



## Development and acceptability of value added muffins and cookies

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### ABSTRACT

Anaemia is a nutritional problem affecting all segments of the population in general and children, woman & pregnant woman in particular. In the latter groups, prevalence of anaemia may be as high as 60 – 70 per cent. Anaemia in our country is essentially due to iron deficiency although in children, woman & pregnant woman, folate deficiency also plays a part. Although our diets contain fairly good amount of iron, its absorption is very poor (2-3 per cent).<sup>9</sup> Micronutrient malnutrition commonly referred as “Hidden Hunger”, causes learning disabilities, impaired work capacity, illness & ultimately death. Forty per cent of the world suffers from iron deficiency.

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### Introduction

Anaemia is a nutritional problem affecting all segments of the population in general and children, woman & pregnant woman in particular. In the latter groups, prevalence of anaemia may be as high as 60 – 70 per cent. Anaemia in our country is essentially due to iron deficiency although in children, woman & pregnant woman, folate deficiency also plays a part. Although our diets contain fairly good amount of iron, its absorption is very poor (2-3 per cent).<sup>9</sup> Micronutrient malnutrition commonly referred as “Hidden Hunger”, causes learning disabilities, impaired work capacity, illness & ultimately death. Forty per cent of the world suffers from iron deficiency.<sup>3,4,5,12</sup>

For successful & sustainable micronutrient interventions, food fortification is recognised as an essential food based approach for solving the nutritional problems in developing countries.<sup>2,3,11</sup> Consumption of ready to eat foods, bakery foods, have risen in India considerably due to liberalisation, globalisation & urbanisation. There is a shift from Indian traditional cuisines to western cuisines hence the availability & consumption of baked products are higher as they are considered fashionable among our younger generation. Hence nutrification of the much sought after food (bakery products) with locally available nutrient dense foods (Dates & Walnuts) becomes a necessity. The present study was taken up to judge the best possible level of incorporation of dates & walnuts in muffins & cookies, to test the acceptability of dates & walnuts added muffins & cookies & to assess the quality of the value added muffins & cookies.

### Methods:

A baseline survey was done with a structured questionnaire consisting of 18 multiple choice questions to assess the knowledge & preference of the bakery items of the adolescent volunteers. Dates (*Phoenix dactylifera*) & Walnuts (*Juglans regia*) were chosen as food enrichers. **Muffins** defined as a small domed cake or quick bread & **cookies** the small sweet cake, typically round, flat, & crisp were selected for value addition. The muffins & cookies were standardised using the standard recipe as given by Gisselen (1989)<sup>10</sup> Dates & walnuts were shred & added just before preparation separately and as 1:1 mix at 30, 40, & 50 per cent in cookies & muffins. The

prepared items were coded appropriately & got ready for subjective evaluation by 20 panel members consisting of young students as well as experienced adults.

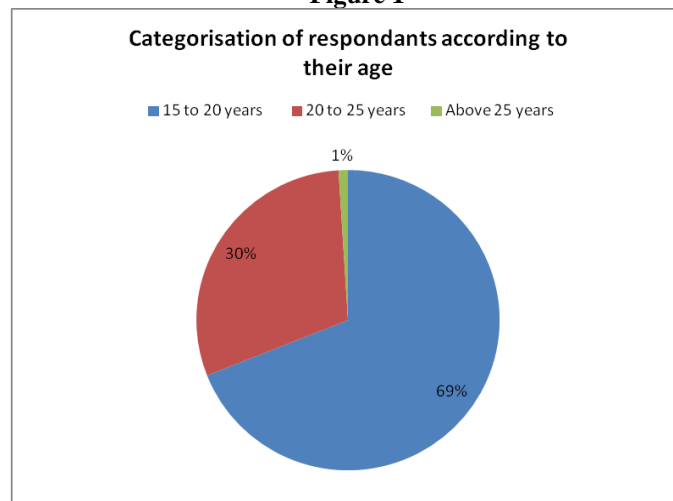
The quality analysis of muffins (total solids, pH, acid insoluble ash & crude fiber) & cookies (moisture & acid insoluble ash) were carried according to according to the Bureau of Indian standards (2009 and 2010)<sup>6,7</sup>. Nutrients *viz* energy, carbohydrate, protein, fat, iron, phosphorus & crude fiber were estimated for “the most acceptable samples of muffins & cookies” as per National Institute of Nutrition (2003)<sup>1</sup>. The cost-effect ratio for each variety of the muffins & cookies was calculated & compared with their micronutrient content. Statistical analyses were done using MS Excel 2010. The Anova was calculated using the anova calculator.

