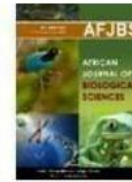


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## Research Article

# Nutrient Analysis and Sensory Evaluation of Ghee Residue and Whey Water Fortified Buckwheat Biscuits

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## Abstract

The entitled product “Nutritive analysis and sensory evaluation of ghee residue and whey water fortified buckwheat biscuits” is carried out for the development of nutritive and protienous snack. By utilizing ghee residue, it is a rich source of fat and proteins, milk sugars, flavouring properties and antioxidant properties. Buckwheat flour is naturally a kernel from flowering plant which is known as the most common millet. It is gluten free and it is an excellent replacement of all-purpose flour. It is good source of fiber and energy. And whey water is used for replacement of water which also increases the quality and nutritive value of the product. This product has sustainable development goals, to reduce global wastage in food and provide healthy diet alternative for people with malnutrition, coeliac disease, and diverticular diseases. To make an impact on developing sustainable food towards health and development of food industry, this product increases immune health, aids digestion, promotes heart health, eye vision and provides instant energy. The proper formulation of this sustainable product to enhance sensory and nutritive value is done by T1, T2, T3 trails and T3 is well satisfied in all aspects. The developed and finalized product is evaluated for physio-chemical, textural, functional and sensory attributes.

**Keywords:** Ghee Residue, Buckwheat Flour, Whey Water.

## Introduction

There are several ready to eat products, this product is developed based on its characteristics and health benefits. It is developed by the utilization of byproducts in the dairy industry which reduces the waste and also provides healthy and tasty food product. In industries byproducts are mostly used for cattle feed, biomass and if there is more production then some energetic drinks are manufactured by using whey water. The residue obtained for this developed product is from unsalted and pasteurized cooking butter. Ghee residue is the byproduct of dairy industry where ghee is manufactured. Ghee residue is often used a cattle feed in many industries due to its potential applications. Ghee residue has many health benefits which are unrecognized by many people. It has high nutritive value, proteins and phospholipids, calcium. Ghee residue is made from boiling of cream/butter. It is often assumed as waste and ghee residue is not utilized properly considering its health benefits and the amount of wastage occurring in households and many industries. Ghee residue has rich source of fat and protein and also a good human dietary supplement, aiding digestion, improves eye vision, natural antioxidant properties because it has both lipid and non-lipid constituents. It also has anti-cancer properties. It strengthens bones and provide required amount of energy to the body. Ghee residue also acts as flavor enhancer. It increases the product shelf life and the taste, texture, aroma and flavor of the product. It totally enhance the sensory appeal of the product. Vanaspati can be replaced by ghee residue. Compared to vanaspati ghee residue has many beneficial facts and also cheaper as vanaspati as the ghee residue can be obtained from preparation of ghee. Ghee residue has many compatible benefits in baked foods. As it increases the sponginess in cakes, muffins and also good for enhancing the proper brown colour to the baked products. 30-40% of ghee residue can be consumed according to the RDA and based on other study papers.

Ghee residue is rich source of minerals. It has both food applications and non-food applications, it increases the product quality and the flavor, it is a good flavor enhancer than ghee. It is beneficial for eye health as ghee itself contains vitamin A, D, E and K which supports overall health and eye health, ghee residue also contains such vitamins helps improve eye sight. Due to its components in fat it aids in good digestion as butyric acid which helps in nourishing of gut lining and good absorption of nutrients, it has anti-inflammatory properties which can reduce (IBS) irritable bowel syndrome. Enhances digestive enzymes and promote gut health as the components in ghee residue helps in growth of healthy bacteria which is crucial for well-functioning of overall gut health. Ghee residue is used as bio-mass for plant growth which balances the soil and helps in healthy growth of plants. Ghee residue is beneficial for many applications. Buckwheat flour is being used in this product as a healthy substituent to the maida. Buckwheat has many health benefits and advantages, it is used in preparation of bread, chapati and cookies. Jaggery and dates honey is being used as healthy alternative sweet enhancers for the product. Whey is the liquid byproduct of dairy products as panner and cheese. The preparation of these products during curdling process, whey water is produced. In both preparations the whey water tends to vary in composition and nutritive value.

