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Study on sugar-free cupcake

Rishabh Raj and Sury Pratap Singh

Abstract
Cupcakes are small loaves baked in thin paper or plastic bowls. As with the best loaves, icing and decorating are optional. A typical gorgeous woman employs basic elements such as fat, carbohydrate and flour (Sorghum crushing and Wheat crush into fine grains). The recipe works well for layer loaf that may be used to make cupcakes. Typically, muffin tins with a non-stick surface composed of metal, silicon rubber, stoneware or another material are used to bake cupcakes. Muffin tins typically contain six cups. A typical cup has a diameter of 3 inches (76mm) and can carry 4 ounces. Cupcake batter can be flavour-infused or have other ingredients like raisins, cherries and nuts included in. Wheat flour can be partially replaced by sorghum flour. Sorghum flour's particle size and shape frequently make baked goods like cakes and bread seem grittier. However, several non-gluten-free baked goods, such as flatbreads, cakes, muffins, cookies and biscuits have been produced using sorghum and wheat flour mixes. Gluten, non-starch polysaccharides and lipids are among the many different compounds found in wheat flour and they all have a significant influence on both the raw material's processability and the quality of the finished goods [15]. Large amounts of carbohydrate and other ingredients including proteins and lipids are present in wheat flour, which impacts the characteristics. Only (1% to 3%) of the wheat flour's overall composition is made up of lipids. Free and bound lipids are the two categories into which they may be divided [44].

Keywords: Cupcakes, sorghum, wheat, sugar-free, gluten-free

Introduction
A delectable baked good with a fluffy top known as a cupcake is created with sorghum and wheat flour. These have a great scent, sweetness and taste. The cupcake created with the inclusion of both wheat and sorghum flour had higher amounts of fat, protein, ash and calories than the control cake. Cakes are commonly served as kid food at birthday parties. It is a manufactured product with high levels of sugar and saturated fat that should only be consumed. The cupcake's origin and sensory attributes have an impact on its quality. Cakes are products made from mixtures including liquids such as milk or water and ingredients like wheat flour, sugar, eggs and fat or oil. Around the world, there are several regional variations on what a cupcake is. Cupcakes are widely used in baked goods in both small and large-scale companies. Both amateur and professional bakers like making cupcakes. They are little specialty desserts. Initially, cupcakes were only popularly consumed and recognized as a culinary item in western countries. However, when civilization is revived, they are becoming more important everywhere. Cupcakes come in a variety of styles and tastes, including strawberry, chocolate, vanilla and butterscotch [19].

Sorghum Flour
It can be difficult to obtain 100 per cent sorghum goods that are palatable when yeast is added because sorghum flour lacks the proteins that give wheat its viscoelastic properties. However, a range of baked foods, including flatbreads, cakes, muffins, cookies and biscuits, are made using sorghum and wheat flour combinations and include gluten. The amount of sorghum used to replace wheat flour depends on the quantity and quality of gluten present in wheat flour, what constitutes an acceptable cupcake, colour, flavour, aroma and any additional additives. Wheat flour can be partially replaced by sorghum flour. Sorghum flour's particle size and shape frequently make baked goods like cakes and bread seem grittier. Sorghum is a crucial crop for future human use due to the rising global population and diminishing water resources. While sorghum is an essential food crop for millions of people in some regions of Africa and Asia, it is largely used as animal feed in most affluent nations making it an underutilized resource [33].

Phytase activities

The phytic acid concentration of sorghum flours are decreased by (40-60%) during lactic fermentation. Calcium, Magnesium, Manganese and Iron are produced in stable molecules with great bioavailability by phytic acid. Microbial acidification solubilizes phytate complexes containing divalent cations in wheat and rye sour dough, promoting phytate hydrolysis by cereal enzymes [25].

Sorghum Health Benefits

Journal of Food Science: Sorghum flour is said to have compounds that lower cholesterol. Sorghum flour is a gluten-free food or a reliable flour substitute for people with celiac disease. Sorghum flour has a high antioxidant capacity because sorghum wax and its polyphenolic component are linked. These substances contain policosanols, which are crucial for maintaining healthy heart function and preventing cancer. Sorghum's protein and starch are more difficult to digest than those of other comparable foods. Those with diabetes can benefit greatly from its slow digesting because it has a very low glycaemic index [35].

Composition

Sorghum has large amounts of potassium and phosphorus. Only minimal amounts of salt and iron are present, but it has a considerable quantity of calcium. It has a lot of proteins, fibre and iron. Although all of the vitamin's B are lost during refining, sorghum is still a significant source of thiamine, riboflavin, vitamin B_6, biotin and niacin. Both millet and sorghum contain comparable mineral compositions. Potassium and phosphorus are the two main minerals in sorghum grain although calcium is scarce [35].

