International Journal of Science, Environment and Technology, Vol. 6, No 2, 2017, 1309 – 1314

ISSN 2278-3687 (O)
2277-663X (P)

# NUTRITIONAL VALUE AND PHYSICAL PROPERTIES OF EGGLESS MUFFIN

***Bhopal Singh[1], Ashish Kumar Singh[1], P.N. Raju[1] and Rekha Rani[2]**
[1]Dairy Technology Division, ICAR-National Dairy Research Institute, Karnal, Haryana
[2]Warner School of Food and Dairy Technology, SHUATS, Allahabad (U.P.)
E-mails: aksndri@gmail.com pnr.ndri@gmail.com verma.rekha@gmail.com
bhopalbtech@gmail.com (**Corresponding Author*)

**Abstract:** Muffins are sweet, high-calorie baked products characterised by good taste and soft spongy texture. Egg is one of the main ingredients that play a pivotal role in maintaining nutritional and physical properties. Although egg possesses excellent functional properties the presence of high cholesterol, risk of allergies by egg protein (avidin) and religious taboos associated with its consumption limit its use. Therefore, there is a need for substitutes of egg. Keeping a view on this, whey protein concentrate and skim milk powder in combination was added as egg substitute and evaluated for their effect on nutritional and physical properties of muffin. The substitution of egg contributed lower calorie, caused lower weight loss and decreased water activity of the muffin.
**Keywords:** Eggless muffin, whey protein concentrate, skim milk powder.

## Introduction

Muffins are cereal based bakery products characterized by a typical porous structure and high volume which confer a spongy texture (Martinez *et al*., 2012). A muffin batter is a complex mixture of interacting ingredients; which is consisted of high level of sugar and variable levels of fat, flour, egg, emulsifier, milk powder, preservative and baking powder. For getting a desired spongy texture, stable batter with many small air bubbles are required. Previously, Shevkani and Singh (2014); Ronda *et al.* (2015); Shevkani *et al.* (2015); Preichardt *et al.* (2011); Singh *et al.* (2015); Matos *et al*. (2014); Rahmati and Tehrani (2014); and Walker *et al.* (2014) reported the rheological properties of muffins. The bubbles produced during the mixing process, act as nuclei and grow in size when the carbon dioxide generated by the baking powder which leavens the product during baking. Egg solids, particularly egg white to a lesser extent and milk proteins are important foam stabilizers, slowing down the coalescence of air bubble. Shortening and oil are used to give a softer structure and avoid a dry mouthful. During the baking of muffins, starch present in flour gets gelatinized and denaturation of proteins set the structure of cake (Baixauli *et al*., 2003). Among all the ingredients, egg plays important role. It is a multi-functional ingredient because its

*Received Mar 10, 2017 * Published Apr 2, 2017 * www.ijset.net*

thickening, gelling, emulsifying, foaming, colouring, and flavouring properties contribute to the texture and sensory characteristics of foods (Kiosseoglou and Paraskevepoulou, 2005). Although egg possesses excellent functional properties, it suffers from some disadvantages such as high cholesterol content. Furthermore, certain individuals are allergic to egg proteins (avidin) and religious taboo also prohibits consumption of products containing egg or egg components. Such issues have led to a research for suitable egg replacer and egg extenders (Rossi *et al*., 2010). Health and nutritional virtues have become the focal point in new product development due to increasing consumer awareness who desire to remain healthy and fit. Whey protein concentrates (WPC) and skim milk powder (SMP) are used in a wide range of food applications (processed meat, bakery and dairy products) due to their nutritional and functional properties (Haeva *et al*., 2006). In cake or muffin preparation, emulsifiers aid the incorporation and subdivision of air into the liquid phase to promote uniform dispersion of fat that contain entrapped air cells, thereby providing more sites for the expansion of gas, resulting in greater volume and soft texture (Manisha *et al*., 2012). Therefore, there is need to apply WPC in combination with SMP to develop eggless muffins. However, no work has been done on egg replacement using the combinations. Moreover, the role of dairy ingredients in these products has also not been evaluated.

