-----------------|----------------|----------------|----------------|----------------|
| | S ₀ | S ₁ | S ₂ | S ₃ |
| Moisture(%) | 11.00 | 10.00 | 12.00 | 15.00 |
| Carbohydrate(%) | 43.45 | 44.00 | 46.02 | 47.10 |
| Protein (%) | 10.56 | 12.09 | 15.10 | 17.8 |
| Fat (%) | 26.89 | 27.07 | 27.05 | 27.13 |
| Ash (%) | 2.09 | 2.03 | 2.03 | 2.25 |

Moisture

Moisture content of all cupcakes was found in the range from 10.00 to 15.00%. It was seen that there is a marked effect of whey powder on moisture content. It was found maximum (15.00%) in the cupcake containing 100:35 proportion of maida and whey powder whereas minimum (10.00%) in the cupcake containing 100:15 proportions. Moisture content of whey powder was 5%.

Carbohydrate

Carbohydrate content in all cupcakes was found in the range from 43.45 to 47.10. It was found maximum (47.10%) in the cupcake containing 100:35 proportion of maida and whey powder whereas minimum (43.45%) in the control sample. Carbohydrate content of whey powder was 73.5%.

Protein

Protein content of all cupcakes was found in the range from 10.56 to 17.80%. It was seen that there is a marked effect of whey powder on moisture content. It was found maximum (17.80%) in the cupcake containing 100:35 proportion of maida and whey powder whereas minimum (10.56%) in the control sample. Protein content of whey powder was 12.9%.

Fat

Fat content in the cupcakes was found in the range from 26.89 to 27.13%. It was found maximum (27.13%) in the cupcake containing 100:35 proportion of maida and whey powder whereas minimum (26.89%) in the control sample. Fat content of whey powder was 0.9%.

Ash

Ash content in the cupcakes was found in the range from 2.03 to 2.25%. It was found maximum (2.25%) in the cupcake containing 100:35 proportion of maida and whey powder whereas minimum (2.03%) in the cupcake containing 100:15% proportion. Ash content of whey powder was 8.0%.

Physical Properties of cupcake:

Physical properties of cupcake are shown in Table 4. The size of cupcake was found between 7.3 and 7.8cm. The weight of cupcake was found in the range from 103 to 117g. The average weight of the cupcakes prepared without whey powder (Control sample) was found minimum (103g). It was found maximum (117g) in the cupcakes prepared with 100: 35 proportion of maida and whey powder (S_3) followed by cupcakes prepared with 100:25 proportion (S_2).

Table 4 Physical properties of cupcake

| Sample | Size (cm) | Weight (g) |
|--------|-----------|------------|
| S_0 | 7.5 | 103 |
| S_1 | 7.3 | 105 |
| S_2 | 7.6 | 112 |
| S_3 | 7.8 | 117 |

Organoleptic Properties

Data on organoleptic properties of cupcake is tabulated in Table 5. Effect of whey powder on organoleptic properties (color, appearance, texture, taste, flavor and overall acceptability) is plotted and shown in Fig. 2. The sensory score of cupcake using whey powder was found in the range between 6.6 and 8.1. The overall acceptability of cupcakes prepared from whey powder (15% and 25%) was found 8.1 and 7.4, respectively. The overall acceptability of cupcakes prepared with 15% level of incorporation of whey powder was found to be close to the control samples (8.2).

Table 5 Organoleptic properties of cupcake

| Sample | Colour | Taste | Flavour | Texture | Overall acceptability |
|--------|--------|-------|---------|---------|-----------------------|
| S_0 | 8.2 | 8.2 | 8.3 | 8.1 | 8.2 |
| S_1 | 8.2 | 8.1 | 7.9 | 8.1 | 8.1 |
| S_2 | 7.7 | 7.4 | 7.8 | 7.2 | 7.4 |
| S_3 | 7.1 | 6.9 | 6.6 | 7.1 | 6.6 |

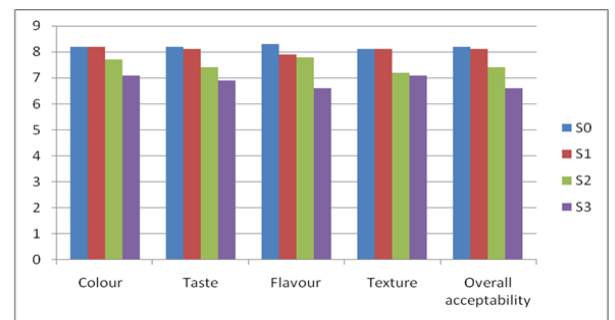


Fig. 2 Effect of whey powder on organoleptic properties

V. CONCLUSION

An investigation was undertaken to standardize the recipe for cupcake using whey powder as egg replacer. The cupcakes were prepared with three different proportions of maida and whey powder (100:15, 100:25 and 100:35). The cupcakes with 100:15 and 100:25 proportion were found more acceptable as compared with 100:35 proportions. The overall acceptability of cupcakes prepared with 100:15 level of incorporation of whey powder was found to be very close to the control samples. Hence, it is concluded that the cupcakes can be prepared with whey powder as egg replacer.

REFERENCES

- [1] Anon., 2003. US Dairy Export Council. Reference Manual for US. Whey and lactose products. Arlington VA: US. Dairy Export Council pp 65-72 Anon, 1971, Sensory Evaluation IS 6373-1971, Indian Standard institution.
- [2] A.O.A.C. 1990. Official Methods of Analysis, Association of Official Analytical Chemists, Washington, DC, 15th edition.
- [3] Bulut Solak B., Akın N., 2009. Nutritional value and health benefits of whey proteins. International Scientific Conference on Nutraceuticals and

International Journal of Science, Engineering and Management (IJSEM)
Vol 2, Issue 10, October 2017

- Functional Foods June 9th -11th 2009 Zilina, Slovakia, p 18
- [4] Harper W. J., 2004. Biological properties of whey components: a review. Chicago IL: The American Dairy Products Institute 2001 with updates 2003. <http://www.adpi.org/tabid/128/newsid545/52/Default.aspx>. Accessed 20 January 2011
- [5] Parchure A., 2002. Healthy additions. Times Food Processing journal. Feb – Mar: 39 – 40.
- [6] Ranganna S., 2007. Handbook of analysis and quality control for fruits and vegetables products, Tata Mcgraw Hill Publication, pp 1-45.
- [7] Saxena D. C., 2003. How to bake your bread. Times Food Processing Journal, Aug- Sept. Pp: 36 – 38.
- [8] Vinay D., Kwatra S., Sharma S. and Pandey K., 2016. Socio Economic Status and Gender Participation in Wheat Production System of Uttarakhand, India International Journal of Agricultural Science and Research (IJASR) ISSN(P): 2250-0057; ISSN(E): 2321-0087 Vol. 6, Issue 5, Oct 2016, 155-162
- [9] Walzem R. L., Dillard C. J., German J. B., 2002. Whey components: Millenia of evolution create functionalities for mammalian nutrition: What we know and what we may be overlooking. Critical Reviews in Food Science and Nutrition 42: 353-375
- [10] Zadow J. G., 1994. Utilization of milk components: Whey. pp 313 – 373, In Modern Dairy Technology (ed Robinson R K) Chapman & Hall, New York.
- [11] <https://www.thinkusadairy.org/>