Wheat Flour

Most cakes and cupcakes are usually made using wheat flour, which includes a significant amount of starch. Gluten, non-starch polysaccharides and lipids are among the many different compounds found in wheat flour and they all have a significant impact on both the raw material's processability and the quality of the finished goods [15]. A major ingredient in baking items is wheat flour. Starch and other ingredients like proteins and lipids are abundant in wheat flour, which impacts the characteristics. Only (1% to 3%) of wheat flour's entire composition is made up of lipids. They fall into one of two categories: lipids both free and bound [44]. The majority of biscuits have wheat as their primary component and the growth of the biscuit business paralleled notable advancements in the science of grain milling. Wheat was crushed between stones to generate flour before roller milling was invented. This meal was difficult to extract the bran from, resulting in an abrasive black flour. The first roller flour mill was erected in Budapest in 1840, whereas Henry Simons developed the first one in Britain [20].

Glutenases

Wheat flour can be fermented with bacterial or fungal derived proteases that digest gluten, rendering it less toxic, may result in a modified flour texture. Glutenase digested wheat flour may also be mixed with other flour like millets etc, to improve its viscoelastic properties, palatability and other characteristics [42]. Wheat proteins come in at least 70 distinct varieties, but in order to evaluate their functioning they may be divided into four major categories based on how well they dissolve in different liquid mediums [26].

Table 1: Osborne fractions of plants and wheat proteins.

Serial number	Solubility	Plant protein fraction	Wheat protein fraction
1.	Water soluble	Albumins	Albumins
2.	Saline soluble	Globulins	Globulins
3.	Aqueous soluble	Prolamins	Gliadins
4.	Remaining soluble fraction	Glutelins	Glutelins

Source: [26].

Composition of white flour

Wheat flour containing wide variations in chemical composition and characteristics are measured in different values such as Starch: (74 - 86%), crude protein: (9 - 18%), ash: (0 -5%) and dietary fiber: (2.7 -7%). The influenced in harvest year it affects the ratio of soluble and insoluble non-starch polysaccharides, with spring wheat flours often having a greater ratio [34].

Outcome of storage temperature on quality of wheat flour

The Journal of Nutritional Sciences reports that under normal circumstances, wheat flour may be kept at temperatures between (27.5 °C to 37.5 °C) for periods of 3, 10, 20 and 30 days. relative humidity levels, chemical properties of the wheat including moisture content and the proportion of wet gluten, as well as physical qualities. From this experiment two more result shows that increasing storage temperature from 27.5 ˚C and 37.5 ˚C has conduct to decreasing moisture content of flour under storage relative humidity of (38% to 70%) expansion of storage period from 1 to 10 days to decrease in moisture content of flour and has increased the storage period up to 30 days [28].

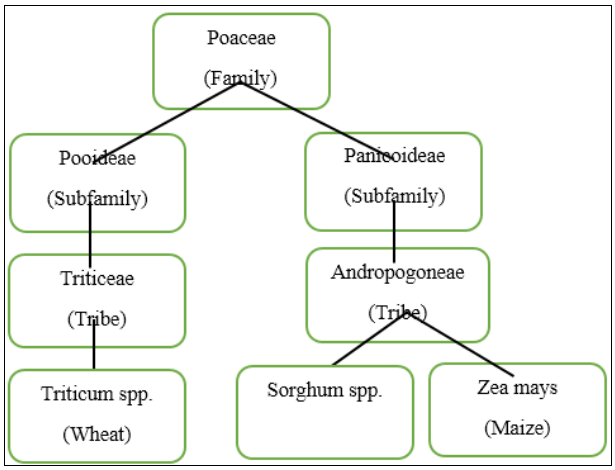
Germination and Temperature effect on sorghum flour

The nutritional and functional characteristics of sorghum flour that had through germination were evaluated and contrasted with sorghum flour that hadn't undergone germination. Sorghum was germinated for various lengths of time (12, 24, 36 and 48 hours) at different temperature (25, 30 and 35 ^{o}C). The content grain crude protein, fat, fiber and ash are negatively affected by germination. As the germination duration increased enzymatic starch modification was seen to reduce water absorption and swelling power and improve oil absorption capacity. In comparison to native flour, sorghum germination enhanced the gel consistency while decreasing the paste clarity. The longer germination time and temperature caused proteins to be altered by the activity of enzymes, greatly increasing the protein solubility of germinated sorghum flour and improving its foaming and emulsifying capabilities [45].