### Results & discussions:

#### Knowledge & preference of bakery products among college going students

Among the 100 participants, maximum (68%) belonged to the 15 – 20 age group & 30 % belonged to the 20 – 25 years category & were pursuing either their UG or PG course, while one percent was above 25 years of age who was a research scholar. (Figure 1)

Figure 1



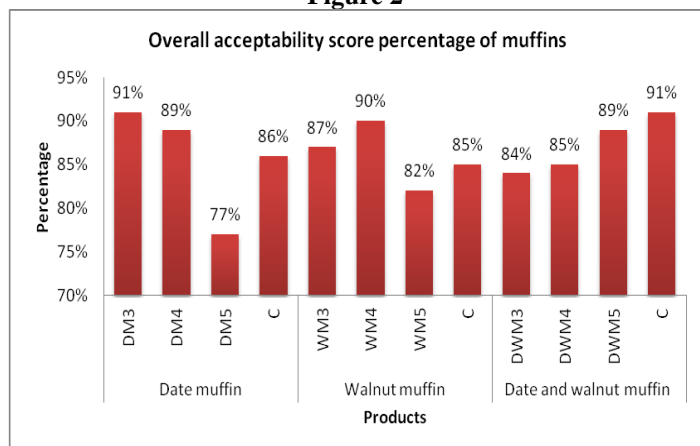
In the present survey nearly half of the participants (49 per cent) like cakes followed by cookies (24 per cent) & biscuits (19 per cent). Bread (16 per cent) & pastries (17 per cent) obtained almost parallel liking in terms of percentage of participants, while muffins were ranked as the lowest (14 per cent) liked product. A maximum 29 per cent bought bakery products on a weekly basis, followed by 26 per cent of respondents buying "twice a week". Twenty seven per cent of respondents claimed that they buy bakery products only occasionally. While eight per cent of respondents bought bakery products thrice in a week, five per cent each of the participants purchased bakery products daily or fortnightly. Contrary to the present finding, Sheereen (2012) had reported in her study that 50 per cent of respondents bought bakery products on a monthly basis while 25 per cent each of respondents purchased daily & occasionally.

The data revealed that majority (82 per cent) of participants buy cakes for birthday followed by *New year* (27 per cent) & *Christmas* (16 per cent). Quite good number of participants purchased bakery products on friendship's day (15 per cent). Purchase of cakes was less on Indian traditional functions as they are celebrated with specific foods meant for such occasions. Among the respondents 31 per cent stated hygiene was the prime factor to choose an outlet followed by 28 per cent whose primary factor is brand name of the outlet. Cost is a deciding factor for 21 per cent to select a specific outlet. While 14 per cent choose the place of purchase due to familiarity, four per cent do not have any such preferences. Two per cent of the participants stated that taste as the criteria for choosing an outlet. Culliney (2012) said that peer group is the main reason for the "influential purchase" & consumption of bakery foods among young adults. Participants of the current study were also found to be influenced by their peers (53 per cent) & parents (47 per cent) to buy bakery products from malls & supermarkets.

When the participants were distributed according to the brand of ready-to-eat bakery product they purchase, Britannia (48 per cent) was ranked the highest followed by Nilgiris (31 per cent), Spencer's (16 per cent) & Milka (13 per cent). Seventy eight per cent of the participants consume bakery products in the evening and they strongly believed that bakery products could be made healthy by altering the ingredients; but 22 per cent of respondents stated that bakery products can't be made healthy.

