CAKES FROM ANCIENT TO CONTEMPORARY TIMES

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CAKES

FROM ANCIENT TO CONTEMPORARY TIMES

***"..And Abraham hastened into the tent unto Sarah, and said, make ready quickly three measures and fine meal, knead it, and make cakes upon the hearth"* (Genesis 18:6).**

Medical Research in Biblical Times

Examination of Passages from the Bible, Exactly as Written

Liubov Ben-Nun

NOT FOR SALE

Cake is a form of sweet dessert that is typically baked. In its oldest forms, cakes were modifications of breads, but cakes now cover a wide range of preparations that can be simple or elaborate, and share features with other desserts such as pastries, meringues, custards, and pies.

Cake is often served as a celebratory dish on ceremonial occasions, such as weddings, anniversaries, and birthdays. There are countless cake recipes; some are bread-like, some are rich and elaborate, and many are centuries old.

Are cakes described in the Bible? What is the history of cakes? Were they consumed in Biblical times? What is their composition? What ingredients are used? What are the characteristics that indicate quality? What are the formulations? What are the rheological, micro-structure and baking properties of cakes and batter? How can improvements to the texture and sensory properties of baked items be achieved? What are gluten free cakes? Rice cakes? How is fat reduction performed? Are alternative sweeteners used?

The Biblical verse dealing with a cake was studied from a contemporary viewpoint.

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CONTENTS

INTRODUCTION

Cake is a form of sweet dessert that is typically baked. In its oldest forms, cakes were modifications of breads, but cakes now cover a wide range of preparations that can be simple or elaborate, and that share features with other desserts such as pastries, meringues, custards, and pies **(1)**.

Typical cake ingredients are flour, sugar, eggs, butter or oil or margarine, a liquid, and leavening agents, such as baking soda or baking powder. Common additional ingredients and flavorings include dried, candied, or fresh fruit, nuts, cocoa, and extracts such as vanilla, with numerous substitutions for the primary ingredients. Cakes can also be filled with fruit preserves, nuts or dessert sauces (like pastry cream), iced with butter cream or other icings, and decorated with marzipan, piped borders, or candied fruit **(2**).

Cake is often served as a celebratory dish on ceremonial occasions, such as weddings, anniversaries, and birthdays. There are countless cake recipes; some are bread-like, some are rich and elaborate, and many are centuries old. Cake making is no longer a complicated procedure; while at one time considerable labor went into cake making (particularly the whisking of egg foams), baking equipment and directions have been simplified so that even the most amateur cook may bake a cake **(1)**.

Are cakes described in the Bible? What is the history of cakes? Were they consumed in Biblical times? What is their composition? What ingredients are used? What are the characteristics that indicate quality? What are the formulations? What are the rheological, micro-structure and baking properties of cakes and batter? How can improvements to the texture and sensory properties of baked items be achieved? What are gluten free cakes? Rice cakes? How is fat reduction performed? Are alternative sweeteners used?

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THE BIBLICAL DESCRIPTION

When Abraham saw three guests: "*…he ran to meet them, from the tent door, and bowed himself towards the ground*" **(Genesis 18:2).**

Here "*And Abraham hastened into the tent unto Sarah, and said, Make ready quickly three measures and fine meal, knead it, and make* ***cakes*** *upon the hearth*" (**18:6).**

HISTORY

The term "cake" has a long history. The word itself is of Viking origin, from the Old Norse word "kaka" **(1)**.

The ancient Greeks called cake πλακοῦς (plakous), which was derived from the word for "flat", πλακόεις (plakoeis). It was baked using flour mixed with eggs, milk, nuts and honey. They also had a cake called "satura", which was a flat heavy cake. During the Roman period, the name for cake became "placenta" which was derived from the Greek term. A placenta was baked on a pastry base or inside a pastry case **(2)**.

The Greeks invented beer as a leavener, frying fritters in olive oil, and cheesecakes using goat's milk **(3)**. In ancient Rome, basic bread dough was sometimes enriched with butter, eggs, and honey, which produced a sweet and cake-like baked good **(4)**. Latin poet Ovid refers his and his brother's birthday party and cake in his first book of exile, Tristia **(4)**.

The ancient Egyptians were the first culture to show evidence of advanced baking skills. But, the first cakes were very different from the moist chocolate cake we are familiar with today. Then they were more bread-like, sweetened with honey, and nuts and dried fruits were often added. In fact, in early Europe, the words for cake and bread were virtually interchangeable; the only distinction was that cakes were sweet while bread was not **(5)**.

The English word for "cake" traces back to the 13th century. It is derived from an Old Norse word, "kaka" **(5)**.

Chen & al. (6) analyzed starch grain, phytolith and cereal bran fragments in order to identify the food remains including cakes,

dumplings, as well as porridge unearthed at the Astana Cemeteries in Turpan of Xinjiang, China. The results suggest that the cakes were made from Triticum aestivum while the dumplings were made from Triticum aestivum, along with Setaria italica. The ingredients of the porridge remain emanated from Panicum miliaceum. Direct macrobotantical evidence of the utilization of six cereal crops, such as Triticum aestivum, Hordeum vulgare var. coeleste, Panicum miliaceum, Setaria italica, Cannabis sativa, and Oryza sativa in the Turpan region during the Jin and Tang dynasties (about 3(rd) to 9(th) centuries) is also presented. All of these cereal crops not only provided food for the survival of the indigenous people, but also spiced up their daily life **(6)**.

It was sometime in the mid-17th century that the forerunners of modern cakes (round ones with icing) were first baked in Europe. At that time, cake hoops - round molds for shaping cakes were placed on flat baking trays - became popular, but only among the well-to-do **(5)**.

In the middle of the 19th century, the practice of eating cake on a regular basis by "average people" became attainable thanks to the Industrial Revolution. Baking ingredients and tools became more affordable and more readily available to home bakers. The introduction of modern leavening agents (baking soda & powder), the supply of cheaper ingredient substitutions (corn syrup for sugar; margarine for butter), and the production of more reliable ovens made it increasingly possible for the middle-class to enjoy this confection by the late 1800s. Because of this, a plethora of simple cake recipes began to show up in cookbooks **(5)**.

Early cakes in England were also essentially bread: the most obvious differences between a "cake" and "bread" were the round, flat shape of the cakes, and the cooking method, which turned cakes over once while cooking, while bread was left upright throughout the baking process **(4)**.

Sponge cakes, leavened with beaten eggs, originated during the Renaissance, possibly in Spain **(3)**.

The first frosting for cake was usually a boiled combination of the finest available sugar, egg whites, and (occasionally) flavorings. This "icing" was poured on the cake and then the cake was returned to the oven for a short time. After the cake was removed, the icing cooled quickly and formed a hard, glossy coating. In the first few

decades of the 20th century, buttercream frostings (which use butter, cream, powdered sugar, and flavorings) began supplanting conventional boiled icings **(5)**.

Łuczaj & al. (7) mentioned that Belarus is an Eastern European country, which has been little studied ethnobotanically. The aim of this study was to compare largely unpublished 19th century sources with more contemporary data on the use of wild food plants. The information on 19th century uses is based on twelve, mainly unpublished, responses to Józef Rostafiński's questionnaire from 1883, and the newly discovered materials of the ethnographer Michał Federowski, who structured his data according to Rostafiński's questionnaire and documented it with voucher specimens. Rostafiński's questionnaire was concerned mainly with Polish territories, but for historical reasons this also encompassed a large part of Belarus, and only the twelve responses (out of the few hundred Rostafiński obtained), which concerned the present Belarus, were analyzed. These data were compared with a few 20th century ethnographic sources, and our own 40 interviews and questionnaires from Belarus. Of wild food plants, 58 taxa used in the 19th century were identified. Some of them are still used in modern Belarus, others are probably completely forgotten. In the 19th century, several species of wild greens were widely used for making soups. Apart from Rumex, other wild greens are now either forgotten or rarely used. The list of species used in the 20th and 21st century encompasses 67 taxa. Nearly half of them were mentioned by Rostafiński's respondents. The list of fruit species has not changed much, although in the 19th century fruits were mainly eaten raw, or with dairy or floury dishes, and now apart from being eaten raw, they are incorporated in sweet dishes like jams or **cakes**. Modern comparative data also contain several alien species, some of which have escaped from cultivation and are gathered from a semi-wild state, as well as children's snacks, which were probably collected in the 19th century but were not recorded back then. The data show that the responses to Rostafiński from 1883 present extremely valuable historical material as the use of wild food plants in Belarus has since undergone drastic changes, similar to those, which have taken place in other Eastern European countries **(7)**.

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CHARACTERISTICS

Cakes are broadly divided into several categories, based primarily on ingredients and mixing techniques.

Although clear examples of the difference between cake and bread are easy to find, the precise classification has always been elusive **(1)**. Thus, banana bread may be properly considered either a quick bread or a cake **(2)**.

Butter cakes are made from creamed butter, sugar, eggs, and flour. They rely on the combination of butter and sugar beaten for an extended time to incorporate air into the batter **(3)**. A classic pound cake is made with a pound each of butter, sugar, eggs, and flour. Baking powder is in many butter cakes, such as Victoria sponge **(4)**. The ingredients are sometimes mixed without creaming the butter, using recipes for simple and quick cakes **(2)**.

Sponge cakes (or foam cakes) are made from whipped eggs, sugar, and flour. They rely primarily on trapped air in a protein matrix (generally of beaten eggs) to provide leavening, sometimes with a bit of baking powder or other chemical leaven added as insurance. Sponge cakes are thought to be the oldest cakes made without yeast. An angel food cake is a white sponge cake that uses only the whites

of the eggs and is traditionally baked in a tube pan. The French Génoise is a sponge cake that includes clarified butter. Highly decorated sponge cakes with lavish toppings are sometimes called gateau; the French word for cake. Chiffon cakes are sponge cakes with vegetable oil, which adds moistness **(5).**

Chocolate cakes are butter cakes, sponge cakes, or other cakes flavored with melted chocolate or cocoa powder **(6).** German chocolate cake is a variety of chocolate cake. Fudge cakes are chocolate cakes that contain fudge **(2)**.

Coffee cake is generally thought of as a cake to serve with coffee or tea at breakfast or at a coffee break. Some types use yeast as a leavening agent while others use baking soda or baking powder. These cakes often have a crumb topping called streusel or a light glaze drizzle **(2)**.

Baked flourless cakes include baked cheese cakes and flourless chocolate cakes. Cheesecakes, despite their name, aren't really cakes at all. Cheesecakes are in fact custard pies, with a filling made mostly of some form of cheese (often cream cheese, mascarpone, ricotta, or the like), and have very little flour added, although a flour-based or graham cracker crust may be used. Cheesecakes are also very old, with evidence of honey-sweetened cakes dating back to ancient Greece **(2)**.

Butter or oil layer cakes include most of the traditional cakes used as birthday cakes, etc., and those sold as packaged cakes. Baking powder or bicarbonate of soda are used to provide both lift and a moist texture. Many flavorings and ingredients may be added; examples include devil's food cake, carrot cake, and banana bread **(2).**

Yeast cakes are the oldest and are very similar to yeast breads. Such cakes are often very traditional in form, and include such pastries as babka and stollen **(2)**.

Some varieties of cake are widely available in the form of cake mixes, wherein some of the ingredients (usually flour, sugar, flavoring, baking powder, and sometimes some form of fat) are premixed, and the cook needs add only a few extra ingredients, usually eggs, water, and sometimes vegetable oil or butter. While the diversity of represented styles is limited, cake mixes do provide an easy and readily available homemade option for cooks who are not accomplished bakers **(2)**.

Cakes may be classified according to the occasion for which they are intended. For example, wedding cakes, birthday cakes, cakes for first communion, Christmas cakes, Halloween cakes, and Passover plava (a type of sponge cake sometimes made with matzo meal) are all identified primarily according to the celebration they are intended to accompany **(2)**.

Birthday cake

The cutting of a wedding cake constitutes a social ceremony in some cultures. The Ancient Roman marriage ritual of confarreatio originated in the sharing of a cake **(2)**.

Wedding cakes at a bridal show.

Particular types of cake may be associated with particular festivals, such as stollen or chocolate log (at Christmas), babka and simnel cake (at Easter), or moon cake. There has been a long tradition of decorating an iced cake at Christmas time; other cakes associated with Christmas include chocolate log and mince pies **(2)**.

A Lancashire Courting Cake is a fruit-filled cake baked by a fiancée for her betrothed. The cake has been described as "somewhere between a firm sponge – with a greater proportion of flour to fat and eggs than a Victoria sponge cake – and a shortbread base was proof of the bride-to-be's baking skills". Traditionally it is a two-layer cake filled and topped with strawberries or raspberries and whipped cream **(8)**.

Cakes are frequently described according to their physical form. Cakes may be small and intended for individual consumption. Larger cakes may be made with the intention of being sliced and served as part of a meal or social function. Common shapes include: Bundt

cakes; Cake balls; Conical, such as the Kransekake; Cupcakes and Madeleines, which are both sized for a single person; Layer cakes, frequently baked in a springform pan and decorated; Sheet cakes, simple, flat, rectangular cakes baked in sheet pans; Swiss rolls **(2).**

Smith & Hawrysh (9) noticed that wheat bran was substituted for cake flour in chiffon cakes at 10, 20, and 30 per cent levels. Bran incorporation significantly affected ($p<0.05$) the appearance, height, and grain of chiffon cakes. Cake height decreased and cell size and cell wall thickness increased with higher levels of bran. Tenderness decreased with higher levels of bran. Compressimeter readings were higher with bran substitution at the 10 and 20 per cent levels. Sensory evaluation indicated no significant differences ($p<0.05$) between the control and 10 per cent bran cakes for moistness, flavor, and overall acceptability. Panelists did note a significant ($p<0.05$) decrease in tenderness and softness and an increase in crumbliness with higher bran levels. All chiffon cakes, regardless of bran level, were termed acceptable **(9)**.

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INGREDIENTS

This chapter is based on basic Cake Ingredients descriptions by Sarah Phillips with mild changes as follows **(1)**:

The ingredients used to make shortened (butter) and unshorten (foam) cakes differ. However, the goal is always to the same: to create great cake recipes through a delicate balance of its ingredients - making sure they have the strength to hold the recipe together, but still create a tender, moist and flavorful cake. Different mixing methods also result in different cakes, as do the type of pans used and their treatment, timing, temperature, baking, cooling and storage. Afterwards, cakes can be filled, frosted or glazed and decorated. Decorated cakes include wedding cakes.

A cake's structure is created mainly from the combination of the flour's starches, by the proteins in whole eggs, egg whites, and/or in milk. The melt-in-his/her-mouth texture comes from tiny air holes left in the cake's structure, created through mixing, serving as nuclei and enlarged through the carbon dioxide gas from the chemical leaveners, heat and /or steam during baking. The sugar and fat in the recipe, as well as any acids, tenderize the cake, as well; they interfere with gluten formation and egg protein coagulation, interrupting the network of gelated starch. But, if the recipe is unbalanced, for example, if there's too much sugar and fat, the cake's structure is weakened so much it cannot support its own weight and will collapse. Too much flour and too many eggs may make the cake tough and/or dry.