**Materials and method**

**Methodology:**

All the dry ingredients (refined wheat flour, baking powder, WPC- 70, SMP) were sieved together using 12 micron mesh size sieve. The sugar and shortening was creamed together at medium speed (418 rpm) for 5 minutes. The cake gel was added to the mixture and it was creamed for 2 minutes to improve the quality of the batter and final product. Then the dry ingredients were blended continuously for 3 minutes at medium speed. Finally the liquids i.e. milk and water were added and blended at low speed (218 rpm). The batter was filled into the muffins moulds and was baked at $180^0$C for 18 minutes into the conventional oven.

**Physico-chemical properties of eggless muffins**

Estimation of fat was carried out as per the procedure of AOAC (1995) and protein, ash, and moisture were done by the method of AOAC (2000). Carbohydrate content was calculated by difference method [100- (fat + protein + ash + moisture)]. Calorific value was calculated using energy value of fat (9 Kcal/g), protein and carbohydrate (4 Kcal/g). The weight loss upon baking was calculated as follows:

Weight loss = $(W_3-W_4) \times 100/W_3$, where, $W_3$ and $W_4$ are the weight of muffin batter before and after baking, respectively. Water activity was measured using water activity meter (AquaLab). Specific volume was measured by the rapeseed displacement method and calculated using the formula:

Specific volume= $(W_1- W_2/ W_2)* 100$, where, $W_1$ and $W_2$ are the weight of cylinder before and after rapeseed addition, respectively.

**Results and discussion**

**Nutritional value of eggless muffin**

Moisture content in control and eggless muffins were 19.73 and 16.46%, respectively. Variation in moisture content of muffins could be attributed to difference in formulation and relative interaction of water with other constituents. Control muffins contain egg yolk that being rich in phospholipids and able to act as emulsifier might have been able to retain more moisture in emulsified form. Increased moisture for control muffins has also been reported by Grigelmo *et al.* (2001) for muffins in which part of the fat had been replaced by peach fibre.

Protein content of eggless muffins was 6.06% (on dry basis) which was slightly higher than control muffins. However, the fat content was highest in control muffin (19.73%) probably due to the contribution of egg yolk fat, whereas eggless muffins contained 17.43%. This was due to the inherent difference in the fat content of egg WPC-70 and SMP *i.e.* 12.25 and 5.80 and 1.40%, respectively as reported by Singh *et al.* (2003).

Ash content of both muffins was almost similar, however, aggregates variation is observed in carbohydrate content. The differences in the ash content of dry mixes in this study can be due to the inherent differences in the ash content of egg and milk proteins. Ash content of about 8.5% in skim milk powder was reported by Walstra *et al.* (2003).Control sample contained lowest carbohydrate content (47%), while eggless muffin had 50.58% (on dry weight basis). Carbohydrate increased in the eggless muffins was due to the lactose present in the WPC and SMP, used as egg replacer. Difference in proximate composition of both muffins also reflected in their calorie content, which were 439.79 and 383.45 kcal for control and eggless muffins, respectively.

**Physical properties of eggless muffin**

Weight loss of control and eggless muffins were 17.65 and 13.48%, respectively. Specific volume of control and eggless muffins were 1.54 and 1.40 $cm^3/g$, respectively. Specific volume of control muffins was higher due to the functional properties of egg which exhibits excellent foaming and emulsifying properties. Jyotsana *et al.,* (2007) reported that the specific volume of eggless cake was 1.84 $cm^3$/g and it was increased with the addition of 20% WPC-70 as the replacement of flour. Water activity of control and eggless muffins were 0.87 and 0.78, respectively. Milk proteins and lactose present in eggless cake formulations posses excellent water binding properties that might be the reason for low water activity.

## Conclusion

Eggless muffin prepared by combinations of milk powder, in place of egg, had 12.81% lower calorific value then control. Vegetarian people easily consume it with the original taste of muffins.

## References

[1] R. Baixauli, T. Sanz, A. Salvador, and S.M. Fiszman, Effect of the addition of dextrin or dried egg on the rheological and textural properties of batters for fried foods. Food Hydrocolloids. **17** (2003) 305-310.

[2] M.N. Grigelmo, B.E. Carreras, and B.O. Martin, Influence of the addition of peach dietary fibre in composition, physical properties and acceptability of reduced-fat muffins. Food Science and Technology International. **7 (5)** (2001) 425-431.

[3] P. Havea, H. Sigh, and L.K. Creamer, Heat-induced aggregation of whey proteins: Comparison of cheese WPC with acid WPC and relevance of mineral composition. Journal of Agriculture and Food Chemistry. **50** (2006) 4674-4681.