Classification of Sorghum

The fifth most produced cereal in the world is sorghum.

Sorghum is regarded as the most significant cereal in Africa, mostly produced in India, the United States, Australia and Argentina outside of Africa, where it is primarily utilized as animal feed. Under sorghum both bicolor and guinea are recognized. All combinations from those mentioned races are called intermediate races. Sorghum bicolor Moench is mainly cultivated [9]. Taylor asserts that there are many classifications for sorghum. Some of them like wheat and maize are complicated which shows that sorghum belongs to the grass family Poaceae. Sorghum is a member of the Andropogoneae tribe and the Panicoideae subfamily just as maize. Sorghum's phylogenetic tree modified in Taylor's opinion [52].



Structure of Sorghum

The structure of a sorghum kernel is comparable to structure of a corn kernel but in general, a sorghum grain is smaller both sorghum and maize have endosperm with a floury and a corneous part [4]. Sorghum field in Horsching Austria. However, the pericarp's colour is not necessarily a good indicator of how sorghum flour will look. A sorghum kernel, for instance has a light-coloured endosperm and a scarlet pericarp. To obtain proper food appearances sorghum fraction is therefore included together with particular food colour [38].

Nutritional Composition of Sorghum

Protein: The protein content in sorghum is comparable to content of wheat [16]. In sorghum protein is predominant fraction of prolamin, which is called kafirin. Research revealed that the glutelin fraction made up half of the sorghum protein (50.7%) followed by the albumin and globulin fraction (24.1%) and the kafirin fraction (18.8%). Sorghum proteins have received a lot of attention because of their capacity particularly when cooked [10, 51]. Sorghum proteins were not able to form complexes between each other but also has the ability to connect with tannins and tannic acids [55].

Carbohydrate: Amount of carbohydrates ranges between (67.5 - 76.4%) were found in different whole grain sorghum varieties from Ethiopia [50]. Starch is the main component of carbohydrate located in the endosperm [48]. Reported that starch content of (72.2% and 73.8%) in dry matter in white and red whole grain sorghum with amylose contents of (25.8% and 24.6%) respectively. Authors compared the fibre content in whole grain sorghum, dehulled sorghum and sorghum bran was found bran fraction had the highest value with 41.38 g/100 g followed by 26.34 g/100 g in whole grain sorghum and 11.53 g/100 g in hulled sorghum [27].

Fat: Whole grain sorghum content high fat about 3.5% compared to wheat (2% in whole wheat) [40]. Fats are located in the sorghum germ. The most common fatty acids are linoleic acid (18:2), oleic acid (18:1) and palmitic acid (16:0) with average contents of (43.86%, 37.98% and 13.07%) in refined sorghum flour [32]. The expandable storage time of sorghum flour from 15 days to several months by means of heat treatments [24]. The ratio of saturated to unsaturated fatty acids was found to be (0.27-0.37) [29]. Sorghum is known for having a valuable micronutrient profile [16]. Regarding the micronutrients, amounts of phosphorus ranged between 112.5-327.7 mg/100 g of sodium between 2.2-6.2 mg/100 g of magnesium between 62.0-207.5 mg/100 g and of calcium between 9.5-67.2 mg/100 g [50].

Starch: The characteristics of sorghum and corn starch are comparable. Sorghum starch granules are a little bit larger but have the same shape as the others. The swelling capacity and paste viscosity of the starch varies slightly in terms of rheological properties. Sorghum starch gelatinizes at a temperature between 71 and 80^{o} C, which is higher than the gelatinization temperature for corn starch which is between 62 and 72^{o} C [32].

Fiber: Sorghum has (6.5-7.9%) and fiber (86.2%) of which is insoluble. This fibre functions as both a structural and protective element. The pericarp of cereal grains is usually where one may find dietary fibre, which is made up of soluble and insoluble portions. Sorghum has insoluble fibers that are high in glucuronoarabinoxylan's. Compared to wheat, which possesses both soluble and insoluble arabinoxylans, barley is abundant in soluble b-glucans [33].

Lipids: The germ of the sorghum plant is where most of the lipids are found. These lipids' fatty acid makeup is quite close to that of corn oil. The following fatty acids in decreasing order of concentration, make up the majority of the sorghum oil: linoleic, oleic, palmitic, stearic, myristic and hexadecenoic.