Overall, the flour mixtures that produce cakes and cookies are very similar to those used to make breads, although they are sweeter and often have added flavorings not typically used in breads. Cakes have a higher proportion of sugar, milk and fat to flour than do breads, and the flour used is usually cake flour.

WHEAT FLOUR. The vast majority of cakes - with the exception of cheesecakes, foam cakes and gluten-free cakes – contain wheat flour as very backbone of their composition. It establishes the crumb structure in cakes and is used to bind all of the other ingredients together during the cake making process. Wheat flour contains two very important proteins, glutenin and gliadin, when mixed with

moisture and stirred, create its structural network. The flour's starches gelatinize or set when baked. The bad part about gluten is that too much - from too much mixing or using the wrong type of flour - creates a tough, dry and flavorless cake. It is gluten from the wheat flour that gives dough its strength and elasticity – qualities that are wanted in yeast breads, but not in cakes.

To help prevent this, he/she may see cake recipes especially high-ratio ones, typically made with chlorinated soft wheat flours, such as bleached cake flour, a potentially containing low-gluten forming proteins. High ratio cakes are where the sugar is higher than the flour level, by weight. Other lower gluten flour types include Southern bleached all-purpose and pastry flour. Soft wheat flours are generally low in water absorption and do not require harsh mixing or a long mix time.

THREE FORMULAS FOR HIGH-RATIO CAKES

There are three formulas for preparing the sweeter high ratio cakes that contain more sugar than flour, by weight. Following these ingredient proportions will ensure a high-ratio cake that is not too dry or too moist:

1. The sugar should weigh the same or slightly more than the flour. It is the weight and NOT the volume that counts.
2. Eggs should weigh almost as much as or slightly more than the fat.
3. The liquid ingredients (including eggs), should weigh the same as or more than the sugar.

High ratio cakes are mixed using the High Ratio or Two Step Mixing Method.

Chlorination of cake flour provides two great benefits. First is bleaching, which gives a whiter crumb color to cakes but second and more importantly it lowers the gelatinization temperature of the starch within the cake flour. This makes it possible for the cake to set faster and therefore reduces the loss of leavening during baking. Bleaching also gives the cake flour the ability to carry more sugar and fat (as well as water), without their tenderizing (collapsing) effects, balancing the recipe.

SWEETENERS. We typically think of sugar's role in a cake recipe to add sweetness, but it also plays other important roles depending upon whether it is in the crystalline (granulated white or brown) or liquid form (honey or corn syrup). All sugar acts as a tenderizer by preventing the wheat flour proteins from forming an excessive amount of gluten. It does this because sugar is hygroscopic, another word for its ability to absorb or attract moisture from the air, and dissolve readily in it (honey and some liquid sugars are more hygroscopic than crystalline sugar). By doing so, sugar essentially absorbs available water in the recipe, until saturated, leaving the rest for the wheat's available gluten forming proteins. Gluten is formed when the wheat flour proteins are moistened and agitated or mixed; the higher the flour's gluten-forming potential, the more available water or liquid and the more mixing (agitation) that takes place and the less tenderizers, such as sugar and fat, (and the warmer the ingredients), the more gluten is formed. Because sugar is also a hygroscopic substance, it helps with a recipe's moisture retention and thus increases its shelf life by slowing the staling process. Sugar also tenderizes by slowing down the coagulation of the egg white and milk proteins, as well, that also contribute to structure of the cake when baked.

Crystalline sugar plays an important role by incorporating air into the batter for leavening when beaten with solid, plastic fat, such as stick butter or margarine or solid shortening, called "creaming" (only when the fat is at an optimal temperature). Sugar plays an important role with the lubrication of other ingredients in the recipe, when molten, and with crust color. Increasing sugar in a cake recipe will raise the gelatinization temperature of the starches in the wheat flour and thus will increase expansion time, so care must be taken in its ratio to the other ingredients; too much can cause a cake's structure to fail or the cake may be so tenderized that it crumbles when cut rather than staying in slices (a warm cake will also cause crumbling). When the sugar is reduced too much, the gluten structure is so strong that the cake develops some long cells or tunnels. Overall volume may even increase, but the cake would be tough.

Other types of sugars used in the cakes include dextrose and brown sugar. Also syrups such as invert sugar, corn syrup, glucose, molasses, honey or refiner's syrups are used either for the particular

flavor they impart or as a moisture retaining capabilities in cakes. When using these sweetener varieties he/she must be aware that some do not have the same sweetness as granulated sugar (sucrose) and do contain various levels of water. Sugars of any kind when used in cakes tend to soften the batter and make it thinner, and they need to be included as liquids. Fine granulated sugar, also known as superfine sugar is used to help create the finest texture and maximum volume in a cake. Sugar can stand in for fat and is often added to commercial low-fat products or recipes.

FATS. There are two types of fat used in cake baking: solid and liquid. The primary function of solid fat, also known as plastic fat, such as solid shortening, stick butter or margarine, is to incorporate air bubbles into its malleable mass for volume. This is done through creaming, or beating the fat with crystalline sugar, also known as white granulated or brown sugar (white granulated sugar combined with molasses). But, it can only be done successfully if the right ingredients, ratios, mixing times and temperature, and using the proper tools are followed.

This makes fat a great tenderizer; expanding air cells help lift the cake's batter during baking, resulting in eventual cake tenderness. They are also known as shorteners; they also shorten the length of the gluten strands when the flour is stirred with that moisture. Fats also tenderize by readily coating the flour proteins like a raincoat, during mixing, preventing moisture from reaching them, helping to reduce their gluten forming potential. Fat is also a good tenderizer because it slows down the coagulation of the egg, flour and milk proteins that set the structure of the cake when baked.

As the fat level in a cake goes up, more eggs are required to emulsify the fat. Eggs also add structure and thus increase the volume depending on the part of the egg used, if it is beaten and when it is added to the recipe; sometimes less flour and chemical leavening agents, such as baking soda or baking powder, is needed.

Fat is a lubricator. It coats the flour particles so the elastic formation slows down; it makes the gluten strands slippery so the gas bubbles can move easily; and it gives the final cake recipe a finer grain. It also lubricates other ingredients, allowing them to mix and disperse more readily and for the cake to rise more readily. Similarly, fat lubricates the inside of his/her mouth, giving the perception that

a high fat cake is especially moist when you eat it because it glides easily on your tongue.

Fat also increases a baked cake's shelf life by helping to retain the moisture in it. Some fats, such as butter, add important flavor to a cake recipe, whereas margarine does not have as fine a texture and taste. Shortening does not contribute flavor, unless you use the "butter flavored" type.

Denser oil cakes such as carrot, zucchini, apple and pumpkin are commonly made with vegetable oil, called liquid fat. Cake mixes are also classified as oil cakes.

EGGS. Eggs perform a multitude of important functions in a cake recipe, depending on the part used. Foamed eggs provide leavening, especially separated and beaten whites. Whole eggs and whites contribute to structure. Egg yolk is also a rich source of emulsifying agents and, thus, is a tenderizer; it facilitates the incorporation of air and inhibits wheat starch gelatinization. Egg yolks also add color, nutrition, and flavor and help to retain moisture in the finished cake. On the other hand, whites can have a drying effect, but they contribute slightly more protein than yolks do, although with far fewer nutrients and without the fat and cholesterol.

Some white cake recipe can use 6 to 8 large egg whites, which have a drying effect on the recipe. When white butter cake recipes were developed, some of the egg whites were substituted with whole eggs, without affecting its color. The result is a more flavorful and moister cake.

Many of the changes from old-fashioned cakes to the recipes, started with the development of cake mixes and the addition of emulsifiers (found naturally in egg yolks) to the shortenings such as Crisco. Before then, cakes tended to be heavier, more like the pound cake consistency. Shortening used today gives better aeration when mixed and with the addition of liquids, make a light and fluffier cake.

LEAVENERS. The leavening source(s) used in cakes may serve to produce gas by physical, chemical or biological methods. It starts with the creation of millions of tiny air bubbles from various mixing methods, trapped in the structural framework of the cake's batter by the gluten strands. Air incorporation comes from beating eggs, creaming butter and sugar together, from folding ingredients

together, and from any agitation. Cakes are then leavened when the air bubbles in their batters expand when heated from water vapor or steam from liquids; carbon dioxide produced from chemical leaveners (baking soda and/or baking powder); general expansion from heat from the oven and in some cakes, from yeast activity. In many baked items, one or more of these agents participate in the leavening process.

A chemical leavening agent provides a source of gas to the recipe called carbon dioxide. When moistened (baking soda and double acting baking powder) and/or heated (double acting baking powder), it expands the millions of air bubbles previously created in a batter or dough from mixing or any agitation made to the cake's ingredients, trapped in the structural framework by the gluten strands. If the batter is over mixed, becomes too warm or not baked promptly, the gas will escape and the final recipe will have poor texture and low volume.

One of the biggest failures of a cake recipe is using baking powder or baking soda that has been weakened from being moistened previously in the cabinet or refrigerator from humidity. Another failure can be caused by pre-wetting a chemical leavened batter because they start to release carbon dioxide bubbles immediately (double acting baking powder will again leaven when heated). Refrigeration will slow their release, but not stop it. When a batter is placed in an oven that has not been preheated, baking powder fails to act until the oven reaches over 120 degrees F. Using the wrong flour can also affect leavening.

DAIRY AND LIQUIDS. Milk is usually the main liquid dairy used in cake recipes. It hydrates the dry ingredients, dissolves the sugar and salt, provides steam for leavening and allows for the baking powder and/or baking soda to react and produce carbon dioxide gas. Milk contains proteins (caseins) that set or coagulate from the oven's heat and help to form the structure of the cake, as do flour and eggs. Other dairy products, such as buttermilk, sour cream or cream cheese add more moisture and flavor to a cake, consequently those made with them keep well. The acid in the buttermilk and sour cream help tenderize the gluten in the recipe, producing a finer crumb. Sour cream and cream cheese add richness to a recipe, which makes them moist and almost springy.

FLAVORINGS. Flavorings come in different forms: ground spices, extracts (especially pure vanilla extract), citrus zest (peel), citrus oil and even liqueurs. Alcohol adds sugar and counts as a liquid ingredient. Be careful how much to add; too much in proportion to the other ingredients in the mix can cause his/her cake to fail.

Salt is an important ingredient because it is a flavor enhancer.

PUDDING. Some cake recipes and mixes call for added pudding. Instant, not cooked pudding should be used in the recipe. The use of cooked pudding will result in a drier, coarser, grittier texture. That is because it has not been activated or pre-gelatinized, as instant puddings have, affecting the cake.

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FLOUR SPECIFICATION

Special cake flour with a high starch-to-gluten ratio is made from fine-textured, soft, low-protein wheat. It is strongly bleached, and compared to all-purpose flour, cake flour tends to result in cakes with a lighter, less dense texture **(1)**. Therefore, it is frequently specified or preferred in cakes meant to be soft, light, and/or bright white, such as angel food cake. However, if cake flour is called for, a substitute can be made by replacing a small percentage of all-purpose flour with cornstarch or removing two tablespoons from each cup of all-purpose flour **(2-4)**. Some recipes explicitly specify or permit all-purpose flour, notably where a firmer or denser cake texture is desired **(5)**.

Three different kinds of wheat and rye flour. From left to right: wheat flour Type 550, wheat flour Type 1050, rye flour Type 1150 (6).

Flour that is used in baking comes mainly from wheat, although it can also be milled from corn, rice, nuts, legumes, and some fruits and vegetables. The type of flour used is vital at getting the right results in the end product. Different types of flour are suited to different items, and all flours are different. He/she cannot switch from one type to another without consequences that could ruin the recipe. To achieve success in baking, it is important to know what the right flour is for the job **(6).**

Table 1 (7).

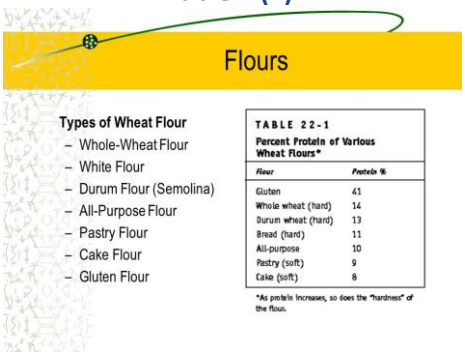
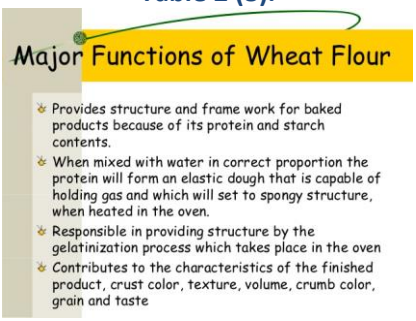


Table 2 (8).



Keppler & al. (9) mentioned that an accurate method was used to heat treat flour samples to quantify the effects of heat treatment on flour functionality. A variety of analytical methods has been used such as oscillatory rheology, rheomixer, solvent retention capacity tests, and Rapid Visco Analysis (RVA) in water and in aqueous solutions of sucrose, lactic acid, and sodium carbonate. This work supports the hypothesis that heat treatment facilitates the swelling of starch granules at elevated temperature. Results furthermore indicated improved swelling ability and increased interactions of flour

polymers (in particular arabinoxylans) of heat treated flour at ambient conditions. The significant denaturation of the proteins was indicated by a lack of gluten network formation after severe heat treatments as shown by rheomixer traces. Results of these analyses were used to develop a possible cake flour specification. A method was developed using response surfaces of heat treated flour samples in the RVA using i) water and ii) 50% sucrose solution. This can uniquely characterize the heat treatment a flour sample has received and to establish a cake flour specification. This approach might be useful for the characterization of processed samples, rather than by baking cakes. Hence, it may no longer be needed to bake a cake after flour heat treatment to assess the suitability of the flour for high ratio cake production, but 2 types of RVA tests suffice **(9).**

Singh & al. (10) mentioned that whole navy bean flour and its fine and coarse particle size fractions were used to completely replace wheat flour in cakes. Replacement of wheat flour with whole bean flour significantly increased the protein content. The protein content was adjusted to 3 levels with navy bean starch. The effect of navy bean flour and its fractions at 3 levels of protein on cake batter rheology and cake quality was studied and compared with wheat flour samples. Batters prepared from navy bean flour and its fractions had higher viscosity than the cake flour. Reducing the protein content by addition of starch significantly lowered the viscosity of cake batters. The whole navy bean flour and coarse bean fraction cakes were softer than cakes made with wheat flour but had reduced springiness. Principal component analysis showed a clear discrimination of cakes according to protein. It also showed that low protein navy bean flour cakes were similar to wheat flour cakes. Navy bean flour with protein content adjusted to the level of cake (wheat) flour has potential as a healthy alternative in gluten-free cakes **(10)**.

