

PREPARATION OF KHAPLI WHEAT FLOUR JAGGERY MUFFINS

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Abstract

Emmer or Khapli Wheat flour has been commercially cultivated in the Indian Subcontinent since ancient times. The long-grain wheat, locally known as khapli wheat, is ground to produce khapli wheat flour, which is then used in the preparation of KWFJ (Khapli Wheat Flour Jaggery) Muffins. The muffins were developed by replacing maida with khapli wheat flour using different formulations: Control sample (T0: Maida 100%, KWF 0%), (T1: Maida 75%, KWF 25%), (T2: Maida 50%, KWF 50%), (T3: Maida 25%, KWF 75%), and (T4: Maida 0%, KWF 100%). Jaggery was added in place of sugar, while other ingredients were kept constant. Sensory evaluation was conducted for all prepared samples, revealing that T4, with Maida 0% and KWF 100%, was preferred the most by the panelists. Proximate analysis of T0 and T4 showed the following results (in percentages): Moisture (%) 21.46, 24.2; Fat (%)30.46,30.45; Ash (%) 1.18, 1.10; Protein (%) 8.86, 7.48; Crude Fiber (%) 0.39, 0.35; Carbohydrate (g/100g) 37.65, 36.42; Energy (kcal/100g) 460.18, 449.65, respectively. Microbiological analysis, including Total Plate Count (TPC) and Yeast and Mold Count (YMC) for T0 and T4, indicated that the T4 sample is safe for consumption within 15 days, with a count of <60 cfu/g. Over the 15-day storage period, proximate analysis and the sensory evaluation chart's overall acceptability for the T4 sample decreased. Therefore, it is concluded that KWFJ muffins are nutritionally beneficial, but efforts should be made to extend their shelf life.

(**Keywords-** Emmer or Khapli wheat, Khapli Wheat Flour Jaggery (KWFJ) Muffins, Maida, Jaggery)

1. Introduction

The words "muffin" originates from the French word "moufflet," which means soft bread, or from the German word "muffe." Because they don't contain yeast, muffins are referred to as quick breads because they don't require the full amount of time needed for kneading, rising, and resting. Compared to yeast breads or cakes, quick breads have received less research attention, making their preparation more of an art than a science (Griswold, 1962). There are numerous types of muffins, including low-fat and flavors with added ingredients like chocolate chips, raspberries, cinnamon, pumpkin, dates, nuts, lemons, bananas, oranges, peaches, strawberries, almonds, and carrots. Muffins are reasonably priced and well-liked in specific regions. Some organizations have taken advantage of this and established stellar reputations for themselves (Walman, 1972).

People have become more prone to health-related disorders like obesity, diabetes, and other heart-related ailments as a result of eating this way, but it is also impossible to ignore people's desire and liking for foods like desserts, sweet baked goods, confections, etc., as society grows wealthier and more people work in white collar jobs with almost

sedentary lifestyles. These factors have made it necessary to replace these high-calorie sugars with jaggery and maida with another flour i.e. Khapli wheat flour (Lamdande 2018).

Recent food crises have caused consumers to look for more authentic and safer foods. Organic food production is widely recognized as being friendlier to the environment, more controlled, better for animal welfare and human health (Rembiałkowska, 2007). Cultivated emmer wheat (*Triticum dicoccon* Schrank) is one of the oldest crop in the world and has been a staple crop over millennia (Zohary and Hopf, 1993; Nesbitt and Samuel, 1996; Damania, 1998). The move in recent years toward more natural foods and sustainable agriculture and the rediscovery of ancient foods and flavours have brought renewed interest in hulled neglected species. Emmer wheat, a minor cereal today, should know a new development due to the nutritional value of its grain, the special taste of its products, and its characters of resistance to pests and disease. Limited data are available on the contents and compositions of chemical and nutritional value of ancient wheat, specifically of emmer wheat. Nevertheless, the data that are available show that emmer wheat differs from

modern wheat species in some components. The low glycaemic index value and high satiety value of emmer wheat make it particularly suitable for special diets, e.g. diabetes. Čurná (2017).

Therefore, in this study, our objectives were to optimize muffins using different proportion of Emmer Wheat Flour, to analyze sensory evaluation and nutritional content of developed muffins and to perform storage study of developed muffins.