[4] R. Jyotsna, R.S. Manohar, D. Indrani, and G.V. Rao, Effect of whey protein concentrate on the rheological and baking properties of eggless cake. International Journal of Food Properties. **10** (2007) 599–606.

[5] G. Manisha, C. Soumya, and D. Indrani, Studies on interaction between stevioside, liquid sorbitol, hydrocolloids and emulsifiers for replacement of sugar in cakes. Food Hydrocolloids. 29 (2012) 363-373.

[6] S. Martinez-Cervera, T. Sanz, A. Salvador, and S.M. Fiszman, Rheological, textural and sensorial properties of low-sucrose muffins reformulated with sucralose/polydextrose. Journal of Food Science and Technology. **45(2)** (2012) 213-220.

[7] M.E. Matos, T. Sanz, and C.M. Rosell, Establishing the function of proteins on the rheological and quality properties of rice-based glutenfree muffins. Food Hydrocolliad. 35 (2014) 150–158.

[8] L.D. Preichardt C.T. Vendruscolo M.A. Gularte, and A.D.S. Moreira, The role of xanthan gum in the quality of gluten free cakes: improved bakery products for coeliac patients. International Journal of Food Science and Technology. 46 (2011) 2591–2597

[9] N.F. Rahmati, and M.M. Tehrani, Influence of different emulsifiers on characteristics of eggless cake containing soy milk: modeling of physical and sensory properties by mixture experimental design. Journal of Food Science and Technology. 51 (2014) 1697–1710.

[10] F. Ronda, S. Perez-Quirce, A. Lazaridou, and C.G. Biliaderis, Effect of barley and oat β-glucan concentrates on gluten-free rice-based doughs and bread characteristics. Food Hydrocolloids 48 (2015) 197–207.

[11] M. Rossi, E Casiraghi, L. Primavesi, C. Pompei, and A. Hidalgo, Functional properties of pasteurised liquid whole egg products as affected by the hygiene quality of the raw eggs. Journal of Food Science and Technology. **43** (2010) 436-441.

[12] K. Shevkani, A. Kaur, S. Kumar, and N. Singh, Cowpea protein isolates: functional properties and application in gluten-free rice muffins. LWT-Food Science and Technology. 63 (2015) 927–933.

[13] J.P. Singh, A. Kaur, K. Shevkani, N. Singh, Influence of jambolan (Syzygium cumini) and xanthan gum incorporation on the physicochemical, antioxidant and sensory properties of gluten-free eggless rice muffins. International Journal of Food Science and Technolology. 50 (2015) 1190–1197.

[14] S. Singh, H.S. Chauhan, R. Raghuvanshui, P. Sharma, O.P. Chauhan, and A. Bajpai, Replcement of egg with whey protein concentrate and optimization of its levels in cake making. Journal of Food Science and Technology. 40 (2003) 386-388.

[15] R. Walker, A. Tseng, G. Cavender, A. Ross, and Y. Zhao, Physicochemical, nutritional, and sensory qualities of wine grape pomace fortified baked goods. Journal of Food Science. 79 (2014) 1811–1822

[16] P. Walstra, 2003. Physical chemistry of foods. New York: Marcel Dekker. Pp: 173-212.

**Table 1: Proximate composition of optimized muffins**

| Constituents (%) | Muffins | Eggless Muffins |
|---|---|---|
| **Moisture** | 19.23±0.21 | 16.46±0.24 |
| **Protein** | 5.63±0.02 | 6.06±0.04 |
| **Carbohydrate** | 47.00±0.23 | 50.58±0.26 |
| **Fat** | 19.73±0.06 | 17.43±0.04 |
| **Ash** | 1.65±0.05 | 1.62±0.03 |
| **Energy(kcal/100g)** | 439.79 | 383.45 |

(Mean ± SE) average of three batches

**Table 2: Physical properties of muffins**

| Parameters | Control | Eggless Muffin |
|---|---|---|
| **Weight loss (%)** | 17.65±0.07 | 13.48±0.26 |
| **Specific volume ($cm^3$/g)** | 1.52±0.02 | 1.40±0.01 |
| **Water activity** | 0.87±0.01 | 0.78±0.01 |

Mean±SE, average of three replicates.