Ramseyer & al. (11) studied the functional differences between straight grade (75% extraction rate) and patent (60% extraction rate) flour blends from 28 genetically pure soft white and club wheat grain lots, as evidenced by variation in sugar snap cookie and Japanese sponge cake quality. Functional differences were examined relative to arabinoxylan content, protein content, and oxidative cross-linking potential of flour slurries. Oxidative cross-linking measurements were obtained on flour slurries with a low shear Bostwick

consistometer and considered endogenous oxidative cross-linking potential (water alone) or enhanced oxidative cross-linking potential (with added hydrogen peroxide-peroxidase). A 2-way ANOVA indicated that flour blend was the greater source of variation compared to grain lot for all response variables except water-extractable arabinoxylan content. Patent flours produced larger sugar snap cookies and Japanese sponge cakes, and contained significantly less total and water-unextractable arabinoxylans, protein, and ash than did straight grade flours. Patent flours produced more viscous slurries for endogenous and enhanced cross-linking measurements compared to the straight grade flours. The functional differences between patent and straight grade flours appear to be related to the particular mill streams that were utilized in the formulation of the 2 flour blends and compositional differences among those streams **(11)**.

Jun & al. (12) mentioned that fiber-enriched materials (FEMs) obtained from preharvest dropped apple peels were utilized as a source of dietary fiber in baked cakes and their effects on the textural/nutritional qualities and starch digestibility (glucose release behavior, starch digestion fraction, predicted glycemic index) of the cakes were evaluated. When FEMs were incorporated into the cake formulation (3 g and 6 g of dietary fiber per serving (100 g)), the volume of the cakes seemed to be reduced and their texture become harder. However, 3 g of FEMs did not degrade the cake qualities. The use of FEMs in cakes significantly reduced the levels of rapidly digestible starch and slowly digestible starch, while the levels of resistant starch increased. Additionally, the cake samples prepared with FEMs exhibited a lower predicted glycemic index. This study may give rise to multi-functional bakery products with acceptable quality and low glycemic index **(12)**.

Min & al. (13) noticed that with rising consumer awareness of obesity, the food industry has a market-driven impetus to develop low-fat or fat-free foods with acceptable taste and texture. Fancy buckwheat flour was thus subjected to steam jet-cooking and the performance of the resulting product in cake-baking was evaluated as a fat replacer. Steam jet-cooking caused structural breakdown and starch gelatinization of buckwheat flour, thus increasing its water hydration properties. In the pasting measurements, steam jet-cooked buckwheat flour exhibited high initial viscosity, while no peak

viscosity was observed. Also, the suspensions of steam jet-cooked buckwheat flour exhibited shear-thinning behaviors, which were well characterized by the power law model. When shortening in cakes was replaced with steam jet-cooked buckwheat gels, the specific gravity of cake batters significantly increased, consequently affecting cake volume after baking. However, shortening replacement with steam jet-cooked buckwheat up to 20% by weight appeared to be effective in producing cakes as soft as the control without volume loss. The data indicate that when buckwheat flour was thermomechanically modified by steam jet-cooking, it was successfully incorporated into cake formulations for shortening up to 20% by weight, producing low-fat cakes with comparable volume and textural properties to the control (**13**).

Lorenz & Coulter (14) evaluated the performance of quinoa-wheat flour blends (5/95, 10/90, 20/80, 30/70) in breads, cakes and cookies. Breads baked with 5% and 10% quinoa flour were of good quality. Loaf volume decreased, crumb grain became more open and the texture slightly harsh at higher usage levels of quinoa flour. A bitter after taste was noted at the 30% level. Cake quality was acceptable with 5% and 10% of quinoa flour. Cake grain became more open and the texture less silky as the level of quinoa substitution increased. Cake taste improved with either 5% or 10% quinoa flour in the blend. Cookie spread and top grain scores decreased with increasing levels of quinoa flour blended with high-spread cookie flour. Flavor improved up to 20% quinoa flour in the blend. Cookie spread and cookie appearance was improved with a quinoa/low-spread flour blend by using 2% lecithin **(14)**.

Segundo & al. (15) described the effect of mechanically fractionated flours from green bananas on the nutritional, physical and sensory attributes of two types of cakes (sponge and layer). A plausible 30% replacement of banana flour in the formulation of layer cakes is demonstrated, finding only a small decline in the sensory perception. On the contrary, sponge cakes were noticeable worsened with the use of banana flours (lower specific volume, worse sensory attributes and higher hardness), which was minimized when using fine flour. Both layer and sponge cakes exhibited an enhancement of the resistant starch and dietary fiber content with the replacement of green banana flour (up to a fivefold improvement in RS performance). Sponge cakes yielded more polyphenols and

antioxidant capacity with banana flours, especially with the coarse fraction. Therefore, results showed that a mechanical fractionation allowed a feasible nutritional enhancement of cakes with the use of banana flours **(15)**.

Segundo & al. **(16)** also mentioned that about one-fifth of all bananas harvested become culls that are normally disposed of improperly. However, ripe banana pulp contains significant amounts of fibre and polyphenol compounds as well as a high content of simple sugars (61.06 g/100 g), making it suitable for sucrose replacement in bakery products. This work studied the feasibility of incorporating ripe banana flour (20 and 40% of replacement) in cake formulation. Physical, nutritional and sensory attributes of sponge and layer cakes were evaluated. The inclusion of ripe banana flour generally led to an increased batter consistency that hindered cake expansion, resulting in a slightly lower specific volume and higher hardness. This effect was minimized in layer cakes where differences in volume were only evident with the higher level of replacement. The lower volume and higher hardness contributed to the decline of the acceptability observed in the sensory test. Unlike physical attributes, the banana flour inclusion significantly improved the nutritional properties of the cakes, bringing about an enhancement in dietary fiber, polyphenols and antioxidant capacity (up to a three-fold improvement in antioxidant capacity performance). Therefore, results showed that sugar replacement by ripe banana flour enhanced the nutritional properties of cakes, but attention should be paid to its inclusion level **(16)**.

Moiraghi & al. (17) noticed that the flour parameters that related strongly to cake-making performance were selected. In this study the relationship between sponge cake quality, solvent retention capacity (SRC) profile and flour physicochemical characteristics was investigated using 38 soft wheat samples of different origins. Particle size average, protein, damaged starch, water-soluble pentosans, total pentosans, SRC and pasting properties were analyzed. Sponge cake volume and crumb texture were measured to evaluate cake quality. Cluster analysis was applied to assess differences in flour quality parameters among wheat lines based on the SRC profile. Cluster 1 showed significantly higher sponge cake volume and crumb softness, finer particle size and lower SRC sucrose, SRC carbonate, SRC water, damaged starch and protein content. Particle size, damaged starch,

protein, thickening capacity and SRC parameters correlated negatively with sponge cake volume, while total pentosans and pasting temperature showed the opposite effect. The findings indicate that the negative correlations between cake volume and SRC parameters along with the cluster analysis results indicated that flours with smaller particle size, lower absorption capacity and higher pasting temperature had better cake-making performance. Some simple analyses, such as SRC, particle size distribution and pasting properties, may help to choose flours suitable for cake making **(17)**.

Jongsutjarittam & al. (18) improved the freeze-thawed cake properties by 10-20% waxy rice flour (WRF) substitution for wheat flour (WF). Viscosity of WRF-substituted batters was lower; consequently, trapped air was less uniformly distributed than WF batter. After five freeze-thaw cycles, firmness and enthalpy of melting retrograded amylopectin of WF- and WRF-substituted cakes increased and the matrix surrounding the air pores from SEM images was denser than in fresh-baked cakes. Sensory evaluation showed an increase in firmness and a decrease in firmness acceptability of freeze-thawed cakes. However, freeze-thawed cake with WRF substitution had significantly less firmness, less dense matrix and more acceptability than WF cake. This could have been due to a low amylose content of WRF and the spread of ruptured waxy rice starch granules around swollen wheat starch granules as observed by confocal laser scanning microscopy (CLSM). Thus, WRF could be used for WF substitution to improve the firmness in freeze-thawed cake **(18)**.

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CHANGES IN COMPOSITION

Zieliński & al. (1) investigated changes in chemical composition and antioxidative properties of rye ginger cakes during their shelf-life. In particular, the changes in antioxidants content, antioxidative and reducing capacity, and Maillard reaction development in rye ginger cakesafter long-term storage were addressed. Ginger cakes produced according to the traditional and current recipe were stored for 5 years at room temperature in a dark place. The total phenolic compounds (TPC), inositol hexaphosphate (IP6), reduced (GSH) and oxidised glutathione (GSSG) contents, antioxidant and reducing capacity and Maillard reaction products (MRPs) were determined in ginger cakes after storage and then compared to those measured after baking. After long-term storage a decrease in TPC and IP6 contents in cakes was noted. In contrast, an increase in antioxidative and reducing capacity of stored cakes was observed. Long-term storage induced formation of furosine, advanced and final Maillard reaction products and caused changes in both reduced and oxidised forms of glutathione. After long-term storage the modest changes in furosine, FAST index and browning in ginger cake formulated with dark rye flour may suggest that this product is the healthiest among others. Therefore, traditional rye ginger cakes can be considered as an example of a healthy food that is also relatively stable during long term storage as noted by the small chemical changes observed in its composition **(1)**.

Pozo-Bayón & al. (2) reported that the use of solvent-assisted flavor evaporation extraction (SAFE) and purge and trap in Tenax allowed the identification of more than 100 volatile compounds in a sponge cake (SC-e). Gas chromatography-olfactometry (GC-O) of the SAFE extracts of crumb and crust were achieved in order to determine the most potent odorants of SC-e. The change in the traditional dough formulation of SC-e in which eggs were substituted by baking powder (SC-b) as the leavening agent produced important changes in some key aroma compounds. The release curves of some aroma compounds-some of them generated during baking and others added in the dough-were followed by cumulative headspace analysis. In the flavored SC-b, the aroma release curves showed a plateau after 15 min of purge, while the release increased proportionally with the purge time in the flavored SC-e. In general,

except for some of the aroma compounds with the highest log P values, the rate of release of most of the added and generated aroma compounds was significantly influenced by the changes in the cake formulation. The higher rates of release found for the aroma compounds in SC-b could contribute to explain its rapid exhaustion of aroma compounds in the purge and trap experiments and might lead to poorer sensorial characteristics of this cake during storage **(2)**.

Przygodzka & al. (3) evaluated the effect of selected spices on chemical and sensorial markers in cakes formulated on rye and light buckwheat flour fortified with spices. Among collection of spices, rye-buckwheat cakes fortified individually with cloves, nutmeg, allspice, cinnamon, vanilla, and spice mix revealed the highest sensory characteristics and overall quality. Cakes fortified with cloves, allspice, and spice mix showed the highest antioxidant capacity, total phenolics, rutin, and almost threefold higher available lysine contents. The reduced furosine content as well as free and total fluorescent intermediatory compounds were observed as compared to nonfortified cakes. The FAST index was significantly lowered in all cakes enriched with spices, especially with cloves, allspice, and mix. In contrast, browning index increased in compare to cakes without spices. It can be suggested that clove, allspice, vanilla, and spice mix should be used for production of safety and good quality cakes **(3)**.

Trattner & al. (4) reported that trans-fatty acids (TFA) have been associated with increased risk of coronary heart disease, by affecting blood lipids and inflammation factors. Current nutrition recommendations emphasize a limitation of dietary TFA intake. The aim of this study was to investigate fatty acid composition in sweet bakery products, with emphasis on TFA, on the Swedish market and compare fatty acid composition over time. Products were sampled in 2001, 2006 and 2007 and analyzed for fatty acid composition by using GC. Mean TFA levels were 0.7% in 2007 and 5.9% in 2001 of total fatty acids. In 1995-97, mean TFA level was 14.3%. In 2007, 3 of 41 products had TFA levels above 2% of total fatty acids. TFA content had decreased in this product category, while the proportion of saturated (SFA) and polyunsaturated (PUFA) fatty acids had increased, mostly through increased levels of 16:0 and 18:2 n-6, respectively. The total fat content remained largely unchanged **(4)**.

Sunil & al. (5) noticed that oilseed cakes have been in use for feed preparation. Being rich in proteins, antioxidants, fibers, vitamins and minerals, oilseed cakes have been considered ideal for food supplementation. These oilseed cakes can be processed and made more palatable and edible by suitable treatments and then incorporated as food supplements for human consumption. Rice bran pellets (RBP), stabilized rice bran (SRB), coconut cake (CC) and sesame cake (SC) were taken up for the study. These were mixed with distilled water and cooked in such a way to separate the cooked solid residue and liquid extract followed by freeze drying to get two products from each. The raw, cooked dried residue and extract were analyzed for various parameters such as moisture (0.9-27.4%), fat (2.1-16.1%), ash (3.3-9.0%), minerals (2.6-633.2 mg/100 g), total dietary fiber (23.2-58.2%), crude fiber (2.7-10.5%), protein (3.2-34.0 %), and the fat further analyzed for fatty acid composition, oryzanol (138-258 mg/100 g) and lignan (99-113 mg/100g) contents and also evaluated sensory evaluation. Nutritional composition of products as affected by cooking was studied. The cooked products (residue and extract) showed changes in nutrients content and composition from that of the starting cakes and raw materials, but retained more nutrients in cooked residue than in the extract. The sensory evaluation of cooked residue and extract showed overall higher acceptability by the panelists than the starting cakes and raw materials. On the basis of these findings it can be concluded that these cooked residue and extract products are highly valuable for food supplementation than the raw ones **(5)**.

Krishnan & Chandra (6) investigated the effects of oilseed cakes on extracellular thermostable alpha-amylase production by Bacillus licheniformis CUMC305. Each oilseed cake was made of groundnut, mustard, sesame, linseed, coconut copra, madhuca, or cotton. alpha-Amylase production was considerably improved in all instances and varied with the oilseed cake concentration in basal medium containing peptone and beef extract. Maximum increases were effected by a low concentration (0.5 to 1.0%) of groundnut or coconut, a high concentration (3%) of linseed or mustard, and an intermediate concentration (2%) of cotton, madhuca, or sesame. The oilseed cakes made of groundnut or mustard could completely replace the conventional peptone-beef extract medium as the fermentation base for the production of alpha-amylase by B.

licheniformis. The addition of corn steep liquor to cotton, linseed, sesame, or madhuca cake in the medium improved alpha-amylase production **(6)**.