2. Materials And Methods

2.1. Materials

All-purpose Flour (Maida),Khapli Wheat Flour,Jaggery,Margarine,Egg,Baking Powder,Calcium Propionate,Vanilla Essence was brought from market.All other chemicals and equipment were available in D.Y. Patil Agriculture and Technical University,Talsande,Kolhapur.

2.2 Methods

2.2.1 Formulation of Muffins

Five distinct formulation of muffins were generated in this study. Control sample T0 was prepared according to the method described by Lamdande (2018). Muffins were prepared by adding different levels of KhapliWheat Flour and Maida (Table 1).

2.2.2 Preparation of Muffins

While making muffins, the liquid and dry ingredients were mixed separately. After that, the dry ingredients were mixed with the liquid mixture, and the batter was formed. After filling the muffin cup still 3/4th of the mould with batter, the muffins were baked at 180°C for 25-30 in a preheated oven.

2.2.3. Sensory Analysis

Semi-Trained panelists comprised of D.Y. Patil Agriculture and Technical University Professors conducted the sensory analysis for overall acceptability of product. Colour, Flavour, Appearance, Texture, Taste, and overall acceptability were the sensory evaluation parameters. Sensory evaluation was undertaken

according to the 9-Point Hedonic Scale (Lamdande 2018).

2.2.4. Proximate Analysis

Proximate analysis of Control sample (T0:- Maida 100%,KWF 0%); (T1:- Maida 75%,KWF 25%); (T2:- Maida 50%,KWF 50%); (T3:- Maida 25%,KWF 75%); (T4:- Maida 0%,KWF 100%) was carried out.Moisture content was determined using a Hot Air Oven.Fat content was determined by using Soxhlet Method(extraction in petroleum ether).Crude protein was determined by kjeldahl method (Digestion, Distillation,.Titration).Total ash was determined by using Muffle furnace i.e. Dry Ashing Method. Crude fiber was determined by using chemical process, the sample was treated with boiling dilute sulphuric acid, boiling sodium hydroxide and then with alcohol, under standardized condition.Total carbohydrate content was determine by difference method.Glutencontent,Weight of muffin was also determined.All these analysis was carried out under the conditions specified under FSSAI Manual. Determination of water absorption in Raw Material (Khapli wheat flour and Maida) was carried out under the conditions specified under AACC International Method(AACC 2000).

2.2.5.Texture Profile Analysis

Texture analyzer (Model TA- XT2i.), (Stable Micro Systems, Godalming, UK) was used for muffins texture analysis. Measurement was conducted using a 50 kg load cells and cylindrical aluminum probe 36 mm diameter. Max. 25% compression Force required for the muffins was recorded. The results were recorded as averages of three replicates.Texture determination of Hardness, Springiness, Cohesiveness, Gumminess, Chewiness, and Resilience of muffins were analyzed.

Table 1:- Formulation of muffins with different levels of Khapli Wheat Flour and Maida.

Ingredients	T0 (%) (Control)	T1 (%)	T2 (%)	T3 (%)	T4 (%)
Maida	100	75	50	25	-
Khapli Wheat Flour	-	25	50	75	100
Jaggery powder	84	84	84	84	84
Egg	84	84	84	84	84
Baking Powder	1.7	1.7	1.7	1.7	1.7
Margarine	84	84	84	84	84
Vanilla Essence	1.5	1.5	1.5	1.5	1.5
Calcium Propionate	0.3	0.3	0.3	0.3	0.3

Bold values are variables of Khapli wheat flour (KWF) and Maida. **T0**:- Maida 100%; **T1**:- Maida 75%, KWF 25%; **T2**:- Maida 50%, KWF 50%; **T3**:- Maida 25%, KWF 75%; **T4**:- KWF 100%.