#### Sensory & quality analysis of muffins:

Figure 2



From the figure-2, it is evident that among the muffins; DM<sub>3</sub>, WM<sub>4</sub> & DWM<sub>5</sub> scored the highest (91, 90 & 89%) overall acceptability. This shows that 30 & 40 per cent incorporation of dates & walnuts respectively is ideal for muffins when the addition is done individually however when

they were mixed in 1:1 proportion & incorporated the level of addition could go up to 50 per cent.

Table 1. Quality parameters of highly acceptable muffins

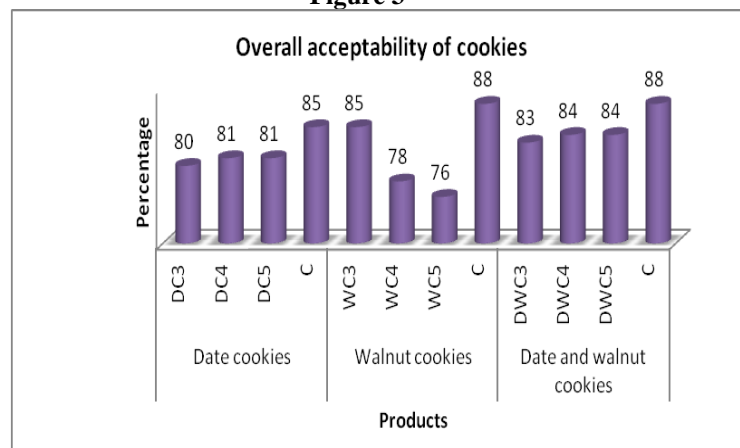
Criteria	Total solids (g)	pH	Acid insoluble ash (g)	Crude fibre (g)
BIS*	60	5.0 to 6.0	0.1	0.5
Control	81.40	7.94	0.00	0.32
DM <sub>3</sub>	83.28	7.82	0.00	0.40
WM <sub>4</sub>	86.70	7.65	0.00	0.44
DWM <sub>5</sub>	85.10	7.35	0.00	0.60

\*Bureau of Indian Standards (2009)

The standards given by BIS for white bread were taken for comparison as there is no specific BIS standard for muffins. The total solid content of all the three highly acceptable samples were 20 - 26 per cent higher than the BIS value of 60 per cent. While WM<sub>4</sub> obtained 86.70 per cent; the control had only 81.4 per cent total solids. Normally muffins should have a pH of 5.0 to 6.0 as per BIS, but all the four samples tested had a pH of above 7 indicating mild alkalinity. The minimum amount of acid insoluble ash value that is acceptable for muffins according to the Bureau of Indian standards (2010) is 0.1g but all the four samples including the control did not have any insoluble ash. This indicates the absence of extraneous matter such as mud, dust, s& in the raw materials used for the muffin preparation. The control samples had the least crude fibre of 0.32g (table 11) but as the level of incorporation of dates & walnuts increased there was a gradual increase in crude fibre content of muffins from 0.40 (DM<sub>3</sub>) to 0.60 per cent (DWM<sub>5</sub>). However all variations except DWM<sub>5</sub>'s crude fibre was within the BIS limit of 0.5 per cent..

#### Sensory & quality analysis of cookies:

Figure 3



All the date cookies excluding the control had almost a similar score with 80 per cent for DC<sub>3</sub> & 81 per cent for both DC<sub>4</sub> & DC<sub>5</sub>. In walnut cookies WC<sub>3</sub> received the highest score of 85 per cent & the other two variations were below 80 per cent. In the case of dates & walnut cookies, all the three were ranked good. From the above figure-3; it could be understood that dates separately or in combination with walnuts improved the acceptability of cookies, however when walnuts were added separately only 30 per cent incorporation seems to be ideal for cookies and any further increase in percentage of walnuts deteriorates the cookies' acceptability.