Production of Sorghum in India

Sorghum is India's third-largest crop producer after rice and wheat. In 2014-15, sorghum was cultivated on 6.16 million hectares producing 5.45 million tonnes in total. According to the 4th advance estimates 5.65 million hectares were planted with sorghum in total in 2015-16 and 4.41 million tonnes were produced overall. The majority of India's sorghum is produced in the state of Maharashtra. Maharashtra produced up to (40.90%) of the nation's total sorghum output in the fiscal year 2013–14, according to the Government of India 2016 followed by Karnataka (23.77%), Tamil Nadu (8.10%), Rajasthan (6.42%) and Andhra Pradesh (6.80%). In the state, high-yielding varieties of sorghum are grown on more than two million hectares of land or around 49.40% of the total area under cultivation. Sorghum is the second-largest producer after rice. Sorghum is largely farmed in Maharashtra during the kharif season. Maharashtra State's total sorghum output reached an all-time high in 1965-1966 at 2294.8 thousand tonnes before declining to 2109 thousand tonnes by 2014-15. A growth

trend study revealed that throughout the same time period the state's sorghum output climbed at a compound annual growth rate of (0.14%) [14].

Sorghum food products

The main cuisines that include sorghum are tortillas (Latin America), thin porridges like bouillie (Africa and Asia), stiff porridges like (West Africa), couscous (Africa), injera (Ethiopia), nasha and kisra. Sorghum may be used to make tortillas either on its own or in conjunction with maize and cassava. Traditional new-born porridge known as nasha is prepared from [33].

Effects of Sorghum in Baking Products

Bread: According to researchers, standard bread properties consisting of wheat-sorghum doughs up to maximum 40% wheat substitute with sorghum [29]. Researchers also described the decrease volume of bread where wheat flour was replaced by sorghum flour, which seemed to decrease gradually increasing in sorghum amount. Reduction of volume was detected after 15% sorghum addition by [9]. Researchers looked even higher sorghum-to-wheat ratios (30% and 40%). Additionally, to testing the physical characteristics of wheat-sorghum bread goods positive results from sensory trials were also found. In the study given loaves up to 30% sorghum were compared to control breads (100% wheat) in terms of flavour, texture and aroma [43].

Cake: Addition of 15% sorghum in wheat cake (made from flour, sucrose, baking powder, vanilla and water), induced no change in weight and volume of the products.

Biscuits: Due to the lack of gluten in sorghum dough, biscuits prepared from this grain have a comparable feel to those made from wheat. Using polarised light microscopy, it was demonstrated that the sorghum biscuits' starch granules are not gelatinized. Sorghum biscuits' breaking strength and brittleness rose as dough water was increased. However, increasing the proportion of pre-gelatinized sorghum flour in dough reduced the strength of the sorghum biscuits, indicating that starch gelatinization weakened the structure of biscuits and increasing the sucrose content in dough also increased sorghum biscuit strength [1].

Gluten-free

People with gluten sensitivity can only be treated with a gluten-free diet. Numerous gluten-related diseases including coeliac disease, dermatitis herpetiformis (the cutaneous manifestation of coeliac disease), gluten ataxia and non-coeliac gluten sensitivity are caused by consuming gluten this concept given by [3]. According to some accounts, gluten-free doughs and batters are more challenging to work with than their grain-based counterparts. They are also less cohesive and bendable and they have a weaker memory for holding vapours. According to the maker, these batters and doughs have a tiny volume, a pale coating, a brittle texture, a thick morsel structure, a bland, stiff flavour, very little nutritional value and a rapid rate of burn. As foundation flours because of their neutral flavour and lack of impact on baked goods, gluten-free flours include maize, potato, rice and starch. These flours and starches often have very little capacity for constructing structures and are generally poor in nutrients. Food scientists have provided evidence for the use of gluten-free ingredients like starches, hydrocolloids, proteins, enzymes, fat sources, faux cereals and sourdough [30].

Effect of sorghum on quality properties of gluten-free bread

Sorghum is milled to flour with different extraction rates (60%, 80% and 100%) and milled at different speeds no pin-milling, low-speed and high-speed to create flours of both variable compositions. The flour composition total starch content, particle size, distribution, colour and water absorption of the grains were all characterised. Specific volume, crumb structure and crumb stiffness were used to describe bread. In comparison to all other extractions and flour kinds breads made with 60% extraction of flour have greater specific volumes, better crumb characteristics and reduced crumb stiffness [54].

Gluten-free bakery and Pasta products (Alternative treatments)

To find out if sorghum flour could be used in gluten-free cake, it underwent a variety of heat treatments. In a micro-oven set at 95° C and 125° C the flour was dried for 15, 30 and 45 minutes. The peak and ultimate viscosities of the flour were assessed after heat treatment using a Rapid Visco Analyzer. The cakes made by heating flour at a higher temperature (125° C) for a longer length of time had the biggest volume and most cells per square inch [7].