Liang & al. (7) evaluated composition change of Jatropha seed cake samples upon lime pretreatment at 100 degrees C with different parameters. With a lime dose of 0.2 g and a water content of 10 ml per gram of cake and a treatment period of 1 hour, 38.2+/-0.6% of lignin was removed. However, 65+/-16% of hemicellulose was also lost under this condition. For all the treatments tested, cellulose content was not affected by lime supplementation. Through further examining total reducing sugar (TRS) release by enzymatic hydrolysis after lime pretreatment, 0.1 g of lime and 9 ml of water per gram of cake and 3 hour pretreatment produced the maximal 68.9% conversion of cellulose. Without lime pretreatment, the highest cellulose conversion was 33.3%. One microalgal species, Schizochytrium limacinum SR21 was able to grow on the hydrolyzates and generate a biomass density of 3.2 g/l in 4 day **(7).**

Shaik & al. (8) carried out studies to replace hydrogenated fat (HF) with rice bran oil (RBO) and two varieties of rice bran oil spread RBOS1 and RBOS2 in the preparation of cake. Physico-chemical properties, sensory properties, scanning electronic microscopic (SEM) study and fatty acid estimation with reference to trans fatty acids of cake made with control and experimental samples were studied. The best acceptable cake among the four i.e., RBOS2 cake was selected for consumer evaluation along with control (HF) cake. Results revealed that there was no significant difference in overall acceptability of cake made with HF and RBOS2. The internal structure and pore structure of RBOS2 cake was finer and smoother than the control cake as per SEM imaging. The pores within the core varied in diameter between 13.9 and 29.6 µm in control cake and between 16.9 and 58.6 µm in RBOS2 cake at 500 × magnification indicating good textural properties compared to HF cake. The fatty acids analysis results showed that the amount of total trans fatty acids (TFA) was 15.46% in HF cake, 3.56% in RBO cake, 4.54% in RBOS1 cake, and 3.78% in RBOS2 cake. The major trans fatty acids observed in all samples were elaidic acid (C18:1 trans-9) and Linolelidic acid (C18:2, trans-6). Elaidic acid was the highest in HF cake (6.64%) and the least in RBO cake (2.62%). Linolelidic acid was the highest in HF cake (8.48%) and the least in RBOS2 cake (0.91%).

Trans Vaccenic acid was detected only in HF cake (0.34%). TFA content assumes significance in terms of its ill effects on the health of consumers, only if fat content is also high. Hence, consumption of the HF products might prove to be harmful, if consumed in large amounts and at higher frequencies. Therefore RBOS can be promoted as healthy fat for production of baked products **(8)**.

Behera & al. **(9)** mentioned that Groundnut cake (GNC) and soybean cake (SBC) by-product of agriculture industry had protein and protein digestibility in the range of 42.7-50.5 and 71.3-76.8%, respectively. Polyphenols present in GNC and SBC were cholorogenic acid, syringic acid and p-coumaric acid. The number of bands separated in soybean meal was greater than the bands observed in GNC flour as seen in SDS-PAGE pattern, respectively. SEM of groundnut flour showed distension of protein bodies due to roasting of the oil cakes. The water absorption of wheat flour GNC blends decreased from 59.2 to 57.3% and increased in wheat flour SBC blends from 59.2 to 68.3% with an increase in oil cake from 0 to 20%. With increase in either GNC or SBC, the biscuits became harder. Addition of glycerol monostearate and sodium stearoyl lactylate in combination with 20% blend of GNC/SBC decreased the breaking strength **(9).**

Ramachandran & al. **(10)** noticed that oil cakes have been in use for feed applications to poultry, fish and swine industry. Being rich in protein, some of these have also been considered ideal for food supplementation. However, with increasing emphasis on cost reduction of industrial processes and value addition to agro-industrial residues, oil cakes could be ideal source of proteinaceous nutrients and as support matrix for various biotechnological processes. Several oil cakes, in particular edible oil cakes offer potential benefits when utilized as substrate for bioprocesses. These have been utilized for fermentative production of enzymes, antibiotics, mushrooms, etc. Biotechnological applications of oil cakes also include their usages for vitamins and antioxidants production **(10)**.

TO SUM UP: this chapter **(1-10)** indicates that various ingredients affect changes in physical and chemical composition, aroma composition and release, antioxidative properties, chemical and sensorial markers of cakes.

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MAIN PRESENTATIONS

This section is based on cake descriptions by Tastessence Staff with mild changes (1):

ANGEL FOOD CAKE

Origin: United States**.** Angel cake is a type of sponge cake, made from egg whites, cream of tartar, flour, and sugar. Often baked in a tube pan which resembles a Bundt pan. The cake is often drizzled with some glaze or fruity syrup.

APPLE CAKE/DORSET APPLES CAKE/DEVON APPLE CAKE/ SOMERSET APPLE CAKE/SZARLOTA

Origin: United Kingdom**.** Apples are the main ingredient for this cake along with almonds, walnuts, nutmeg, and cinnamon. The cake is often not glazed or frosted; however, it can be decorated with sliced apples.

BABBKA/BOBKA/BABA

Origin: Poland. This is a yeasty sponge cake often found with a chocolate or vanilla glaze and icing, garnished with almonds and/or rum.

BASBOUSA

Origin: Turkey. Basbousa is traditional Middle-Eastern cake made from semolina or farina soaked in simple syrup. The syrup is usually infused with coconut, orange flower water, or rose water.

BOSTON CREAM PIE

Origin: United States. Boston Cream Pie is made from sponge cake and chocolate cake with a layer of custard/cream in between the two layers of cake. It is then glazed with chocolate or ganache, sprinkled with sugar, and decorated with cherries.

BANANA CAKE/BREAD

Origin: United States. Banana cake or banana bread is made from mashed ripe bananas topped with nuts and chocolate.

BATTENBERG CAKE

Origin: United Kingdom. Battenberg cake is a simple sponge cake, which when cut into slices gives it a checkered pattern. It is decorated with marzipan and jam. The Battenberg cake is generally available in yellow and pink colored sponge cake.

BAUMKUCHEN

Origin: Germany. Baumkuchen is a unique vanilla layered cake with a hollow center. The cake is known for its layers that resemble the rings of a cut tree. In fact, the name of this cake in German translates to tree cake.

BIENENSTICH/BEE CAKE

Origin: Germany. Bienenstich is a yeasty cake, filled with vanilla custard, buttercream, and topped with caramelized almonds. According to the legend, a bee was attracted to this cake and stung the person who invented it, hence the name.

BLACK FOREST CAKE

Origin: Germany. This is a gorgeous chocolate sponge cake frosted and sandwiched between whipped cream and maraschino cherries. Chocolate shavings are sprinkled all over the cake to give it a richer taste.

BROWNIES

Origin: United States, Canada. Brownies are flat cakes baked square in a shallow dish. They are often made of flour, eggs, chocolate, cocoa powder, sugar, and butter. They may also contain nuts and chocolate chips. Brownies can be enjoyed with chocolate syrup and a sprinkling of powdered sugar.

BUCCELLATO

Origin: Sicily, Italy. The Buccellato is a circular cake prepared on special occasions and for that special someone. It is usually given to the godchild and his/her family by the godparents on the day of the christening. This cake contains honey, marsala, aniseed, and raisins. It is often paired with cappuccino or tea.

BUNDT CAKE

Origin: United States. The Bundt cake is baked in a distinct ring shape with a hollow center. This cake is generally found in one flavor, and often sprinkled with powdered sugar or at times glazed with chocolate.

BUTTER CAKE

Origin: United Kingdom. The main ingredient of the butter cake is butter. Other ingredients include sugar, flour, and eggs. This cake is made by the creaming method, which means butter and sugar are whisked till it turns fluffy, and eggs are gradually whisked.

BUTTERFLY CAKE

Origin: United Kingdom. The butterfly cake is a variation of a cupcake and is also known as the fairy cake. This versatile cake can be made in any flavor. The cake is carved out with a spoon to give it a shape that resembles butterfly wings. Buttercream and jam are often preferred as the filling. The wings are further decorated using icing sugar.

CARROT CAKE

Origin: United Kingdom. As the name suggests, carrots are the main ingredient for this cake, followed by flour, eggs, sugar, and almonds. Cream cheese, and sugar glaze best enhance the flavor of the cake.

CHARLOTTE CAKE

Origin: France. Charlotte cake is made from bread, sponge cake, and cookies, while ladyfingers are used to mold the cake lining. Fruit puree or custard, or flavored gelatin is filled in the layers to give it an intense taste and flavor.

CHEESECAKE

Origin: Greece. Cheesecake has a base made from crushed cookies, which is then topped with thick luscious soft cheese, eggs, and sugar.

CHIFLON CAKE

Origin: United States. Chiffon cake is another type of sponge cake made with vegetable oil, eggs, flour, and sugar. It is made in the same way as an Angel cake but with a small change, its aerated properties are combined with meringue.

CHOCOLATE BOUCHON

Origin: France. Bouchon is a rich chocolate cake, it has a unique corkscrew shape, and it's aptly named bouchon - cork in French.

CHOCOLATE CHAMBORD CAKE

Origin: Chambord is a brand of raspberry liqueur, which is amalgamated with rich dark chocolate sponge to make the chocolate Chambord cake. It is then dolloped with a bittersweet chocolate ganache.

CHOCOLATE CAKE

Chocolate is often the base cake for many other chocolate cakes. It is a common sponge cake with cocoa powder added to it while whisking the ingredients together. Ganache, fudge, sweeteners and vanilla creme are often used in between two layers as icing.

CHOCOLATE SATIN CAKE

Chocolate satin cake is a deep rich and moist chocolate layer cake filled and coated with chocolate ganache.

CHRISTMAS CAKE

Origin: United Kingdom**.** A Christmas cake is rum-soaked cake infused with dried fruit such as raisins and almonds, cinnamon, cherries, and whisked into a chocolate cake. Royal icing or glaze are often used to decorate this Christmas treat.

COCONUT CAKE

Origin: United States. Coconut cake, a popular southern delight, is white or yellow cake made with coconut milk and coconut extract. This cake is frosted and layered with cream cheese or buttercream frosting mixed with grated coconut or coconut flavor.

COLOMBA OR EASTERN DOVE CAKE

Origin: Italy. The Colomba cake is made from flour, eggs, butter, sugar, candied peel, raisins, almonds, natural yeast, and pearl sugar. Often found drizzled with chocolate.

COFFE CAKE

Origin: Germany. This cake does not have any coffee in it, but is often has coffee. The cake is flavored with cinnamon, spices, nuts and fruits, and drizzled with light glaze.

CREMESCHNITTE

Origin: Slovenia, Croatia, Germany. Cremeschnitte is a vanilla and custard cream cake. There are many regional variations, but they all include puff pastry base and custard cream.

CROQUENBOUCHE

Origin: France. The Croquembouche consists of choux pastry balls bound together with caramel. This cake is often made and served for special occasions.

CRYSTAL CAKE

Origin: China. Crystal cake is a traditional Chinese dessert and derives its name from its appearance. The cake is shiny, bright, glittering, and translucent, like a crystal.

CUPCAKE

Origin: United States. Cupcakes are made in the shape of miniature cups, hence the name. They are often frosted with rich delicious icing and at times sprinkled with sprinkles and candy.

DACQUOISE

Origin: France. Dacquoise is made from meringue, almonds, hazelnuts, whipped cream, chocolate, and buttercream.

DATE AND WALNUT LOAF

Origin: United Kingdom. Date and walnut loaf/cake is heavily induced with dates, walnuts, treacle, and tea.

DATE SQUARE/MATRIMONIAL CAKE

Origin: Canada. Date square/Matrimonial cake is a coffee cake made from cooked dates, candied peel, and oatmeal crumble.

DEATH BY CHOCOLATE CAKE

Death by chocolate cake is a rich chocolate fudge cake with double the chocolate. A soft delicious chocolate layer cake sandwiched between chocolate ganache, meringue, buttercream, and mousse.

DEPRESSION CAKE

Origin: United States. Depression cake originated, during the Great Depression, hence the name. It is made from flour, apples, raisins, prunes, allspice, cloves, nutmeg, walnut, almonds, pecans, and pears.

DEVIL'S FOOD CAKE

Origin: United States. Devil's food cake is a rich, moist chocolate layer cake. Sandwiched between rich chocolate or vanilla frosting. The chocolate cake is at times replaced by red velvet cake.

DUNDEE CAKE

Origin: Scotland. Dundee cake is made with oodles of currants, almonds, sultanas, and fruit peels.

DOBOS CAKE

Origin: Hungary. The Dobos cake has multiple layers of sponge cake. It is frosted with chocolate buttercream and coated with a thin caramel topping, with chestnuts, walnuts, hazelnuts, and almonds.

ECCLES CAKE

Origin: United Kingdom. Eccles cake are small round cakes filled with currants, topped with demerara sugar.

ESTERAZY TORTEÁZY CAKE

Origin: Hungary. The Esterházy torte is made with buttercream mixed with vanilla or cognac, sandwiched between multiple layers of almond meringue.

FAT RASCAL

Origin: Yorkshire, United Kingdom. The Fat Rascal is a yeast cake made with dried fruit, candied peel, and oats.

FINANCIER

Origin: France. The Financier is a small, light and moist, sponge cake, containing almond flour, with ground almonds, and/or almond flavoring. Other ingredients consist of flour, egg whites, and powdered sugar. The cakes are baked in small rectangular loaves.

FROG CAKE

Origin: Australia. Frog cake is shaped exactly as their name suggests. However, they are made from sponge cake, frosted with cream and fondant.

FRAISIER

Origin: France. Fraisier is a chocolate cake filled with fresh strawberries and crème pâtissière.

FRUITCAKE

Origin: Rome, Italy. Fruitcake is a simple cake loaded with dried fruits and nuts, spices, and candied fruits. The cake is often soaked in spirits and nuts.

FUNING BIG CAKE

Origin: China (Funing County, Jiangsu province). Funing big cake is a simple Chinese cake made from sticky rice, sugar, pine nuts, and lard or vegetable oil.

GENOA CAKE

Origin: Italy. Genoa cake is a yeasty cake made by adding pine nuts, and fruits viz. sultana's, cherries, almonds, candied fruits, and raising.

GERMAN'S CHOCOLATE CAKE

Origin: United States. German chocolate cake is a multiple chocolate layered cake filled and topped with pecan, chocolate, and coconut frosting. It is often garnished with caramel and maraschino cherries.

GINGERBREAD OR PIERNIK

Origin: United Kingdom. Gingerbread is a moist loaf cake made with ginger root, molasses, and honey.

GOOEY BUTTER CAKE

Origin: United States. Gooey butter cake is a flat and dense cake. It is sweet and rich, perfect to have with coffee as a coffee cake.

GÅSEBRYST

Origin: Denmark. Gåsebryst is also known as a cream cake. This cake is made with Danish pastry at the base, topped with custard, jam, whipped cream, and coated with marzipan.

HOT MILK CAKE

Origin: United States. Hot milk cake is a twin layered cake with a sweet mocha icing, topped with fruits, boiled icing, and powdered sugar. The recipe requires scalding hot milk that is poured into the batter to make this cake.

HUMMINGBIRD CAKE

Origin: United States. Hummingbird cake is made from fruits viz. banana, pineapple, pecan, vanilla extract, and spices. It is topped with dollops of cream cheese frosting.

ICE CREAM CAKE

Ice cream cake is often a three-layered cake, coated and sandwiched between ice cream.

ICEBOX CAKE

An Icebox cake is made of ladyfingers or cookies, sandwiched between jell-o, whipped cream, and pudding that is later set in the refrigerator. Cream is whipped soft and infused with cookies, chocolate, and essence and made into a cake. This cake is also called a zebra cake.

ITALIAN CREAM CAKE

Origin: Italy. Italian cream cake is a rich cake containing nuts and sweet creamy fillings.