2.2.6. Microbial Analysis

Total plate count (TPC) and Yeast And Mold Count was determined at 0th day, 5th day, 10th day, and 15th day of T4 sample and 0th day, 5th day, 10th day, 15th day and 20th day of T0 sample at room temperature. Muffin sample 25gm was aseptically weighed and placed in a PP bag. Five gram of the Muffin Sample was obtained (using a sterile knife and wearing sterile disposable hand gloves) and transferred into 9 ml of distilled water in a glass beaker. Thoroughly shake beaker. Serial dilution of the solution was done by transferring 1ml into 9 ml of distilled water up to 10⁻² dilution. For TPC . Pour about 12 ml to 15 ml of the plate count agar at 44 °C to 47 °C into each Petri dish. Carefully mix the inoculums with the medium and allow the mixture to solidify, by leaving the petri dishes to stand on a cool -horizontal surface. Invert the plates and place them in the incubator at 30°C ± 1°C for 72 ± 3 hr. For YMC Pour about 15 ml of the yeast extract dextrose chloramphenicol-agar medium. Carefully mix the inoculum with the medium and allow the mixture to solidify, by leaving the petri dishes to stand on a cool -horizontal surface. Invert the plates and place them in the incubator at 25 ± 1°C. After the specified incubation period, count the colonies on the plates, using the colony counting equipment, reported as log CFU/gm. (FSSAI 2016).

2.2.7. Storage study of final product

For Storage study of final product's microbial analysis, proximate analysis and sensory evaluation which include colour, taste, flavor, texture, appearance, overall acceptability was carried out for 15 days of T4 sample and 20 days of T0 sample. Sensory evaluation was done according to the 9-Point Hedonic Scale. Microbial analysis was carried out under laboratory conditions. (Bhos. 2019)

3. Results And Discussion

3.1. Analysis of Raw Materials

The Khapli Wheat flour and Maida used for the studies had 11.15% and 10.5% moisture, 1.95% and 0.8% ash, 1.29% and 0.98% fat, 11.2% and 13.75% protein and Gluten Percentage was 8.46 and 10.33% respectively results mention above are within the limits specified by FSSAI (2023).

3.1.1 Water Absorption

Water absorption of Khapli wheat flour and Maida was carried out under the conditions specified under AACC International Method. One significant factor that may impact the stability and durability of food is its moisture content. One way to gauge the degree of food safety is to look for the presence of water Kusnandaret. al. (2019). These findings were similar with those of Belcar (2021), who also noted the same results (Table 2).

Table 2:- Water absorption (Farinograph measurements) of KWF and Maida

Characteristics	KWF	Maida
Consistency [FU]	494.00±6.93	510.00±6.22
Normal water absorption [%]	66.30±0.90	57.50±0.93
Dough development time [min]	2.20±0.05	2.10±0.05
Dough stability time [min]	2.70±0.03	5.00±0.03
Resistance [min]	5.30±0.03	6.98±0.03
Degree of softening [FU]	92.00	100.00
Valorimetric value	49.00±1.80	56.00±2.20

3.2. Analysis of Muffins

3.2.1. Weight of muffin

Weight of the muffin was measured with the help of a weighing balance AOAC (2000). Different Trailweights were note down.1-2% weight was reduced of all the muffins during baking of muffins due to moisture loss.

3.2.2. Sensory evaluation of muffin

Semi-Trained panelists comprised of D.Y. Patil Agriculture and Technical University Professors conducted the sensory analysis for overall acceptability of product. Colour, Flavour, Appearance, Texture, Taste, and overall acceptability were the sensory evaluation parameters. Sensory evaluation was undertaken

Table 3:- Proximate Analysis of Muffins

Parameters	T0 (Control)	T1	T2	T3	T4
Moisture (%)	21.46±0.02	21.9±0.02	22.15±0.04	23.1±0.02	24.2±0.03
Ash (%)	1.18±0.03	1.03±0.02	1.1±0.02	1.13±0.01	1.1±0.03
Fat (%)	30.46±0.01	30.76±0.01	30.43±0.01	30.63±0.01	30.45±0.02
Protein (%)	8.86±0.02	7.46±0.04	7.25±0.03	7.39±0.02	7.48±0.03
Crude Fiber (%)	0.39±0.01	0.33±0.02	0.36±0.02	0.32±0.01	0.35±0.01
Carbohydrate (%)	37.65	38.52	38.71	37.43	36.42
Energy (Kcal/100g)	460.18	460.76	457.71	454.95	449.65

Values are the means of triplicates. (±) Figures are the standard deviation.

3.2.3. Texture Analysis of Muffins

Texture analyzer (Model TA- XT2i.), (Stable Micro Systems, Godalming, UK) was used for muffins texture analysis. Measurements were conducted using a 50 kg load cells and cylindrical aluminum probe 36 mm diameter. Max. 25% compression Force required for the muffins was

according to the 9-Point Hedonic Scale. On the basis of overall acceptability T4 was found to be best. It was found that increasing the amount of Khapli Wheat Flour, increases the acceptability of the muffins. The highest overall sensory score was obtained when khapli wheat flour was 100% addition level. T4 muffin had desirable smell, texture and taste. Therefore, T4 was selected for further analysis.