Gluten free bread and bakery products

In baking technology, rye, barley and oats are significant derivatives of gluten a protein component from wheat. As more individuals throughout the world become gluten-intolerant there is a rising need for items that are suited for a gluten-free diet. A daily diet must include bread and other bakery goods. The goal of current research is to increase the bread and bakery goods' ability to be distributed in a fresh form as well as their shelf life. For a consumer used to traditional wheat or wheat-rye bread, gluten-free bread and other gluten-free bakery items are relatively uncommon have demonstrated that (70.8%) of the customers polled were unsatisfied with the texture and flavour of gluten-free loaves [53].

By-Products of Gluten free flour

By-products of food have been highlighted as a possible underused element due to their mechanical and digestive qualities. These by-amounts might be represented as the residue left over from crop production and product manufacture. They consist of the product's seeds, peel, pips, skins, stems and cores. Green banana flour was used to make gluten-free pasta (a banana industry by-product). The authors chose green banana flour because of its resistant starch and high phenolic acid content. Two further by-products under investigation are defatted strawberry seeds and blackcurrant seed the material remaining after the oil has been removed. These by-products' potential for nutrition including their protein, fibre and bioactivity has piqued researchers' curiosity. In comparison to loaves containing defatted strawberry and blackcurrant seeds is control it was discovered that adding defatted strawberry to a gluten-free bread formulation dramatically increased the loaf volume [30].

Different Ingredients to improve the nutritional value

Resulting in high prevalence of osteoporosis in celiac, the difficulty in including sources of calcium such as dairy ingredients due to lactose intolerance and due to lactose intolerance. The effects of the inclusion of two different calcium supplements such as calcium citrate and calcium caseinate on the baking properties of a gluten-free formulation. At 2% addition of calcium citrate showed the most positive effects on bread characteristics [30].

Impact of sorghum flour on gluten free cake

As demand for gluten-free goods rises using sorghum flour is a wise choice. Worldwide consumption of sponge cakes makes them a good candidate for formulations that might sub in wheat flour. The size of the flour particles has the greatest impact on the quality of sponge cake. In this work, we milled white and brown sorghum grains to generate various flours described them and assessed how the features of the flour affected the qualities of the batter and gluten-free sponge cake. The composition, density and viscosity of the batters as well as the sponge cake's specific volume and crumb characteristics were assessed. The findings demonstrated that the milling operations changed the characteristics and content of flour. Smaller-particle brown or white sorghum flour created high-density, viscous batters with uniformly-sized air bubble dispersion. Smaller flour particles regardless of the kind of sorghum used to produce sponge cakes with a large volume and low degree of stiffness [22].

Effect of heat treatment on sorghum products

We looked at how heat treatment affected sorghum's ability to function in gluten-free bread and cake. Dry-heating the sorghum flour at two temperatures (95 ° C and 125 ° C) for 15, 30 and 45 minutes. Viscosity is impacted by flour heat treatment and this has a significant impact on the ultimate quality of cakes and breads. The bread with the largest specific volume (3.08 mL/g) and the most cells per slice area (50.38 cells/cm2) was created by heating the flour at (125 ° C) for 30 minutes. The breads and cakes made with the control sorghum flour had low volumes, poor crumb qualities and thick textures. Additionally in consumer testing cake and bread produced with this heat treatment performed better than the controls [18].

Microwave heating also effects on the sorghum grains

Sorghum grains were heated using microwaves at 350 and 500 W of power for periods of 15, 30 and 45 seconds. The impact of microwave heating on the sorghum grain's functional and anti-oxidant characteristics, protein content, *in vitro* digestibility and fungal growth. Fungal incidence in the grain was dramatically decreased up to (26.2 and 33.4%) by microwave heating at 350 and 500 W. There were no discernible changes in the sorghum's crude protein content, protein digestibility, water holding capacity or oil holding capacity. However, using 500 W of microwave radiation for 30 and 45 seconds significantly decreased the solubility of proteins (8.2-7.6%). These revealed that sorghum seed might potentially be cooked alongside at 350 and 500 W for around 45 and 15 seconds, respectively in account of claimed improved attractiveness functional and digestive features. Accordingly, microwave heating particularly at low power may be an effective emerging method for improving the physicochemical and nutritional properties of sorghum grain [39].