JELLY ROLL/ROULADE/YULE LOG/ BÛCHE DE NOËL

Origin: France. Jelly rolls are sponge cake roles or roulade, filled with buttercream, jam, ganache, fruit or fruit puree, lemon curd, whipped cream, and nuts that are rolled into a log shape. They are then frosted with buttercream icing.

KING CAKE, GALETTE DES ROIS

Origin: France, Spain. King cake is also known as the Epiphany cake and is made at the end of the Christmas season. This cake has a yeasty base filled with nuts and dried fruits. The cake often decorated with a tiny plastic baby as a representation of Baby Jesus.

KLADDKAKA

Origin: Sweden. Kladdkaka is a sticky chocolate cake that is quite similar to a brownie with a soft center. The cake is dusted with powdered sugar and dolloped with whipped cream and/or vanilla ice cream.

KLIŅĢERIS

Origin: Latvia. Kliņģeris is another yeasty cake baked in a mold with a hollow center, like the bundt cake mold. The cake is infused with saffron and golden dried fruits and sprinkled with sugar.

KOLACZ

Origin: Poland. Kolacz is a wheel shaped coffee cake. It is traditionally a pastry that is often used as a wedding cake whole history dates back to the 13th century.

KOUIGN-AMANN

Origin: France (Brittany). Kouign-amann is doughy cake baked in a round baking tin. It is made from bread dough, layered with butter and sugar layers. The sugar and salty butter melts as the cake bakes, giving it layers.

KRANSEKAKE

Origin: Denmark, Norway. Kransekake is unique as it is made into a series of concentric rings. Eighteen layers, to be exact, are layered on top of each other. These rings are stuck to each other with a unique icing made from almond paste, egg whites, and sugar.

KREMÓWKA

Origin: Poland. Kremówka is made of two layers of puff pastry, sandwiched between whipped cream, custard, buttercream, or sometimes egg white cream, and is dusted with powdered sugar.

LADY BALTIMORE CAKE

Origin: United States. Lady Baltimore cake is a popular wedding cake made taller by layers of white cake enveloped and sandwiched in between boiled white icing infused chopped nuts and candied fruits.

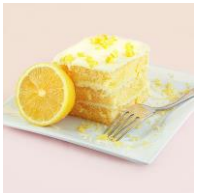
LADYFINGERS OR SAVOIARDI OR SPONGE FINGERS

Origin: France. Ladyfingers are soft sweet sponge cakes made in finger-shaped cake tins. These cakes are used to make other cakes viz. Charlotte cake, Tiramisu. These cakes are sprinkled with powdered sugar before baking. The sugar caramelizes and gives it a crunchy crust.

LAMINGTON

Origin: Australia. Lamingtons are square single-layered cakes that are coated with a thin layer of chocolate ganache or syrup and re-coated with desiccated coconut.

LEMON CAKE



Lemon cake batter is infused with lemon zest and a few drops of freshly squeezed lemon juice, along with buttermilk, vanilla extract.

MADELEINE OR PETITIE MADELEINE

Origin: France. Madeleines are known for their distinctive shell shape. These cakes are simple sponge infused with ground almonds, lemon or orange flower water.

MADEIRA CAKE

Origin: England. Madeira cake is a traditional sponge cake that is sprinkled with confectioner's sugar and garnished with dollops of whipped cream. This cake best complements tea.

MARBLE CAKE

Origin: Denmark. Marble cake is made by lightly swirling yellow cake and chocolate cake batter together. Once done, the cake is laced with chocolate frosting.

MARJOLAINE

Origin: France. Marjolaine is a multiple layered cake sandwiched between mocha almond, hazelnut butter, whipped cream, and iced with coffee buttercream, or chocolate ganache, topped with toasted almonds.

MERINGUE CAKE

Meringue is a flourless cake made from numerous cakes made of meringue, and filled with custard, mousse, whipped cream, and fruit.

MILLE CRÊPES CAKE

Origin: France. Mille Crêpes cake is composed of 20 layers of thin French crêpes sandwiched between vanilla pastry cream.

MILLE-FEUILLE OR NAPOLEONSKAKE

Origin: France. Mille-feuille, also known as a Napoleonkake, is made of caramel or carob flavor and made in the same way as tompouce. The cake has three layers of puff pastry alternating with pastry cream. It is glazed in white icing and chocolate strips, only to be combed later.

MOLTEN CHOCOLATE CAKE/LAVA CAKE

Origin: United States. Molten chocolate cake is a cross between chocolate soufflé and a flourless cake. It has an ooey-gooey molten chocolate center in the middle. Resembling lava from a volcano—chocolate volcano.

MOUSSE CAKE

A mousse cake is made of layers of mousse and sponge cake, biscuits, meringue, macaroon, or butter cake layers. The cake also consists of a layer of bittersweet chocolate mousse, and another milk chocolate mousse and a few thin layers of chocolate butter cake, frosted with a some ganache.

OPERA CAKE

Origin: France. Opera cake has a layer of chocolate, espresso, and almond, called joconde, layered with coffee-chocolate ganache and buttercream.

PACZKI

Origin: Poland. Paczki is a round spongy cake made of strawberry, sweet cheese, liqueurs, and chocolate.

PANPEPATO

Origin: Italy. Panpepato is a round cake made of almonds, pine nuts, pepper, cinnamon, nutmeg, orange and lime zest, hazelnuts, cocoa, flour, honey, and grape must.

PANETTONE

Origin: Italy. Panettone is a cross between bread and cake, made in a circular base. The cake contains lemon zest, citron, raisins, and candied orange.

PARKIN

Origin: United Kingdom. Parkin is a gingerbread cake made with treacle and oatmeal. It is often baked using golden syrup and sprinkled with extra sugar.

PAVLOVA

Origin: New Zealand. Pavlova is named after a ballerina Anna Pavlova. The cake is made of circles of meringue filled with fresh fruits and whipped cream.

PETIT FOUR

Origin: France. Petit four are tiny cakes served with coffee after meals. These are inch-square sponge cakes layered with buttercream and coated with colored fondant and redecorated with fruits, marzipan, nuts, and more icing.

PETIT GÂTEAU

Origin: France. Petit Gâteau are small chocolate cakes with a crunchy exterior with a soft and molten center. They are closely related to chocolava cake and are often with vanilla ice cream.

POVITICA

Origin: Croatia. Povitica is a rich and dense yeasty cake made from butter and cream cheese.

POUND CAKE

Origin: United Kingdom. Pound cake is the base of many a cakes. It is a rich dense buttery cake with ingredients used in the same quantity. Many varieties of this cake are found with ingredients like liqueur, extracts, flavors, chocolate chips, candied fruits, lemon and/ or orange zest, dried fruits, coffee, key lime, and other fruits.

PRINCESS CAKE

Origin: Sweden. Princess cake has alternating layers of whipped cream and sponge cake, along with layers of jam and custard, coated with marzipan.

PRINZREGENTENTORTE

Origin: Germany. The Prinzregententorte is made with sponge cake sandwiched between buttercream and chocolate glaze.

PUNSCHKRAPFEN

Origin: Austria. Punschkrapfen is a punch cake made of fine rum infused with nougat, chocolate, cake crumbs, apricot jam soaked in rum. It is glazed in thick pink sugary rum glaze drizzled in chocolate. The cake is similar to the petit four.

QUEEN CAKE

The Queen cake is a white-layered cake frosted in caramel.

RED BEAN CAKE

Origin: Japan, China. Red Bean cake is made from mashed red beans and gelatin.

RED VELVET CAKE

Origin: United States. The red velvet cake is a simple sponge cake infused with beet root juice and cocoa powder, but nowadays, food color is used instead of beet root, which gives it its distinct maroon color. The cake is topped with a thick white frosting.

RUM CAKE

Origin: Jamaica, Trinidad and Tobago. Rum cake is a pound or sponge cake that is soaked in rum, and filled with whipped cream and fresh fruits. The cake is frosted with boiled icing and dried fruits. This cake is often baked in loaf or bundt baking tins.

RUM BABA

Origin: Italy. Rum Baba are small yeasty cakes soaked in rum and/or hard liquor. They are filled with whipped cream or royal icing.

RUSKE KAPE

Origin: Bosnia. Ruske Kape cake is made in small round molds and set and cooled, the sides are coated with grated coconut and crushed walnuts. The top of the cake is drenched in chocolate, vanilla, or mocha.

SACHERTORTE

Origin: Austria. Sachertorte is a three-layered chocolate sponge cake layered and filled with apricot jam, only to be iced with dark chocolate and whipped cream.

ŠAKOTIS

Origin: Lithuania. Šakotis means 'a tree with many branches', this is probably because the cake is often found in a conical shape. The cake is rotated in front of an open fire as layers are added one on top of the other, giving it a distinct shape. This cake is drenched in chocolate glaze.

SAVARIN

Savarin is another yeast cake baked in a bundt cake mold, and soaked in orange rum syrup. It is later filled with royal icing and fresh fruit.

SEVEN LAYER CAKE

Origin: Hungary. Seven Layer cake is made of 5 to 7 thin layers and of cake and frosted with chocolate buttercream.

Sfouf

Origin: Lebanon. Sfouf is a simple cake made of semolina and almond cake that is flavored with sugar and turmeric.

SHORTCAKE

Origin: United Kingdom. Shortcake is a simple sponge cake. The first half of the cake is topped with whipped cream and fruits drizzled with biscuit or scone powder.

SICILIAN CASSATA

Origin: Italy. Sicilian Cassata is a round sponge cake moistened by fruit juices or liqueur. Layered with candied peels, ricotta cheese, and chocolate or vanilla filling. It is then coated with marzipan.

SIMNEL CAKE

Origin: United Kingdom. A Simnel cake is a fruit cake with marzipan. The cake is induced with spices, dried fruits, and zest.

SNOW SKIN MOONCAKE

Origin: Hong Kong, China. Snow Skin Mooncake is made and devoured during a mid-autumn festival. It is made from glutinous rice which is later frozen.

SOULLÉ

Origin: France. Soufflé is a light and fluffy cake made with eggs combined with other ingredients like jams, cheese, fruits, chocolate, berries, lemon and lemon zest.

SPEKKOEK

Origin: Netherlands. Spekkoek is a multilayer cake containing almonds, cashews, cheese, and dried fruits.

SPICE CAKE

Origin: North America. Spice cake is made with an abundance of spices like cloves, allspice, nutmeg, maple syrup, ginger, and cinnamon.

SPONGE CAKE

Origin: United Kingdom. The sponge cake is the base of almost any cake. It is a light cake that makes the base of many cakes viz., ladyfingers and many other.

STACK CAKE

Origin: United States. Stack Cake is a type of sponge cake in which cakes made of different flavors and frosting are stacked one on top of the other.

STRAWBERRY CAKE

Strawberry cakes are simple white sponge cakes infused with fresh and dried strawberries. They are then frosted with royal icing topped with fresh strawberries.

STREULKUCHEN

Origin: Germany. Streuselkuchen is a yeasty doughy flat cake which is cut into oblong pieces. It is enveloped with streusel a combination of crumbs made from sugar, flour, and fat.

SWISS ROLL

Origin: United Kingdom. Swiss roll is a thin sponge cake filled with jam, icing, and whipped cream, then rolled and allowed to set. Then, it is cut into slices.

Tarte Tatin

Origin: France. Tarte Tatins are upside down tarts that are made from caramelized fruits.

TEACAKE

Origin: United Kingdom. Teacakes are a cross between a cake and cookie and served as finger foods. Dolloped with whipped cream and sandwiched between two small discs of sponge cake.

THOUSAND/TWELVE LAYER CAKE

Origin: Dutch. Though the number thousand is highly exaggerated, the cake has only 12 layers. The layers are thin and flavorful, often infused with local spices.

TIRAMISU

Origin: Italy. Tiramisu has layers of ladyfingers that are soaked in espresso liqueur and layered with mascarpone cheese and custard mixture, and dusted with cocoa powder.

TORTE

Origin: Spain. Tortes are a round, rich, dense cakes that are infused with ground nuts and fruit puree. Unlike cakes, tortes are not layered and are often glazed and topped with fresh fruits and whipped cream.

TORTA TRE MONTI

Origin: Italy (San Marino). A Torta Tre Monti is a three-layered cake made of thin wafers sandwiched between hazelnut or chocolate ganache, and decorated with fondant.

TRES LECHES CAKE

Origin: South America. The tres leches cake is a sponge cake soaked in a variety of milk, like evaporated milk, condensed milk, and whole milk, which is topped with whipped cream.

TUNIS CAKE

Origin: Scotland. Tunis cake is a madeira cake with a thick layer of chocolate cake and coated with marzipan and fruits.

UPSIDE-DOWN CAKE

Origin: United Kingdom. The upside-down cake is a single-layer vanilla cake. The base of which is layered and made of syrupy sliced fruit topped with cake batter. Once baked and cooled, the cake is turned upside down, making the base of the cake into the top of the cake. Fruits like pineapples, apples, and cherries are often used in the cake.

VICTORIA SPONGE CAKE

Origin: United Kingdom. The Victoria sandwich cake is a twin-layered sponge cake filled with whipped cream and jam, topped with a light glaze. The cake is often served with tea and sandwiches.

WHOOPIE PIES

Origin: United States. Whoopie pies are a triple amalgamation between cakes, cookies, and pies. It is also known as gob or black moon. Often found in chocolate cake, pumpkin or gingerbread cake, sandwiched between frosting.

WINE CAKE

Origin: Colombia. Wine cakes are made with additional ingredients such as wine, candied fruit, rum, and raisins.

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FORMULATIONS/PREPARATION

Sakiyan & al. (1) mentioned that dielectric properties can be used to understand the behavior of food materials during microwave processing. Dielectric properties influence the level of interaction between food and high frequency electromagnetic energy. Dielectric properties are, therefore, important in the design of foods intended for microwave preparation. In this the variation of dielectric properties of different cake formulations during baking in microwave and infrared-microwave combination oven was determined. In addition, the effects of formulation and temperature on dielectric properties of cake batter were examined. Dielectric constant and loss factor of cake samples were shown to be dependent on formulation, baking time, and temperature. The increase in baking time and temperature decreased dielectric constant and loss factor of all formulations. Fat content was shown to increase dielectric constant and loss factor of cakes **(1)**.

Sakiyan & al. (2) also determined the effect of different formulations on color and textural characteristics of different cakes during baking in microwave and near infrared-microwave combination ovens. For comparison, cakes were also baked in conventional ovens. Color and hardness for both types of baking schemes were found to be dependent on formulation. Cakes containing Simplesse, a fat replacer consisting mostly of whey protein, baked in microwave and near infrared-microwave combination ovens were found to be the firmest cakes **(2)**.

Hill & Reagan (3) mentioned that the quality of yellow butter cakes was adversely affected by microwave cookery. Conventional cakes consistently received the highest sensory ratings. Cakes baked on a carousel in the microwave oven were evaluated as being equal or superior to cakes baked in the microwave without a carousel. Sensory evaluations for appearance and flavor were significantly higher, and values for shear resistance were significantly lower, indicating greater tenderness, for cakes baked in the microwave oven

with a carousel compared to those manually turned. Although cakes baked in a conventional oven were superior in appearance, tenderness, mouth feel, flavor, and texture, cakes baked in the microwave oven were considered satisfactory **(3)**.