Table 2. Quality parameters of highly acceptable cookies

Criteria	Moisture (g)	Acid insoluble ash
BIS*	5.0	0.05
Control	1.61	0.02
DC <sub>5</sub>	1.60	0.02
WC <sub>3</sub>	1.57	0.04
DWC <sub>5</sub>	1.0	0.02

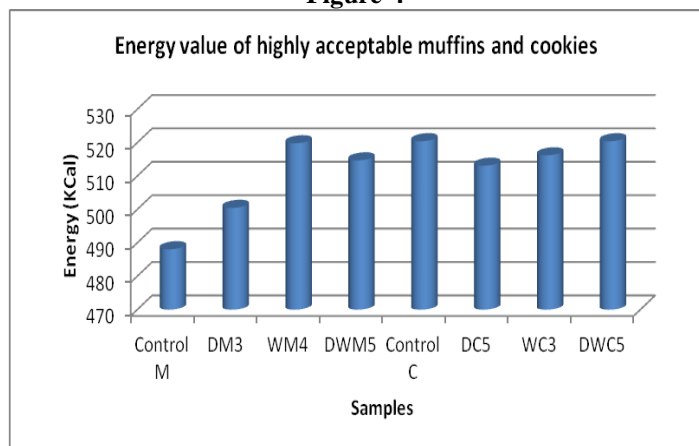
\*Bureau of Indian standards (2010)

The cookies that were “highly acceptable” had a moisture content that ranged from 1.0 (DWC<sub>5</sub>) to 1.61 (Control). Although moisture of up to 5g% is permitted according to BIS (2009), all the four “highly acceptable” samples (control & three variations) had their moisture well below the permissible level. The “Acid Insoluble Ash” for the “highly acceptable samples” was very much within the BIS (2009) specifications. WC<sub>5</sub> had marginally more acid insoluble ash (0.04g %) compared to that of other samples that had 0.02g% only. Presence of acid insoluble ash indicates the necessity for stringent quality assessment of raw ingredients.

#### Nutrient analysis of muffins & cookies:

Energy is obtained from all the macronutrients with the help of micronutrients consumed through the food ingested.

Figure-4



Off all the muffins (Figure 4) WM<sub>4</sub> had the highest energy (519 Kcal) followed by DM<sub>3</sub> (500 Kcal) & DWM<sub>5</sub> (520 Kcal) & the least energy value (488 Kcal) was obtained for control muffin. In the case of cookies, the energy value was the same for both control & DWC<sub>5</sub> (520 Kcal) & it was the highest followed by the other two variations viz WC<sub>3</sub> (516 Kcal) & DC<sub>5</sub> (513 Kcal).

Table 4. Nutrient content of highly acceptable muffins & cookies

Nutrients	Carbohydrate (g)	Protein (g)	Fat (g)	Iron (mg)	Phosphorus (mg)	Calcium (mg)
<b>Criteria</b>	<b>Muffins</b>					
Control M	48.8		26.9	0.20	8.0	171.0
DM <sub>3</sub>	47.0	171.0	28.9	0.28	5.60	192.6
WM <sub>4</sub>	44.6	192.6	32.1	0.30	10.03	195.0
DWM <sub>5</sub>	47.0	195.0	30.1	0.40	12.0	204.0
<b>Criteria</b>	<b>Cookies</b>					
Control C	69.8	17.5	20.0	1.80	8.0	17.5
DC <sub>5</sub>	71.6	53.5	18.9	2.0	11.03	53.5
WC <sub>3</sub>	71.45	35.5	19.0	2.0	12.0	35.5
DWC <sub>5</sub>	72.2	50.5	18.9	2.20	9.02	50.5

It could be observed from the table 4 that the carbohydrate of all variations of muffins is lower than that of cookies. According to USDA National Nutrient Database (2000), the carbohydrate content for standard muffin is 58.14g/100g. In the present study all the variations of muffins including the control has a lower carbohydrate content compared to the above quoted standard of 58.14g/100g. The cookies of the present study had the double carbohydrate content compared to the USDA database of 34.50g/100g. Value added cookies had more carbohydrates than control.