Physical Properties of Microwave-Baked Cupcake

The physical properties of the cupcakes such as density, porosity, colour and height as well as the textural characteristics of crispness, hardness, cohesiveness, springiness, resilience, gumminess and chewiness were all varied depending on the microwave power used (150, 300, 450 and 600W) as well as the operational time (3.5, 5, 8 and 16 minutes). This characteristic demonstrates that colour intensity and overall colour deviations from the reference batter grew as microwave power rose. In comparison to the other microwave powers the 600W-baked cupcake had the lowest values for hardness, density, chewiness and gumminess the quickest baking time, and the greatest values for cohesiveness, resilience, porosity, height and browning index. Therefore, 600W was the ideal operating power for achieving desired baking quality [46].

Physiochemical parameter reduced sugar in cake

It is challenging to reduce sugar in baked goods like pound cake because of the many roles that sugars provide. Temperature, batter rheology, protein denaturation, starch gelatinization and flour pasting behaviour are all influenced by sucrose. Consequently, switching sugar for sugar can substantially alter the structure and texture of baked goods. According to this study, phase transitions in batter rheology during baking and a 50% sugar substitution both affect the physical properties of baked cakes. The study is based on relating three physicochemical parameters such as the volumetric density of effective H-bonding sites available in the sugar-water phase the number of effective H-bonding sites within a sugar's molar volume and the volume averaged interaction parameter of the sugars with water to the physical properties of batter and cakes [36].

Gluten free eggless cake using gluten free made from sorghum flour

The study's objective was to create a gluten-free eggless cake for celiac disease patients using a gluten-free composite flour composed of sorghum millet. Prepared gluten-free eggless cakes' physical, textural, rheological and nutritional characteristics were examined. A gluten-free eggless cake with a high nutritional content and excellent qualities serves as a decent option for eggless cakes made with refined flour and composite flour. Higher mineral content due to germinated ingredients also made it a nutritious and palatable naturally gluten free is best option for the people with celiac disease [2].

Replacement of eggs effects on cake batter and properties

The most recent study indicates that egg replacement is becoming increasingly valuable. Customers' dietary preferences (vegan and vegetarian), religious beliefs and health conditions like phenylketonuria, egg allergy or health-related worries like cholesterol and avian influenza are to blame for this. In this way, the food industry is searching for egg alternatives to produce goods that are either completely, partly or wholly eggless. Therefore, current research has concentrated on the use of egg substitutes from various sources in bakery goods, especially in cake compositions. The most popular egg substitutes are whey and soy-based proteins; when combined with

additional food additives like emulsifiers and hydrocolloids, they can mimic the qualities of eggs. These egg substitutes can affect batter properties like specific gravity, viscosity, textural properties, rheological properties and bubble size distribution as well as cake quality parameters like moisture content, baking loss, specific volume, external properties, colour, texture, crumb structure and sensory preferences. They are also easy to store and have long shelf lives [13].

Shelf-life of packaged bakery goods

As many of the items are for subsequent use, the packaging requirements for unique culinary businesses where baked goods are created are minimal. However, the wrap may play a significant role in extending the usable life of extra rice-located items (toast, stopped fruit, biscuits, loaves and pastas). Some amount of the fabric changes and flavour deficit manifest over the shelf life of a compassionate-stewed good can commonly be underrated or deferred by effective use of bundle fabrics [12]. Cakes typically have a shelf life of one to four weeks although due to the usage of specific ingredients, industrial cakes typically have extended shelf lives. The development of certain microorganisms, starch retrogradation events, water migration from internal to exterior zones and subsequent loss of the water to the atmosphere are some of the reasons that contribute to quality degradation [21]. Starch declining is the primary mechanism to find the shelf life of the crop. This crop is microbiologically safe which adversely effects on starch granules on textural properties so this is main reason of product is cut by the customer which leads to big economical losses [47].

Factors Affecting the Microbial growth in food products

The environment around food can help or hinder microbes' capacity to thrive establish themselves and change. Each one appears to be a typical element of food that is naturally occurring or is controlled by artificial means. Maintaining a system of microbiologically safe food depends on two criteria. Extrinsic factors include those come from the environment the food product is exposed to such as temperature, relative humidity, gaseous environments or the presence of microorganisms. Intrinsic factors however are internal to the food product such as nutrient content, pH levels, water activity, redox potential and other antimicrobial components acting as defences against pathogens [37].