The sustainability of the product has many aspects in developing a healthy ready to eat product and reducing the wastage and utilizing the byproducts based on their nutritional facts and benefits. These sustainable products are useful to the people with malnutrition and it is a healthy alternative snack which also provides instant amount of energy that is required. This product provides energy required for a day, boosts immune system health and aids in better digestion as it improves the gut health, the flour we use is good for heart health and it helps strengthen bone calcium, it is good for diabetic people and for lactose intolerant people. It has to be noted that this product is made from whey and ghee residue from cooking butter where lactose is removed during processing. Some people with very sensitive lactose intolerance should be careful as even a small amount which is consumable for lactose intolerant people might harmful for high sensitive lactose intolerant people and it is completely gluten free product which makes it a healthy alternative for people with celiac disease. It increases eye vision, and the fiber content helps in controlling of blood sugar levels, it helps in managing of weight loss, lower cholesterol. It also has anti-cancer properties which makes it more beneficial to the overall body health

and also helps in liver detoxification and prevent anemia. It is gluten and grain free product. The development of this product helps in reducing the wastage and develops more byproducts forms byproducts. Usage of the raw materials in proper compositions makes the product beneficial to human health with many advantages. The utilization of byproduct in proper way with proper study and right composition is crucial to develop a sustainable food product.

## **Materials and Methods**

### **Raw materials:**

The raw materials used in the preparation of the fortified biscuits are ghee residue, whey water, buckwheat flour, dates honey, jaggery, salt, cardamom powder, baking powder.

### **Ghee residue:**

Ghee residue is prepared from curdling process of milk in manufacturing of panner and cheese. Ghee residue has many health benefits, it contains milk solids, proteins, fats, vitamins, minerals and has the ability to enhance flavor and shelf life. It has anti-cancer properties, aids digestion and provides healthy eye health and energy. It has calcium which strengthens bones health. It also improves sensory appeal of the product.

### **Whey water:**

Whey is the liquid byproduct of dairy products as panner and cheese. The preparation of these products during curdling process, whey water is produced. In both preparations the whey water tends to vary in composition and nutritive value. Whey is well known for its high amount of protein content and many dairy industries use whey by infusing it in energetic drinks or making whey protein powders. Whey water is used as water substitute based on their nutritional values. Whey is rich in protein, lactose, vitamins and minerals. Whey is beneficial for gut health as whey acts as probiotic. As buckwheat is used to make the product gluten free but adding of whey may cause harm to lactose intolerant people but according the studies lactose intolerant people can consume upto 8 ounces of lactose. And these being the parameters doesn't affect any lactose intolerant people. Whey water is mostly used in drinks, smoothies, baking, cooking and as protein powder. Whey has many health benefits and also reduces wastage.

### **Buckwheat flour**

Buckwheat flour is being used in this product as a healthy substituent to the maida. Buckwheat has many health benefits and advantages, it is used in the preparation of bread, chapati and cookies. Buckwheat is another pseudocereal that is a plant based source of complete protein. It is most common type of millet being used mostly in Gujarat. Mostly used during navratri festival. In India buckwheat is called "kuttu", buckwheat has the most nutty and earthy flavor. It is a gluten free and grain free millet which makes it more healthy and excellent source of alternative for people with celiac disease and diverticular disease. It is also easy to digest. The another name for buckwheat is "beech wheat". Buckwheat has high protein, fiber, which provides required amount of energy to the body. It is a immunity booster, good for weight loss, heart health and rich in minerals. It is highly recommended alternative for maida and gluten free products, as it has many health benefits.

### **Dates honey and jaggery:**

Jaggery and dates honey is being used as healthy alternative sweet enhancers for the product. Which are good for liver detoxification, improve digestion and prevent anemia. Jaggery has more nutritious value than refined white sugar. Jaggery contains high amount of sucrose, iron, fiber, minerals. Whereas dates honey contain magnesium, potassium and other vitamins and minerals, B6, it provides energy and improves the taste, texture, consistency of the material. It also has natural anti-oxidants which is polyphenol. It has good amount of fiber content. These both are used as natural and healthy sweeteners and for a balanced taste and flavor and texture.