Ozkahraman & al. (4) compared the quality of legume cakes baked in microwave-infrared combination (MW-IR) oven with conventional oven. Legume cake formulations were developed by replacing 10% wheat flour by lentil, chickpea and pea flour. As a control, wheat flour containing cakes were used. Weight loss, specific volume, texture, color, gelatinization degree, macro and micro-structure of cakes were investigated. MW-IR baked cakes had higher specific volume, weight loss and crust color change and lower hardness values than conventionally baked cakes. Larger pores were observed in MW-IR baked cakes according to scanning electron microscope (SEM) images. Pea flour giving the hardest structure, lowest specific volume and gelatinization degree was determined to be the least acceptable legume flour. On the other hand, lentil and chickpea flour containing cakes had the softest structure and highest specific volume showing that lentil and chickpea flour can be used to produce functional cakes **(4)**.

Aydogdu & al. **(5)** investigated the effects of addition of dietary fibers on rheological properties of batter and cake quality. Wheat flour was replaced by 5 and 10% (wt%) oat, pea, apple and lemon fibers. All cake batters showed shear thinning behavior. Incorporation of fibers increased consistency index (k), storage modulus (G') and loss modulus (G”). As quality parameters, specific volume, hardness, weight loss, color and microstructure of cakes were investigated. Cakes containing oat and pea fibers (5%) had similar specific volume and texture with control cakes which contained no fiber. As fiber concentration increased, specific volume decreased but hardness increased. No significant difference was found between weight loss of control cake and cakes with oat, pea and apple fibers. Lemon fiber enriched cakes had the lowest specific volume, weight loss and color difference. When microstructural images were examined, it was seen that control cake had more porous structure than fiber enriched cakes. In addition, lemon and apple fiber containing cakes had less porous crumb structure as compared to oat and pea containing ones. Oat and pea fiber (5%)

enriched cakes had similar physical properties (volume, texture and color) with control cakes **(5)**.

Seyhun & al. (6) investigated the effects of different types of emulsifiers, gums, and fat contents on the retardation of staling of microwave-baked cakes. First, different types of emulsifiers (DATEM, Lecigran, and Purawave) at three different fat contents (50%, 25%, and 0%) were added to cake formulations to retard staling of microwave-baked cakes. Then, three types of gums (guar gum, xanthan gum, and methylcellulose) were added to the optimum formulations chosen. As a control, cakes formulated without any emulsifier or gum addition and baked in a conventional oven at 175 degrees C for 25 min was used. Weight loss, firmness, soluble starch and amylose content of the cakes were used as the indicators of staling criteria. Cakes were baked in a microwave oven for 1.5 min at 100% power. Variation of staling parameters during storage of cakes followed zero-order kinetics. Use of emulsifiers and gums helped to retard staling of microwave-baked cakes. Fat content was found to be a significant factor in affecting variation of firmness and weight loss of the cakes during storage. DATEM and Purawave were the most effective emulsifier types. Using gums in combination with emulsifiers gave better moisture retention and softer cakes than using gums alone **(6)**.

TO SUM UP: this chapter **(1-6)** shows that different formulations affect physical properties of cakes baked with microwave and near infrared-microwave combinations.

Although cakes baked in a conventional oven are superior in appearance, tenderness, mouth feel, flavor, and texture, cakes baked in the microwave oven are considered satisfactory.

Different flours affect quality of legume cakes baked in microwave-infrared combination oven and conventional oven.

Addition of different fibers affects rheological characteristics of cake batter and quality of cakes.

Different emulsifier types, fat contents, and gum types influence retardation of staling of microwave-baked cakes.

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IMPROVEMENT OF TEXTURE & SENSE PROPERTIES

Ben Jeddou & al. (1) mentioned that demand for health oriented products such as low calories and high fiber product is increasing. The aim of the present work was to determine the effect of the addition of potato peel powders as protein and dietary fiber source on the quality of the dough and the cake. Powders obtained from the two types of peel flour showed interesting water binding capacity and fat absorption capacity. Potato peel flours were incorporated in wheat flours at different concentration. The results showed that peel powders additionally considerably improved the Alveograph profile of dough and the texture of the prepared cakes. In addition, color measurements showed a significant difference between the control dough and the dough containing potato peels. The replacement of wheat flour with the potato powders reduced the cake hardness significantly and the L(*) and b(*) dough color values. The increased consumption of cake enriched with potato peel fiber is proposed for health reasons. The study demonstrated that protein/fiber-enriched

cake with good sensory quality could be produced by the substitution of wheat flour by 5% of potato peel powder. In addition and technological point of view, the incorporation of potato peel powder at 5% increase the dough strength and elasticity-to-extensibility ratio (P/L) **(1)**.

Aziah & al. (2) investigated sponge cake prepared by partial substitution of wheat flour with mango pulp and mango peel flours (MPuF and MPeF, respectively) at different concentrations (control, 5%, 10%, 20% or 30%) for the physico-chemical, nutritional and organoleptic characteristics. Results showed sponge cake incorporated with MPuF and MPeF to have high dietary fiber with low fat, calorie, hydrolysis and predicted glycemic index compared with the control. Increasing the levels of MPuF and MPeF in sponge cake had significant impact on the volume, firmness and color. Sensory evaluation showed sponge cake formulated with 10% MPuF and 10% MPeF to be the most acceptable. MPeF and MPuF have high potential as fiber-rich ingredients and can be utilized in the preparation of cake and other bakery products to improve the nutritional qualities **(2)**.

Baeva & al. (3) studied the complete sucrose elimination and its replacement by microencapsulated aspartame (Nutra Sweet) and bulking agents (sorbitol, wheat starch and wheat germ) on the physical and textural sensory characteristics of two diabetic sponge cakes against a control sponge cake. Mathematical and statistical methods were used and regression models worked out, describing the physical and textural characteristics of the three sponge cakes and their values were optimized. The effect on the porosity, springiness, volume and shrinkage of sponge takes was substantial and depended on the amount of the added ingredients. The diabetic sponge cake containing wheat germ showed the least physical and sensory deviations against the control sponge cake. The energy value of the diabetic sponge cakes against the control one was reduced with 25% for the ordinary sponge cake without sucrose and with 29% for sponge cake without sucrose containing wheat germ **(3)**.

Singh & al. **(4)** used whole navy bean flour and its fine and coarse particle size fractions to completely replace wheat flour in cakes. Replacement of wheat flour with whole bean flour significantly increased the protein content. The protein content was adjusted to 3 levels with navy bean starch. The effect of navy bean flour and its

fractions at 3 levels of protein on cake batter rheology and cake quality was studied and compared with wheat flour samples. Batters prepared from navy bean flour and its fractions had higher viscosity than the cake flour. Reducing the protein content by addition of starch significantly lowered the viscosity of cake batters. The whole navy bean flour and coarse bean fraction cakes were softer than cakes made with wheat flour but had reduced springiness. Principal component analysis showed a clear discrimination of cakes according to protein. It also showed that low protein navy bean flour cakes were similar to wheat flour cakes. Navy bean flour with protein content adjusted to the level of cake (wheat) flour has potential as a healthy alternative in gluten-free cakes **(4)**.

Srivastava & Semwal (5) mentioned that virgin coconut meal (VCM) cakes were prepared by replacing refined wheat flour (maida) (5 to 20% level) to check its effect on chemical, textural and rheological attributes of cake. The addition of VCM significantly ($p \leq 0.05$) increased redness (a*), yellowness (b*) while reduced lightness (L*) of cakes. The incorporation of VCM affects the hardness, adhesiveness gumminess and chewiness of cake. The effect of flour replacement with VCM increased the viscosity of batter which leads to increase in consistency index and lower the shearthining behavior. The viscoelastic behavior of cake batter in which elastic modulus (G') and viscous modulus (G'') both were decreased with the increase in percentage of VCM. The differential scanning calorimetry (DSC) analysis revealed that the onset (To), end set (Tc) and enthalpy of gelatinization (ΔH) increased with the increased level of VCM **(5)**.

Gough & al. (6) evaluated the literature on the role of chlorine treatment of flour for use in high-ratio cake production in relation to current knowledge of cereal chemistry and cake technology. A brief perspective of the present use of chlorine in high-ratio cake flours is included. Investigations of the uptake of gaseous chlorine by flour and its distribution among and chemical action upon the major flour components (water, protein, lipid, and carbohydrate) are assessed. The physical effects of chlorination as demonstrated by experiments with batters and cakes and by physicochemical observations of flour and its fractions are also considered. The characteristics of the starch in flour appear to be critical in high-ratio cakes. Chlorine treatment modifies the gelatinization behavior of the starch granules yet does

not change their gelatinization temperature not is there evidence of chemical attack upon the starch molecules. Therefore, it is suggested that chlorine effects the necessary changes in starch behavior by reacting with the noncarbohydrate surface contaminants on the granules. Alternative methods of improving high-ratio cake flours are mentioned, particularly heat-treatment processes **(6)**.

TO SUM UP: this chapter **(1-6)** demonstrates that texture and sensory properties of cakes can be improved by addition of potato peel powder with high level of dietary fiber and protein. In addition, nutritional and sensory quality of sponge cake can be reached by incorporation of high dietary fiber containing mango (Mangifera indica var. Chokanan) pulp and peel flours. While navy bean flour particle size and protein content affect cake baking and batter quality.

VCM cakes by replacing refined wheat flour (maida) increased redness, yellowness, reduced lightness of cakes, and affects the hardness, adhesiveness gumminess and chewiness of cake.

Chlorine treated flour for use in high-ratio cake production causes the necessary changes in starch behavior by reacting with the noncarbohydrate surface contaminants on the granules.

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FAT REDUCTION & REPLACERS

Fernandes & Salas-Mellado (1) mentioned that breads and chocolate cakes were prepared with different levels of chia mucilage dried at 50°C or lyophilized as fat, resulting in healthier products. Results indicated that breads and chocolate cakes made with chia mucilage can replace up to 50% of fat without affecting the technological and physical characteristics. The replacement of 75% of fat, for both types of mucilage, had a significant reduction in fat content of 56.6% in breads and 51.6% in cakes, producing a slight decrease in the technological characteristics of the products. Sensorial parameters showed good acceptability, with greater purchase intent for both products when added with chia mucilage dried at 50°C. Therefore, chia mucilage proved to be a new alternative for replacing fat in food products, preserving the quality attributes and making them healthier foods **(1)**.

Psimouli & Oreopoulou (2) noticed that fat at 35% to 100% was replaced in cakes by maltodextrin (dextrose equivalent = 3), inulin (high performance and granulated), oligofructose, citrus pectin, and microparticulated protein. Fat replacement by 35% did not induce significant differences in general. Above 65% fat replacement resulted in statistically significant ($p<0.05$) decreased viscosity (except for pectin) that was followed by statistically significant decrease in air incorporation and broader bubble size distribution. The starch gelatinization temperature showed a statistically significant increase when fat was replaced by fructose oligosaccharides. The cakes presented statistically significant increase of hardness, elasticity, and decrease of volume development as fat replacement increased above 65%. Also cakes with increased fat replacement received lower scores on taste and flavor, whereas at total fat replacement they were evaluated as not acceptable. Nevertheless, at 65% fat replacement, the samples presented acceptable textural, physical, and sensorial attributes **(2)**.

Diez-Sánchez & al. (3) assessed the effect of substituting 30% of fat by soluble, insoluble fiber, or a mix of both fibers in sponge cake quality, structure, acceptability, and starch digestibility. The apparent viscosity of the different formulations was measured and micro-baking was simulated. Texture profile tests were carried out and the crumb structure was examined. In vitro digestion was performed to study the digestibility of starch and a sensory test was carried out to know consumer acceptance. The soluble fiber (maltodextrin) affected the structure and quality of the cakes less than the insoluble fiber (potato fiber) and the use of soluble fiber in the formulation resulted in lower glucose release under in vitro conditions. The consumer did not find differences among the control cake and the cakes prepared with soluble fiber. Considering the results as a whole, soluble fiber may be used for partial replacement of fat in sponge cake formulations and may constitute an appropriate strategy for obtaining healthy sponge cakes **(3)**.

Eslava-Zomeño & al. **(4)** mentioned that the fat was partially replaced in a sponge cake formulation (0%, 30%, 50%, and 70%) with OptiSol™5300. This natural functional ingredient derived from flax seeds, rich in fiber and alpha-linoleic acid, provides a natural substitute for guar and xanthan gums, avoiding E-numbers on labels. The structure and some physicochemical properties of the formulations were examined, sensory analysis was conducted and changes in starch digestibility due to adding this ingredient were determined. Increasing quantities of OptiSol™5300 gave harder cakes, with less weight loss during baking, without affecting the final cake height. There were no significant differences ($p>0.05$) in texture, flavor and overall acceptance between the control and the 30% substitution cake, nor in the rapidly digestible starch values. Consequently, replacing up to 30% of the fat with OptiSol™5300 gives a new product with health benefits and a clean label that resembles the full-fat sponge cake **(4)**.

Rodríguez-García & al. (5) studied the effects of several fat replacement levels (0%, 35%, 50%, 70%, and 100%) by inulin in sponge cake microstructure and physicochemical properties. Oil substitution for inulin decreased significantly ($p<0.05$) batter viscosity, giving heterogeneous bubbles size distributions as it was observed by light microscopy. Using confocal laser scanning microscopy the fat was observed to be located at the bubbles'

interface, enabling an optimum crumb cake structure development during baking. Cryo-SEM micrographs of cake crumbs showed a continuous matrix with embedded starch granules and coated with oil; when fat replacement levels increased, starch granules appeared as detached structures. Cakes with fat replacement up to 70% had a high crumb air cell values; they were softer and rated as acceptable by an untrained sensory panel (n=51). So, the reformulation of a standard sponge cake recipe to obtain a new product with additional health benefits and accepted by consumers is achieved. In this study, fat is replaced by inulin in cakes, which is a fiber mainly obtained from chicory roots. Sponge cake formulations with reductions in fat content up to 70% are achieved. These high-quality products can be labeled as "reduced in fat" according to U.S. FDA (2009) and EU regulations (European-Union 2006) **(5)**.

Andrade & al. (6) evaluated potential replacers of fat in sponge cake formulations. This investigation consisted initially of monitoring the physical-chemical changes in sponge cake batters caused by gradually replacing the vegetable fat/margarine of a control sample (standard sponge cake recipe) with galactomannan extracted from the seeds of Cassia grandis. Several samples were prepared where a 100% concentration of vegetable fat was substituted with galactomannan in different concentrations. Both microscopic and macroscopic characteristics of pure fat cake batter formulations and formulations were compared with controlled fat/galactomannan mixtures. At this first stage, rheometry and optical microscopy were employed to characterize the rheological features and air bubble distribution in the batters. In the second stage, the effects of fat substitution with galactomannan, now for the final baked cakes, were also monitored. Scanning electron microscopy (SEM) and standard sensorial tests were performed in order to correlate the final color, texture, and taste characteristics of the final sponge cake and those characteristics obtained initially for the batter. According to the statistical analysis of the data, a 75% fat replacement with galactomannan at only 1.0% concentration was achieved, while successfully maintaining surface microstructure, sensory acceptance, and rheological behavior similar to the original formulation containing only fat. Regarding vegetable fat substitution with galactomannan, the results allow to conclude that rheometry and

bubble distribution tests on the initial batters are useful indicators of the final cake quality **(6)**.