Alternate way to sugar reduces in cake

An effective way to reduce calorie intake need to substitute sugar with a natural sweetener in meals. The World Health Organization suggests limiting added sugar consumption to under 10% of total energy. Food items include glucose syrup, molasses, fructose syrup, invert syrup and malt extract all contain sugar analogues. Dates are a perfect product to substitute for additional carbohydrates in cuisine and are an essential part of many people's daily diets in dry regions. These products are rich in phenolic compounds, minerals, vitamins and dietary fiber in addition to antioxidant substances. When manufacturing date syrup which is used to manufacture various types of sugar compounds dates are an excellent alternative. They include a lot of carbohydrates and minerals and are high in energy but they also contain a complex blend of amino acids, organic acids, polyphenols and carotenoids includes fructose, glucose and sucrose as well [5].

Effect of Freezing on cake quality

Layer cakes and sponge cakes are the two types of cakes. These cakes may be refrigerated for between 60 and 120 minutes before baking kept for between 30 and 100 days and frozen at temperatures between (18 and 26^{o} C). In contrast, batter characteristics such as pH, density, viscosity and microstructure were investigated for cakes. As a result, a cake's volume drops but its hardness improves when it is frozen. In comparison to storage or freezing conditions or resting time, the freezing process has a stronger impact on batter and quality features. While freezing mostly changed the colour and volume of layer cakes it primarily affected the body texture of sponge cakes [21].

Chemical composition of sorghum

Sorghum was achieved through dry milling from 20 commercial hybrids expands in Argentina with the average chemical composition of the samples are:

S. No.	Chemical composition (Sorghum)	Sample percentage
1.	Ash	0.68%
2.	Fat	3.67%
3.	Protein	12.21%
4.	Total Carbohydrate	83.5%
5.	Starch	79.77%
6.	Tannic acid	34.9mg per 100g flour

Source: [31].

Heath Benefits

In addition to being used for human food, sorghum is also utilised as an alternative to wheat that doesn't contain gluten as well as for biofuel and animal feed. However, these uses are rapidly increasing. They have a lot of nutrients are high in soluble fibre and antioxidants and may lower the risk of developing certain diseases [23]. Sorghum is the most significant staple grain in the world rich in nutrients and phenolic compounds that are good for your health. Three main phenolic chemicals found in sorghum are 3-deoxyanthocyanidins, condensed tannins and phenolic acids. According to recent research, sorghum's phenolic compounds can serve as antioxidants *in vitro* and eating the whole grain may enhance gut health and reduce the chance of developing chronic illnesses [56]. Sorghum grain is also rich in bioactive phenolic compounds such as ferulic acid, gallic acid, vanillic acid, gallic acid, caffeic acid, p-coumaric acid, luteolin, apigenin and 3-deoxyanthocyanidins(3-DXA) which contribute to many health benefits along with antioxidant, anti-inflammatory, anti-proliferative, anti-diabetic and anti-atherogenic activities.

Compounds of phenolic in sorghum

It is known that plants spontaneously biosynthesize secondary metabolites, including phenolic chemicals. The sorghum grain contains a sizable number of flavonoids and phenolic acids. The subgroups of flavonoids include flavanone, flavanol, anthocyanins and condensed tannins often known as proanthocyanins. Among the phenolic acids contained in sorghum grains and caffeine acid predominates. Typically, phenolic chemicals in sorghum grain are extracted using the following methods such as

maceration, refluxing, water, Soxhlet and organic solvent extraction [17].

Potential Molecular Mechanism of phenolic Compounds

Antioxidant activity: According to author, antioxidants per dietary polyphenols can clean free radicals for preventing chronic diseases. This area typically concentrates on the antioxidant activity of phenolics compounds isolated from sorghum grains from both *in vitro* and *in vivo*.

Anti-Diabetic action: Diabetes is one of the most common chronic diseases. Hyperglycaemia and inappropriate glucose metabolism, which are brought on by insulin resistance and pancreatic b-cell are the causes of diabetes. Phenolic, which is extracted from sorghum begins to effectively manage diabetes by decreasing blood glucose, total cholesterol and triglycerides [17].

Antioxidant and Antimicrobial of Date seed extract effect on cupcake

By-products of date seed can be used in a variety of ways. The extracted antioxidant was evaluated using the 2,2-diphenylpicrylhydrazyl radial scavenging technique. The findings showed that increasing antioxidant activity extraction enhanced its concentration. The IC50 of the date seed extract was found to be 1568.93 mg/L. Using minimum inhibitory concentrations and minimum bactericidal concentrations of 0.08 and 0.4 mg/ml, respectively the extraction of antibacterial activity against Salmonella typhimurium was assessed. The cupcake configuration now includes extracts at four different levels are (0, 0.05, 0.1 and 0.2%). Additional tests were performed on cupcake samples including those for Peroxide number, acidity, pH, proximate analysis and sensory assessment. Therefore, all cakes are extracted in the standard range for physicochemical qualities at various levels including (0, 0.05, 0.1 and 0.2 g/ml.). The sample comprises 0.2% date seed extract and both the sensory features and the microbiological count were satisfactory. Overall, the study found that date seeds can be employed as an affordable natural preservative in food compositions due to their inclusion of phenolic compounds, antioxidants and antibacterial activity [6].