**Salt and baking powder:**

Salt is taste enhancer and helps in balancing of flavors, moisture and yeast. Salt lockdown the moisture level present in product and provide shelf life. It balances all the flavors and gives good taste and aroma to the product. Salt is used to many food products such as chocolate milk it balances and gives extra kick to the flavor which makes it more delicious and tasty and baking powder, it helps to raise the dough and attain good texture to the product gives colour and texture to the product. The dough raise is important for the product if not texture would be hard and flat. Good raise of the dough gives good texture, colour and taste to the product. Baking powder is used in many baking products such as cakes, cookies, muffins, biscuits, baking powder gives the soft and sponginess to the product which are crucial. Proper leavening is important for product. If baking powder is added excess than required quantity it effects the taste, texture total sensory appeal of the product.

**Cardamom powder:**

It is known a famous Indian spices used in other dishes but used mostly in sweets, cakes. It has a flavorful aroma and taste. Cardamom powder is used for enhancing of flavor for the unique blend in flavors, aroma. It gives a sweet taste and elevates the product. Cardamom is known for its flavor also for digestive benefits which can make biscuits not only tasty and flavorful but also-easy for digestion.

**Methodology:****Procedure for incorporating ghee residue and whey water in the preparation of fortified buckwheat biscuits:**

1. These biscuits are prepared by using nutritive ingredients, to prepare them take a bowl and add required compositions of buckwheat flour, ghee residue, jaggery, honey, pinch of salt as it balances the flavours and also add cardamom powder.
2. We add required amount of baking powder along with whey water, mix the dough properly and leave it for 5 to 10mins until it gets the right consistency.
3. We tried repeating different methods but finalized a method with different compositions each time and prepared to find out the best value and quality product.
4. And roll the dough horizontally and cut into tiny pieces using knife and make the small pieces into required shapes to make biscuits of your desired shape. You can design them by using different kitchen tools such as spoon, fork, knife.
5. Now, pre-heat the oven for 180°C for 10mins, in convention mode by inserting a steel stand.
6. Take a plate and apply butter to it or place a butter paper in the plate, you can also use ghee in replacement of butter if needed.
7. Place the shaped biscuit dough on the plate and keep it on the stand with the same mode for 15mins until it reaches brown colour.
8. In the meantime of baking you can sense aroma of the biscuits and after 15mins take out the biscuits and let it set to the room temperature.
9. Now, you can enjoy delicious and fiber rich biscuits.



**Figure 1.** Fiber rich biscuits.

**Table 1.** Formulation of developed product.

<b>Ingredients</b>	<b>T1</b>	<b>T2</b>	<b>T3</b>
Buckwheat flour	160g	100g	200g
Ghee residue	7g	6g	12g
Jaggery	15g	20g	28g
Dates honey	3tbsp	5tbsp	5tbsp
Baking powder	2g	2g	2g
Cardamom powder	1g	2g	2g
Salt	2g	1g	2g

**Formulation:**

The formulation of dough is crucial part of the product. Buckwheat flour has unique properties compared to the other refined flour. With addition of ghee residue and whey water it is important to balance the texture and composition of the product. The application of various ingredients according to the RDA makes it difficult to formulate but essential to develop nutritive product. It has various ingredients and various properties and characteristics, balancing and formulating is necessary.

**Water absorption:**

Water absorption of buckwheat flour is high compared to other refined flours. The water absorption capacity OF buckwheat flour is (66.0%-69.3%). Consistency of dough is based on the water absorption in the evaluation of 4 trails the moisture absorption plays a vital role. In 4 trails 1<sup>st</sup> trail wasn't applicable in the method or in formulating due to high moisture content and it decreased the shelf life of the product and the sensory attribute levels are low compared to the other 3 trails.