3.2.2. Proximate Analysis of Muffins

The Proximate Analysis of all Formulations (T0:- Control Muffin); (T1:- Maida 75%, KWF 25%); (T2:- Maida 50%, KWF 50%); (T3:- Maida 25%, KWF 75%); (T4:- KWF 100%), was presented in Table 3.

recorded. The results were recorded as averages of three replicates. Texture determination of Hardness, Springiness, Cohesiveness, Gumminess, Chewiness, and Resilience of muffins were analyzed and presented in Table 4.

Table 4:- Texture Analysis of muffins

Sample	Force (g)	Hardness (g)	Springiness	Cohesiveness	Gumminess	Chewiness	Resilience
T0 Muffin	410.28	476.71	0.859	0.640	305.071	262.029	0.267
T4 Muffin	1543.06	2165.10	0.762	0.517	1124.33	858.26	0.199

3.2.4. Microbiological analysis of Muffins

3.2.4.1. TPC (Cfu /g) of KWFJ Muffin at room temperature (28±2°C)

Control Sample was prepared i.e. T0 (Maida 100%, KWF 0 %). Table 4.6 gives details of Total Plate Count of Muffin. Table gives results about number of colonies at 0th, 5th, 10th, 15th, 20th and 25th day. The prepared Control sample was stored at room temperature. The colony appeared from 15th day of analysis. On 15th day numbers of colonies were 26 for 10⁰ dilution, on 20th day 42 colonies and 25th day 284 colonies respectively were counted. Hence, it was concluded that control sample has a shelf life of 20 days.

Khapli Wheat Flour Jaggery Muffins were prepared i.e. T4 (Maida 0%, KWF 100 %). Table 4.7 gives details of Total Plate Count of KWFJ Muffin. Table gives results about number of colonies at 0th, 5th, 10th, 15th and 20th day. The prepared KWFJ Muffins were stored at room temperature. The colony appeared from 10th day of analysis. On 10th day numbers of colonies were 24 for 10⁰ dilution, on 15th day 40 colonies and 20th day 290 colonies respectively were counted. The main reason for the spoilage of KWFJ Muffins was that it is a good source of carbohydrates and it has higher moisture content. Hence, it was concluded that T4 muffin has a shelf life of 15 days. The results of total plate count of the muffins were found to be within the recommended limits set by FSSAI (2016).

3.2.4.2. Yeast & mold count (Cfu /g) of KWFJ Muffin at room temperature (28±2°C)

Control Sample was prepared i.e. T0 (Maida 0%, KWF 100 %). Table 4.8 and Table 4.9 gives details of YMC of Muffin. Table gives results about number of colonies at 0th, 5th, 10th, 15th, 20th and 25th day. The prepared Control Sample T0 was stored at room temperature. The colony appeared from 10th day of analysis. On 10th day number of colonies of yeast and mold were 12,5 and 18,8 for 10⁻¹, 10⁻² dilution respectively, on 15th day number of colony of yeast and mold were 20,12 and 30,16 for 10⁻¹, 10⁻² dilution respectively, on 20th day number of colony of yeast and mold were 40,20 and 54,40 for 10⁻¹, 10⁻² dilution and on 25th day number of colony of yeast was too numerous to count. On 25th day number of colony of mold

were 88 and 72 for 10⁻¹, 10⁻² dilution. Hence, it was concluded that control sample has a shelf life of 20 days.

Khapli Wheat Flour Jaggery Muffins were prepared i.e. T4 Maida 0%, KWF 100 %. Table 4.9 and Table 4.10 gives details YMC of Muffin. Table gives results about number of colonies at 0th, 5th, 10th, 15th and 20th day. The prepared KWFJ Muffins were stored at room temperature. The colony appeared from 10th day of analysis. On 10th day number of colony of yeast and mold were 15,7 and 10,8 for 10⁻¹, 10⁻² dilution respectively, on 15th day number of colony of yeast and mold were 30,22 and 25,17 for 10⁻¹, 10⁻² dilution respectively. And on 20th day number of colony of yeast was too numerous to count. On 20th day number of colony of mold were 80 and 69 for 10⁻¹, 10⁻² dilution. Hence, it was concluded that T4 muffin has a shelf life of 15 days. The results of yeast and mold count of the muffins were found to be within the recommended limits set by FSSAI (2016).