Khalil (7) studied physical and sensory characteristics of cakes prepared with either the carbohydrate-based fat replacers N-Flate, Paselli MD 10 and Litesse (0, 25, 50 and 75% of fat weight) or fat replacers plus emulsifier (mono- and diglycerides; 0 and 3% of flour weight). Specific gravity of the batter was significantly ($p \leq 0.05$) improved by using the carbohydrate-based fat replacers, especially at the 25 and 50% replacement levels. The combination of the emulsifier with either Paselli MD 10 or Litesse also enhanced the specific gravity. Cakes prepared with fat replacers at the 25 and 50% levels had higher volumes, specific volume and standing heights than those of the control. Cakes prepared with fat replacers at the 25, 50 and 75% levels were more compressible than the control. Cakes prepared with Paselli MD 10 had the highest volumes, specific volume, standing heights and compressibilities. Incorporation of emulsifier with fat replacers improved cake volumes, standing heights and compressibilities. Cakes prepared with fat replacers exhibited higher crust and crumb color values compared to the control. Cakes prepared with 25 or 50% fat replacers had higher mean scores for flavor, softness and eating quality than the control. Incorporation of emulsifier with fat replacers did not affect the crust color, crumb color and flavor, but significantly ($p \leq 0.05$) improved softness and eating quality **(7)**.

Román & al. (8) studied the effects of three levels of fat replacement (1/3, 2/3, and 3/3) by extruded flour paste and the effects of the presence of emulsifier on layer cake batter characteristics and final cake quality. Replacement of oil by extruded flour paste modified the batter density and microscopy, reducing the number of air bubbles and increasing their size, while emulsifier incorporation facilitated air entrapment in batter. Emulsifier addition also increased the elastic and viscous moduli of the batter, while oil reduction resulted in a less structured batter. Emulsifier incorporation leads to good quality cakes, minimizing the negative effect of oil reduction, maintaining the volume and reducing the hardness of cakes. Consumer acceptability of the reduced fat cakes was improved by the addition of emulsifier. Thus, the results confirmed the positive effect of partial oil substitution (up to 2/3) by

extruded flour paste on the quality of reduced fat cakes when emulsifier was incorporated **(8)**.

TO SUM UP: this chapter **(1-8)** shows that reduction or replacement of fat contents in cakes can be achieved by addition of chia seed mucilage, maltodextrin (dextrose equivalent = 3), inulin (high performance and granulated), oligofructose, citrus pectin, and microparticulated protein, insoluble fiber, or soluble fiber or a mix of both fibers, OptiSol™5300, and galactomannan extracted from the seeds of Cassia grandis.

Fat replacement presents acceptable textural, physical, and sensorial attributes. New alternatives for replacing fat preserve the quality of cakes and make them healthier.

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ALTERNATIVE SWEETENERS

Psimouli & Oreopoulou (1) investigated whether certain polyols (mannitol, maltitol, sorbitol, lactitol), fructose, oligofructose and polydextrose can replace sugar (by an equal amount of each substitute) in cake formulations. The rheological behavior of the cake batter and the physical characteristics of the cakes containing sugar substitutes were compared with the respective attributes of the control cake. Differential scanning calorimetry was used to investigate the effect of sugar substitutes on starch gelatinization. Sensorial characteristics were evaluated by instrumental measurements and sensory evaluation. The correlation of the batter characteristics with the textural attributes of the final product was also attempted. The best results were obtained by using oligofructose, lactitol or maltitol as sugar replacers, which exhibited similar behavior to sucrose in terms of batter rheology and increased starch gelatinization temperature. Fructose and mannitol led to cakes of poor quality characteristics, as was demonstrated by instrumental measurements and sensory evaluation. The data show that batter rheological behavior as well as the ability of sugar substitutes to increase starch gelatinization temperature proved to be controlling factors of the textural properties and volume of the cakes. The sensory evaluation indicated that overall acceptance followed closely the scores of tenderness and taste **(1)**.

Lecerf & al. **(2)** evaluated the glycemic and insulinaemic responses, in healthy adults, to short-chain fructo-oligosaccharides (scFOS) from sucrose used to replace sugars in foods. Two study populations aged 18-50 years were recruited and they consumed dairy desserts or pound cakes containing either standard sugar content or scFOS to replace 30 % of the sugar content. For each study, the two products were tested once under a double-blind and cross-over design with at least 7 days between the two tests. Glucose and insulin were measured using standard methods in blood samples collected with a venous catheter for 120 min during a kinetic test. For the dairy desserts, replacing 30% of the sugars with scFOS significantly reduced postprandial glycemic (AUC0-120 min; p=0.020) and insulinaemic (AUC0-120 min; p=0.003) responses. For the pound cakes, the glycemic response was not altered (AUC0-120 min; p=0.322) while the insulinaemic response tended to be lower (AUC0-

120 min; p=0.067). This study showed that scFOS can be used to replace sugars with the benefit of lowering the postprandial glycemic response without increasing the insulinaemic response. The effect might be modulated by other parameters (e.g. fat content) of the food matrices **(2)**.

Miller & al. **(3)** mentioned that several commercially available alternative sweeteners have potential in reducing the caloric content of baked products. Sugar alcohols and natural sweeteners have similar bulk as sucrose and can replace sucrose directly. High intensity sweeteners have high potency but light weight so bulking agents are often added. This study determined alternative sweeteners and combinations of alternative sweetener and a bulking agent that produced good quality white layer cakes. Cakes made with maltitol were acceptable but erythritol and fructose produced undesirable cakes. Maltodextrin and polydextrose were acceptable bulking agents, producing cakes that were similar to control cakes. The flavor of cakes sweetened with sucralose was acceptable but those with stevia had a disagreeable metallic aftertaste. Cakes made with sucralose plus maltodextrin were preferred over those containing sucralose plus polydextrose. Consumer acceptance of flavor, texture and overall liking of cakes containing maltitol was similar to sucrose and both were preferred over cakes containing maltodextrin plus sucralose. The data indicate that replacing sucrose with maltitol in white layer cakes reduced the caloric content by 16% with no loss in quality **(3)**.

TO SUM UP: this chapter **(1-3)** indicates that certain polyols (mannitol, maltitol, sorbitol, and lactitol), fructose, oligofructose and polydextrose can replace sugar (by an equal amount of each substitute) in cake formulations.

scFOS can be used to replace sugars with the benefit of lowering the postprandial glycemic response without increasing the insulinaemic response.

Replacing sucrose with maltitol in white layer cakes reduces the caloric content by 16% with no loss in quality.

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RICE CAKES

Goto & al. (1) evaluated the whiteness of cooked rice and rice cakes using a portable spectrophotometer with a whiteness index (WI). Also, by using boiled rice for measurement of Mido values by Mido Meter, it was possible to infer the whiteness of cooked rice without rice cooking. In the analysis of varietal differences of cooked rice, 'Tsuyahime', 'Koshihikari' and 'Koshinokaori' showed high whiteness, while 'Satonoyuki' had inferior whiteness. The whiteness of rice cakes made from 'Koyukimochi' and 'Dewanomochi' was higher than the whiteness of those made from 'Himenomochi' and 'Koganemochi'. While there was a significant correlation (r = 0.84) between WI values and whiteness scores of cooked rice by the sensory test, no correlation was detected between the whiteness scores and Mido values, indicating that the values obtained by a spectrophotometer differ from those obtained by a Mido Meter. Thus, a spectrophotometer may be a novel device for measurement of rice eating quality **(1)**.

Buttery & al. (2) obtained volatiles from commercially prepared and laboratory-prepared rice cakes using high-flow dynamic headspace isolation with Tenax trapping. Analysis was carried out by capillary GC/MS. More than 60 compounds were identified Major volatiles included 1-hydroxy-2-propanone, furfuryl alcohol, 2, 5-dimethylpyrazine, 2-methylpyrazine, pyrazine, hexanal, furfural, pentanol, 3-hydroxy-2-butanone (acetoin), and ethyl-3, 6-dimethylpyrazine. Although not ideally applicable to a dry product, concentration/threshold ratios indicated that the compounds with a high probability of contributing to the aroma and flavor included 3-methylbutanal, dimethyl trisulfide, 2-ethyl-3,5-dimethylpyrazine, 4-

vinylguaiacol, hexanal, (E,E)-2,4-decadienal, 2-methylbutanal, 2-acetyl-1-pyrroline, 1-octen-3-ol, and 1-octen-3-one **(2)**.

Sae-Eaw & al. (3) evaluated consumer acceptance and purchase intent of nonwheat butter cake formulations prepared with Thai jasmine rice flour. Three nonwheat rice butter cakes were prepared with varying amounts of powdered emulsifier (propylene glycol ester:diacetyl tartaric acid ester of monoglyceride, 8:2) at 0% (product A), 7.5% (product B), and 15% (product C) of the margarine content (15%) in the cake formulation. A commercial wheat-based butter cake served as the control. Consumers (n=400) evaluated acceptability of 9 sensory attributes using a 9-point hedonic scale. Overall acceptance and purchase intent were determined with a binomial (yes/no) scale. At least 81% of consumers accepted products B and C, of which 42.1% and 47%, respectively, would purchase the products if commercially available. Product A was neither liked nor disliked with an overall liking score of 5.39. The butter cake products were differentiated by textural acceptability (overall texture, softness, and moistness) with a canonical correlation of 0.71 to 0.79. Overall liking and taste influenced overall acceptance and purchase intent. Odor influenced purchase intent ($p=0.0014$), but not overall acceptance. The odds ratio of overall liking was 3.462 for purchase intent, indicating the probability of the product being purchased is 3.462 times higher (than not being purchased, $p<0.0001$) with every 1-unit increase of the overall liking score. Based on the logit model, overall acceptance and purchase intent could be predicted with 89.3% and 83.3% accuracy, respectively. The study demonstrated feasibility of completely substituting wheat flour with Thai jasmine rice flour for production of butter cake products acceptable to American consumers **(3)**.

Yoon & al. **(4)** investigated whether the consumption of Korean rice cakes enriched with dietary fiber with or without polyphenol rich plants might decrease the risk factors of metabolic syndrome (MetS). Rice cakes were manufactured using fructooligosaccharides, resistant starch, and psyllium as sources of dietary fibers with and without polyphenol rich Artemisia annua and Gynura procumbens Merr. (RC+FP and RC+F, respectively), and prepared in three forms (songpyeon, seolgidduk, and chaldduk). Ninety subjects with at least one MetS risk factor were recruited for 6 weeks of dietary intervention. Sixty subjects were finally included for the analysis.

Compared to the initial values, RC+FP group had decreased levels of fasting blood glucose (FBG), HOMA-IR and blood pressure after 6 weeks, whereas RC+F group didn't have significant changes in them. Regarding the improvement of individual MetS risk factors, RC+FP group showed significant reduction in FBG and blood pressures but RC+F group only had reduction in systolic blood pressure. After the intervention, a reduction in the number of MetS risk factors was greater in the RC+FP group than in the RC+F group. The data indicate that dietary fiber enriched rice cakes with or without polyphenols decreased the number and/or the levels of MetS risk factors. Polyphenol rich plant components may provide additional health benefits in controlling FBG and blood pressure **(4)**.

TO SUM UP: this chapter **(1-4)** shows that whiteness of cooked rice and rice cakes can be evaluated by using a portable spectrophotometer.

Thai jasmine rice flour for production of butter cake products is acceptable by American consumers.

Rice cakes containing dietary fiber supplemented with or without Artemisia Annua and Gynura Procumbens Merr alleviate the risk factors of metabolic syndrome.

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GLUTEN FREE CAKES

Pineli Lde & al. (1) mentioned that the extraction of oil from baru almonds produces a waste that carries part of their nutritional qualities and antioxidants. It can be used to produce partially deffated baru flour (PDBF). This study aimed to evaluate the applicability of PDBF and the effect of the addition of xanthan gum (XG) to produce gluten free cakes. Cakes were prepared with 100% wheat flour (WF cake) and with 100% PDBF and four different levels of XG (0%-PDBF cake, 0.1%-X1, 0.2%-X2 and 0.3%-X3 cakes), and evaluated for composition, antioxidants, moisture, specific volume, texture and sensory acceptance. PDBF cakes showed lower carbohydrate values, but higher protein, lipids, calories and antioxidant contents. They were rich in fiber, as well as iron, zinc and copper. The replacement of WF by PDBF resulted in an increased hardness and adhesiveness and a decreased cohesiveness, elasticity and moisture. Chewiness of X2 cake was similar to that of WF cake. X2 and X3 cakes showed specific volume closer to that of WF cake. No difference was found among the treatments for texture and appearance acceptances. Flavor of X2 and X3 cakes were more accepted than WF cake. Acceptance of all cakes was in the liking region of hedonic scale. PBDF associated to XG is a feasible option to substitute WF in gluten free cake, improving its nutritional quality **(1)**.

Gluten free sponge cake.

Majzoobi & al. (2) mentioned that carrot pomace powder (CPP) is a valuable by-product of carrot processing containing nutrients and fiber and can be utilized for enrichment of gluten-free products. The main purpose of this study was to determine the effects of various levels of CPP (0, 10, 20, and 30%) and a mixture of hydrocolloids (HC) including pectin and xanthan (1.5% of each) on the quality of batter and gluten-free cakes. With increasing the level of CPP and inclusion of HC the viscosity of the batter increased significantly from 87 mPa s for the control to >7000 mPa s for 30%CCP + HC sample. The density of the control batter was 1.2 g/cm^3 which reduced significantly to 0.899 g/cm^3 for HC sample. The pH of the cake reduced from 7.23 to 6.78 with addition of CPP but increased slightly with inclusion of HC. The density of the cake reduced from 0.510 g/cm^3 for the control to 0.395 g/cm^3 for 20%CCP + C sample. The texture of the cakes became softer, more springy and chewable with addition of CPP, CPP + HC, and HC. The control sample had the lowest uniformity index (0.178) which improved with addition of CPP and CPP + HC and a highly uniform cake with a uniformity index of 0.045 was obtained for the 30%CCP + HC cake. Addition of CPP increased the dark color of the cakes while inclusion of HC had no effect on the appearance of the cake and coor. It was concluded that inclusion of maximum 30%CCP and 20%CPP + HC promoted the quality and sensory attributes of gluten-free cakes. Although different types of gluten-free products are available in the market, most of them contain insufficient amount of fiber and nutrients. Despite popularity, gluten-free cakes are poor in fiber and nutrient contents. Therefore, improving the nutritional value of these products has received an increasing attention by the food industry. Carrot pomace powder (CPP) is an available source of fiber and nutrients and hence can be utilized for enrichment of gluten-free products. This study showed that the inclusion of up to 30% CPP or 20% CPP with a mixture of xanthan and pectin (3%, 1:1) improved the quality and sensory attributes of the cakes. Industrial implications of this study may lead to new product development and improved marketing due to the enhancement of quality, sensory attributes, and nutritional value of the products **(2)**.