Quality of Protein in Sorghum

Sorghum had a larger range of protein or amino acid digestibility values than maize or wheat. Sorghum frequently makes up all or a portion of the cereal grain. A healthy diet contains around 30% protein from sorghum and it's likely that the quality of its protein and amino acids has an impact on how well children develop. Sorghum likely has a wider range of digestibility and amino acid concentrations than other cereal grains. Kafirin and glutelin the two primary sorghum proteins are found in the endosperm. However, it is not a suitable source of amino acids due to disulphide bonds and low lysine content Protein bodies contain kafirin and glutelin makes up the protein matrix in sorghum endosperm. Kafirin, glutelin, globulin and albumin together accounted up (54.1%, 33.4%, 7.0% and 5.6%) of the endosperm protein. As sorghum protein levels increase, the amount of kafirin increases at the expense of glutelin. The amino acid content of sorghum is impacted by the reciprocal relationship between kafirin and glutelin since they have distinct amino acid profiles [41].

Effect of Sorghum grain on Protein Digestibility

Sorghum, but not maize contains less digestible protein after cooking. Before *in vitro* pepsin digestion, boiling sorghum and maize whole grain and endosperm flours were smoothed with alpha amylase to improve protein digestibility. Sorghum protein was less digestible after cooking, while overall polyphenol levels in the samples remained unaffected. It was shown that the pericarp, germ and gelatinized starch could act as digestive inhibitors for sorghum protein. This study used both raw and cooked high-tannin sorghum variety 6043 a hybrid maize grown in both have low protein amounts which has been shown. Unprocessed whole grains have *in vivo* and *in vitro* digestibility's of 9 and 10, respectively. The sorghum samples however were broken up in a lab hammer mill and other cultivars with comparable tannin contents may have varying degrees of protein digestibility [8].

Effect on Sorghum starch and Sorghum flour by Heat-moisture treatment

At (20% and 25%) moisture levels, sorghum starch and flour underwent heat-moisture treatment. The solubility and swelling power of the treated materials decreased, according to the results. In comparison to the control samples the changed samples had a greater level of crystallinity. Compared to sorghum starch, sorghum flour's solubility, swelling power, setback viscosity, through viscosity, enthalpy and crystallinity were all significantly affected by heat and moisture treatment. The inadequate functional properties of native starch are enhanced by the important physical procedure known as heat moisture treatment, which is especially advantageous for food applications. Heat moisture treatment is an inexpensive, sustainable method of starch modification. They were able to demonstrate through extensive research that heat moisture treatment significantly alters the molecular structure and physicochemical properties of early Indica rice, chestnut corn, rice and potato starches [49].

Conclusion

Continued debate makes it evident that wheat and sorghum flour millets may be utilised to create sugar-free improved cupcakes. Certain types of wheat flour can be substituted with sorghum flour. The particle size and form of sorghum flour usually give baked foods like bread and cakes a gritty appearance. During lactic fermentation, the phytic acid content of sorghum flours is reduced by (40-60%). The production of phytic acid results in stable molecules with excellent bioavailability of calcium, magnesium, manganese and iron. Sorghum flour to several heat treatments and confirmed the usefulness of the flour in gluten-free cake. The flour was placed in a micro-oven and dried heated for 15, 30 and 45 minutes at 95 and 125° C. We looked into how heat treatment affected sorghum's ability to function in gluten-free bread and cake. Dry-heating the sorghum flour at two temperatures (95 ° C and 125 ° C) for 15, 30 and 45 minutes. Sorghum grains were heated using microwaves at 350 and 500 W of power for periods of 15, 30 and 45 seconds. The impact of microwave heating on the sorghum grain's functional and anti-oxidant characteristics, protein content, *in vitro* digestibility and fungal growth. The physical properties of the cupcakes such as density, porosity, colour and height as well as the textural characteristics of crispness, hardness, cohesiveness,

springiness, resilience, gumminess and chewiness, were all varied depending on the microwave power used (150, 300, 450 and 600W) as well as the operational time (3.5, 5, 8 and 16 minutes).

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