**Consistency of dough:**

The consistency of dough is important as it finalizes the overall product texture. 160, 100, 200gms are taken in trails of 3 in flour and ghee residue to 7, 6 and 12gms each time jaggery 15, 20, 28gms each time and other ingredients are taken accordingly every ingredient plays a role in matter of consistency. Water absorption is the main base of the product. Proper mixture and shaping is necessary. The consistency should be thick but soft enough for shaping and preparing biscuits. If there is any stickness in dough it doesn't give proper results as the moisture remains high and texture turns out be soft inside, which also reduces the shelf life.

**Swelling capacity:**

Buckwheat flour usually doesn't have any fermenting capacity as other refined flours. It takes upto 3 days to ferment naturally as other flours take upto an hour or day. The swelling capacity in shaped dough is considerable as the texture attributes are fine and similar to cookies and biscuits. Ghee residue and dates honey provide good texture and consistency to the product. Ghee residue helps in flavor, texture and colour of the biscuits.

**Analytical methods:**

The characteristics of developed product is analyzed by physical and chemical properties, the product undergoes with crude fiber, ash, moisture, protein, carbohydrates for analysis in all T1, T2, T3 trails with different compositions they vary in analysis result. Proper developed product is analyzed by sensory attributes and its functional characteristics.

**Physio-chemical analysis:****Moisture content:**

Moisture content in the product can be measured by using hot air oven method in a TS analyzer. This method provides accurate and consistent results by drying the sample to constant weight.

$$\text{Moisture content} = \frac{b-c}{a} \times 100$$

**Fat:**

The fat content can be determined by using gerber method, which is widely used in the dairy industry.

$$\text{Fat percentage} = \frac{\text{weight of fat}}{\text{initial weight of the sample}} \times 100$$

**Protein:**

Protein content can be measured by using Kjeldhal method

Protein can be calculated by using the following

$$\text{Protein content (\%)} = \frac{(N \times 6.25) \times 100}{w}$$

**Ash:**

The ash content can be determined by using muffle furnace method

**Carbohydrates:**

The carbohydrates content can be determined through Fehling solution

**Fiber:**

Fiber content can be calculated by using

**Formula:**

$$\frac{\text{Final weight of sample}}{\text{weight of sample}} \times 100$$

**Result and Discussion****Proximate analysis for biscuits:**

The proximate analysis of the product is done in three trails

**Sensory analysis:**

The sensory analysis is done to evaluate the product by colour, appearance, flavor and taste, mouth feel, cooked note, after taste on the scale of 10.

**Table 2.** Sensory evaluation.

Sensory attributes	Control	Trail-1	Trail-2	Trail-3
Colour and appearance	8	7	9	9
Mouth feel	9	8	8	8
Flavor and taste	9	7	7	9
Cooked note	9	8	8	9
After taste	9	8	8	9

Hedonic scale: 9-Excellent, 8-Very good, 7-Good, 6-Slightly like, 5-Neither like nor dislike, 4-Dislike slightly, 3-Dislike moderately, 2-Dislike very much, 1-Dislike.

Majority of the evaluation value is done by Trail-3, considered to take as new product development sample according to the sensory evaluation results on scale of 10.

**Sensory characters of biscuits:**

Biscuits turned out to be dark brown in colour due to ghee residue and buckwheat flour characteristics.

**Table 3.** Physico-chemical analysis of ghee residue and whey water fortified buckwheat biscuits.

Nutrition	Control	Sample
Protein	13.7	10.6
Ash	2.0	1.7
Fat	31.03	18.26
Moisture	1.89	2.00
Fiber	3.00	2.36
Carbohydrates	50.23	51.34

### Conclusion

The formulated product is fiber rich and is combined with taste and health. These fortified biscuits offer a healthier alternative to conventional biscuits. Aligning with current trends in health conscious eating and sustainable food production, shelf life studies show that it can sustain upto 90days. Biscuits fortified with ghee residue and whey water has enhanced the sensory attributes of the product, indicates a positive reception from consumers, with improved taste, texture and overall acceptability. The unique combination of ingredients provided a distinctive flavor profile.

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