The majority of microbiological spores are destroyed during cake baking. Still, some spores may live Bryan *et. al.* (1997), and during the cooling and packing processes, post-baking contamination may happen Doulia *et. al.* (2006). Therefore, Microbial Analysis was concluded that the T4 muffin was edible till 15th day. It shows mold growth increases rapidly, which makes it non-edible. Hence, the study says that the T4 KWFJ muffins Shelf life is 15 days.

3.2.5. Storage study of final product

Sensory evaluation of KWFJ Muffins (T4) was done for the attributes namely colour, Texture, Taste, Appearance and Overall acceptability. Evaluation was done on the basis of 9 point hedonic scale. Control sample (T0)'s sensory evaluation was also done. The sensory evaluation during storage was done for over 20 and 15 days at room temperature of Control sample (T0) and KWFJ Muffins (T4) respectively. (Table 5 and Table 6)

3.2.6. Proximate analysis of KWFJ Muffins during storage

Moisture content in muffins typically decreases over time during their shelf life due to factors like water loss and staling. This can result in muffins

becoming drier and less fresh with time during storage. These findings were similar with those of Lamdande (2018), who also noted a decrease in moisture content. The fat content in muffins generally does not increase during their shelf life.

Instead, it's more common for the fat content decrease slightly over time. Factors such as oxidation lead to a gradual degradation of fats in baked goods, which result in changes in flavor and texture.(Table 7 and Table 8).

Table 5:- Sensory evaluation of Control Sample (T0) during storage at room temp. (28±2⁰C)

Days	Colour	Flavour	Appearance	Texture	Taste	Overall Acceptability
0 th	9	8.7	9	8.6	9	8.8
5 th	8.8	8.4	8.9	8.5	8.9	8.5
10 th	8.6	8.3	8.6	8.4	8.3	8.4
15 th	8.4	8	8.6	8.4	8.1	8.4
20 th	8.2	7.9	8.2	8	7.9	8.1

Table 6:- Sensory evaluation of KWFJ Muffins (T4) during storage at room temp. (28±2⁰C)

Days	Colour	Flavour	Appearance	Texture	Taste	Overall Acceptability
0 th	9	8.6	8.9	8.8	9	8.9
5 th	8.7	8.4	8.6	8.6	8.8	8.6
10 th	8.5	8.1	8.2	8.3	8.5	8.3
15 th	8.2	7.9	8	8	7.9	8.0

Table 7:-Proximate analysis of Control Sample (T0) during storage at room temp. (28±2⁰C)

Days	Moisture (%)	Fat (%)	Protein (%)	Carbohydrate (%)
0 th	21.46	30.46	8.86	37.65
5 th	21.42	30.4	8.84	37.77
10 th	20.3	30.1	8.82	39.21
15 th	20.1	29.85	8.8	39.68
20 th	19.82	29.46	8.79	40.36

Table 8:- Proximate analysis of KWFJ Muffins (T4) during storage at room temp. ($28\pm 2^{\circ}\text{C}$)

Days	Moisture	Protein	Fat	Carbohydrates
0 th	24.2	7.48	30.45	50.8
5 th	23.98	7.45	30.4	30.22
10 th	23.5	7.42	30.33	74.3
15 th	22.3	7.38	30.1	17.27

4. Conclusion

On the basis of research work, following conclusion have been drawn. The use of 100% date Khapli Wheat Flour in muffins not only improved sensory attributes but also contributed to a distinctive flavor and texture, making it a potential choice for consumers seeking unique and healthier baked goods. The superior nutritional quality of the T4 muffin, as compared to other trials, can be attributed to the inherent qualities of Khapli wheat, such as higher protein and fiber content. This indicates that Khapli wheat can be a valuable ingredient for enhancing the nutritional profile of baked products. The extended shelf life of up to 15 days at room temperature highlights the practicality and feasibility of incorporating Khapli Wheat Flour into muffin production. This could have positive implications for commercial production and distribution, and ensuring product availability for a longer duration. The results of this study suggest that Khapli Wheat Flour has the potential to not only create delicious and nutritious muffins but also offers a solution for enhancing the overall quality and shelf life of bakery products.

5. References

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