A muffin should contain approximately 8.8g/100g of protein as per USDA database (2000) & would rise up to 12g/100g if enriching food fortificants are added. In the present

study DWM<sub>5</sub> (6.63g) was found to have the highest amount of protein followed by DM<sub>3</sub> (6.12g) but the protein content is much below the USDA value quoted above. In the case of cookies, compared to that of the USDA Nutrient database value (6.2g/100g) all the cookies had higher protein content. The control cookie had the highest protein content (8.02g/100g) followed by DC<sub>5</sub>, WC<sub>3</sub>, DWC<sub>5</sub> varieties which had similar values.

According to USDA (2000) recommendations muffins per 100g would contain approximately 26.2g of fat. In the present study the muffins had either the same or a little higher fat content. WM<sub>4</sub> & DWM<sub>5</sub> obtained the higher fat values of 32.08 & 30.10g. In the case of cookies, control cookie obtained the highest fat content (20.0g) compared to the value added variations. All the cookies fat content was much above the reference standard (USDA, 2000) of 18.6g/100g.

Higher iron values were obtained for cookies than the muffins. Among the muffins the highest value was observed for DWM<sub>5</sub> (0.40mg/100g) followed by WM<sub>4</sub> (0.30mg/100g) & DM<sub>3</sub> (0.28mg/100g). In the case of cookies DC<sub>5</sub> (2.2mg) had the highest value while WC<sub>3</sub> & DC<sub>5</sub> had same iron content of 2.0mg. Control cookie had the least iron content of 1.8mg per 100g.

From table 4 it is clear that of all the muffins DWM<sub>5</sub> had the highest phosphorus content (12.0mg) followed by WM<sub>4</sub> (10.0mg) & control (8.0mg). The least phosphorus content was observed in DM<sub>3</sub> (5.6mg). In cookies all the three variations of cookies had quite a good amount of phosphorus compared to that of control cookie with WC<sub>3</sub> having the highest value(12.0mg).

Dietary fibre is considered as part of the carbohydrates in foods or the unavailable carbohydrates, that aid in digestion & maintenance of good health. All the four samples of muffins had almost the same value, except DWM<sub>5</sub> that had a little high fibre content. A similar trend was observed in cookies too. It was also noted that the fibre content of cookies was more compared to that of muffins.

#### Statistical analysis:

The P value indicates the level of significance. The ANOVA scores of following parameters of value added muffins were significantly different from that of control.

- Colour & appearance of date muffin, walnut muffins, date walnut muffins.
- Taste of date muffin & walnut muffin
- Flavour of date muffin & walnut muffin
- Overall acceptability of walnut muffin & date walnut muffin.

However, the **texture** of walnut muffin, date walnut muffin, **taste & flavour** of walnut muffin & **overall acceptability** of date muffin were not significantly different from that of control. The ANOVA scores for colour & appearance, taste, flavour & overall acceptability of date cookies were higher than the P value. This indicates that they are significantly different from that of control. All the five parameters ANOVA scores for walnut cookies were lower than the P values & this shows that the value added cookies are not significantly different from that of control.

#### Cost effect ratio:

The cost of control muffins was Rs. 39.79. On value addition with either dates, walnuts or together the raise in cost was between 23 paise to 38 paise. The enhancement in iron content ranged from 0.64mg to 1.49mg/100g. Likewise, the increase in phosphorus content was between 9 and 91.2mg/100g. And that of calcium ranged from 21.6mg to 33mg.

The cost of control cookies was Rs. 22.25. Enhancement in cost of value added cookies with dates, walnuts or a combination of dates & walnuts was between 45 paise to 70 paise. The increase in iron content ranged from 0.47mg to 2.19mg/100g. Similarly, while the increase in phosphorus content was between 15mg to 68.4mg, the increase in calcium content was from 18mg to 36mg/100g.

**Conclusion:**

Cookies and Muffins which are available in the market now are mainly calorie rich however these could made micronutrient rich with the addition of dates and walnuts without appreciable increase in cost.

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