Levent & Bilgiçli (3) studied the effect of debittered lupin flour (LF) and whole buckwheat flour (BF) on the nutritional and sensory quality of gluten-free cake. LF (10, 20, 30 and 40%) and BF (5, 10, 15

and 20%) were partially replaced with corn starch and rice flour mixture (1:1 w/w) in the gluten-free cake recipe. LF increased the protein, calcium, iron, manganese, phosphorus and zinc contents of the cakes, while BF caused a significant increase ($p<0.05$) especially in potassium and magnesium contents of the gluten-free cakes. According to the overall acceptability rating, gluten-free cake could be produced with satisfactory results by the addition of LF and BF up to 30% and 10%, respectively **(3)**.

Tsatsaragkou & al. **(4)** investigated the effect of resistant starch (RS) addition on gluten-free cakes from rice flour and tapioca starch physical and sensorial properties. Increase in RS concentration made cake batters less elastic (drop of G'(ω), G''(ω) values) and thinner (viscosity decreased). Cakes specific volume increased with an increase in RS level and was maximized for 15 g/100 g RS, although porosity values were significantly unaffected by RS content. Crumb grain analysis exhibited a decrease in surface porosity, number of pores and an increase in average pore diameter as RS concentration increased. During storage, cake crumb remained softer in formulations with increasing amounts of RS. Sensory evaluation of cakes demonstrated the acceptance of all formulations, with cake containing 20 g/100 g RS mostly preferred. Gluten-free cakes with improved quality characteristics and high nutritional value can be manufactured by the incorporation of RS **(4)**.

Gambuś & al. (5) mentioned that gluten-free confectionery products were used as controls for comparison with the products, which included different supplements such as linseed meal, amaranth and/or buckwheat. The latter were expected to increase nutritional values of confectionery products. Cookies were analyzed in terms of volume, selected textural parameters (hardness, cohesiveness), organoleptic quality, shelf-life, and different chemical components. All supplemented gluten-free products received high consumer scores, exceeding in some cases those of control samples. Supplementation of gluten-free confectionery products with linseed meal, amaranth and/or buckwheat flours enhanced their final nutritional quality. A significant rise was observed in the protein content and dietary fiber, and in the case of linseed meal also alpha-linolenic acid. All of the supplemented gluten-free confectionery products contained more macro-elements and micro-elements (i.e. potassium, phosphorus, magnesium, calcium, iron, manganese, zinc

and copper), as compared with the controls. Taking into account the amino-acid composition, amaranth proved a more beneficial supplement of gluten-free products than linseed **(5).**

Itthivadhanapong & al. (6) compared the effects of 1% addition of four selected hydrocolloids (xanthan, guar, hypdroxypropylmethylcellulose and carrageenan) on quality characteristics of batter and of black waxy rice steamed cake compared to a control without hydrocolloids. Dynamic frequency sweeps of the batters at 25°C indicated that all formulations exhibited gel-like behavior with storage moduli (G') higher than loss moduli (G"). Hydrocolloids increased the apparent viscosity and the thixotropic behavior, depending on the type of hydrocolloids. Xanthan had the greatest effects on both moduli, whereas carrageenan had the smallest effects. During a storage period of 4 days the cakes with xanthan remained softer than control samples. The overall acceptability of cake with xanthan and guar were higher than control. This study is the first report on using black waxy rice flour as a main raw material in gluten free cake. The results of this study provided useful information for selection hydrocolloids as ingredients that can help to improve the physical properties of waxy rice steamed cake **(6)**.

Agrahar-Murugkar & al. (7) developed gluten free eggless cake using gluten free composite flour made of finger millet, sprouted soy and amaranth, for patients with celiac disease. Gluten free eggless cake prepared (T2), were analyzed for physical, textural, rheological and nutritional properties and compared with control cake (C) made using refined wheat flour and eggs and eggless composite flour cake made using whole wheat flour, malted finger millet, sprouted soy flour and amaranth (T1). There was no significant difference between T2 and C batter in terms of textural properties, flow behaviour index and consistency index. T2 had higher volume (454.4 cm^3) as compared to T1 (437.1 cm^3) cake. Insignificant differences in textural analysis were observed between cakes in terms of springiness, resilience and cohesiveness. The nutritional quality of T2 cake was significantly ($p<0.05$) higher in case of phosphorous (224.0 mg/100 g) and iron content (7.39 mg/100 g). Therefore, gluten free eggless cake of high nutritional composition with good quality characteristics is a good substitute for refined flour egg and composite flour eggless cake. Higher mineral content due to

germinated ingredients made it a nutritious and palatable naturally gluten free food option for the people with celiac disease **(7)**.

Román & al. (**8)** noticed that carob flour is a product rich in fiber obtained from by-products of the locust bean gum extraction processing. The flour is commercialized with different degrees of roasting in order to improve its organoleptic characteristics. In this study, carob flour with three different roasting degrees was used to replace rice flour (15%) in gluten-free cakes and cookies. The influence of this replacement was studied on the psychochemical characteristics and acceptability of the final products. The incorporation of carob flour increased the viscosity of cake batters and increased the solid elastic-like behavior of the cookie doughs, indicating a stronger interaction among the formula ingredients. The inclusion of carob flour, with a low time of roasting, did not lead to any significant differences in the specific volume and hardness of the cakes, but reduced cake staling and the thickness and width of the cookies. Darker colors were obtained when carob flour was incorporated into the product. The acceptability of cakes was only reduced with the addition of highly roasted carob flour, while in the case of cookies there was a decline in the acceptability of all carob flour cookies, which was mostly perceived with the highest roasting degree, something mainly attributed to the bitter taste of the products **(8)**.

Drabińska & al. (9) described the successful development of new gluten-free (GF) mini sponge cakes fortified with broccoli leaves. The aim of this study was to evaluate the effect of broccoli leaf powder (BLP) on the content of biologically active compounds and the antioxidant capacity of GF mini sponge cakes. Broccoli leaf powder was a good source of nutritional components, including proteins and minerals, as well as bioactive compounds such as glucosinolates and phenolics. Glucosinolate content was higher than expected, which points to a synergistic interaction between bioactive compounds and the food matrix. The incorporation of BLP into GF mini sponge cakes significantly ($p<0.05$) increased their antioxidant capacity. The overall sensory acceptance of GF mini sponge cakes was affected by increasing BLP content. The addition of 2.5% BLP as a starch substitute resulted in an optimal improvement in the nutraceutical potential of GF cakes without compromising their sensory quality **(9)**.

TO SUM UP: this chapter **(1-9)** shows that various products can be used to produce gluten-free cakes. These include: baru (Brazilian almond) waste from physical extraction of oil, carrot pomace powder, debittered lupin flour and whole buckwheat flour, resistant starch, linseed meal, amaranth and/or buckwheat flours, black waxy rice flour, carob flour a product rich in fiber obtained from by-products of the locust bean gum extraction processing, and broccoli leaf powder.

Gluten free eggless cake is developed using gluten free composite flours made from sprouted and malted ingredients.

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CONTAMINATION

Mmongoyo & al. (1) reported that aflatoxin, a mycotoxin found commonly in maize and peanuts worldwide, is associated with liver cancer, acute toxicosis, and growth impairment in humans and animals. In Tanzania, sunflower seeds are a source of snacks, cooking oil, and animal feed. These seeds are a potential source of aflatoxin contamination. However, reports on aflatoxin contamination in sunflower seeds and cakes are scarce. The objective of the current study was to determine total aflatoxin concentrations in sunflower seeds and cakes from small-scale oil processors across Tanzania. Samples of sunflower seeds (n=90) and cakes (n=92) were collected across two years, and analyzed for total aflatoxin concentrations using a direct competitive enzyme-linked immunosorbent assay (ELISA). For seed samples collected June-August 2014, the highest aflatoxin concentrations were from Dodoma (1.7-280.6 ng/g), Singida (1.4-261.8 ng/g), and Babati-Manyara (1.8-162.0 ng/g). The highest concentrations for cakes were from Mbeya (2.8-97.7 ng/g), Dodoma (1.9-88.2 ng/g), and Singida (2.0-34.3 ng/g). For seed samples collected August-October 2015, the highest concentrations were from Morogoro (2.8-662.7 ng/g), Singida (1.6-217.6 ng/g) and Mbeya (1.4-174.2 ng/g). The highest concentrations for cakes were from Morogoro (2.7-536.0 ng/g), Dodoma (1.4-598.4 ng/g) and Singida (3.2-52.8 ng/g). Thus, humans and animals are potentially at high risk of exposure to aflatoxins through sunflower seeds and cakes from micro-scale millers in Tanzania; and location influences risk **(1)**.

Wang & al. (2) evaluated the microbial contamination in rice cake materials and products during processing and in the operation environment in nonhazard analysis [and] critical control point factories. The environmental health of the processing facilities and the bacterial and fungal contamination on the workers' hands were investigated. Pour plate methods were used for enumeration of aerobic plate count (APC), yeast and molds (YM), Bacillus cereus, Staphylococcus aureus, and Clostridium perfringens, whereas Petrifilm count plates were used for enumeration of coliforms and Escherichia coli. The respective microbial levels of APC, coliforms, YM, and B. cereus were in the range of 2.6 to 4.7, 1.0 to 3.8, not detected (ND) to 2.9, and ND to 2.8 log CFU/g in the raw materials and in the range of 2.3 to 6.2, ND to 3.6, ND to 2.7, and ND to 3.7 log

CFU/g during processing of the rice cake products. During the processing of rice cakes, APC, coliforms, YM, and B. cereus increased during soaking and smashing treatments and decreased after steaming treatment. E. coli, S. aureus, and C. perfringens were not detected in any of the raw materials and operating areas or during processing. B. cereus was detected on the operators' hands at microbial contamination levels of 1.9 ± 0.19 to 2.0 ± 0.19 log CFU/g. The results showed that B. cereus in the end product was presumably the main concern for rice cakes. In addition, the high contamination level of B. cereus during manufacturing processes, including soaking, smashing, and molding, and the absence of B. cereus from the air sampling plates indicated that the contaminated equipment showed the potential risk to cause cross-contamination **(2)**.

Solhan & al. (3) described the epidemiological, microbiological and environmental investigations conducted during an outbreak of Salmonella gastroenteritis in Singapore. A case-control study was undertaken to identify the vehicle of transmission. Microbiological testing was performed on fecal, food and environmental samples. Isolates of Salmonella were further characterized by phage typing and ribotyping. There were 216 gastroenteritis cases reported from 20 November to 4 December 2007. The causative agent was identified as Salmonella enterica subspecies enterica serotype Enteritidis for 14 out of 20 cases tested. The vehicle of transmission was traced to cream cakes produced by a bakery and sold at its retail outlets ($p<0.001$, OR 143.00, 95% CI 27.23-759.10). More than two-thirds of the 40 Salmonella strains isolated from hospitalized cases, food samples and asymptomatic food handlers were of phage type 1; the others reacted but did not conform to any phage type. The phage types correlated well with their unique antibiograms. The ribotype patterns of 22 selected isolates tested were highly similar, indicating genetic relatedness. The dendrogram of the strains from the outbreak showed distinct clustering and correlation compared to the non-outbreak strains, confirming a common source of infection. The data indicate that the cream cakes were likely contaminated by one of the ingredients used in the icing. Cross-contamination down the production line and subsequent storage of cakes at ambient temperatures for a prolonged period before consumption could have contributed to the outbreak **(3)**.

Friedman & al. (4) determined the source of a norovirus outbreak among attendees of 46 weddings taking place during a single weekend. Norovirus-compatible illness was experienced by 332 (39%) of wedding guests surveyed; the outbreak affected up to 2,700 persons. Illness was associated with eating wedding cake provided by a bakery common to the weddings (adjusted RR 4.5, $p<0.001$). A cake requiring direct hand contact during its preparation accounted for the majority of illness. At least two bakery employees experienced norovirus-compatible illness during the week preceding the weddings. Identical sequence types of norovirus were detected in stool specimens submitted by two wedding guests, a wedding hall employee, and one of the ill bakery employees. It is likely that one or more food workers at the bakery contaminated the wedding cakes through direct and indirect contact. These findings reinforce the necessity of proper food-handling practices and of policies that discourage food handlers from working while ill **(4)**.

Ward & al. (5) investigated an outbreak of 54 cases of Salmonella Typhimurium phage type 9 (STM9) with a specific antibiotic resistance pattern. Sequential analytic studies were used: two retrospective cohort studies, a case-control study, and a modified case-control study. An outbreak of salmonellosis due to Salmonella Typhimurium PT9 SSu (resistant to streptomycin and sulphafurazole) was identified. Fifty-four cases had illness onset from November 1998 to March 1999. Notifications commenced following a restaurant birthday party in December 1998. An initial cohort and case control study found no association with consumption of custard cake. However, case follow-up identified another cohort of people who had attended a birthday party in February at which 8/27 people who consumed a continental custard cake were ill compared to 0/10 who did not ($p=0.07$). A revised case control study found illness that was strongly associated with consumption of a particular continental custard cake (Mantel-Haenszel matched OR infinity, $p=0.00004$). This report highlights the epidemiological value of using sequential study types, and persisting with the investigation of apparently sporadic food-borne outbreaks **(5).**

TO SUM UP: this chapter **(1-5)** shows that contamination of cakes can occur. The high contamination level of B. cereus occurred during manufacturing processes, including soaking, smashing, and molding.

An outbreak of gastroenteritis caused by Salmonella enterica serotype Enteritidis was traced to cream cakes. An outbreak of norovirus gastroenteritis associated with wedding cakes. While a salmonellosis outbreak was linked to continental custard cakes.

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ADVERSE REACTIONS

Kiyohara & al. (1) reported that Japanese rice cake ("mochi") is a major cause of food-choking accidents in Japan. However, the epidemiology of out-of-hospital cardiac arrests (OHCAs) due to suffocation caused by rice cakes is poorly understood. OHCA data from 2005 to 2012 were obtained from the population-based OHCA registry in Osaka Prefecture. Patients aged ≥20 years who experienced OHCA caused by suffocation that occurred before the arrival of emergency-medical-service (EMS) personnel were evaluated. Patient characteristics, prehospital interventions, and outcomes were compared based on the cause of suffocation (rice cake and non-rice-cake). The primary outcome was 1-month survival after OHCA. In total, 46 911 adult OHCAs were observed during the study period. Of the OHCAs, 7.0% (3,294/46,911) were due to suffocation, with choking due to rice cake as the cause in 9.5% of cases (314/3,294), and of these, 24.5% (77/314) occurred during the first 3 days of the New Year. In crude analysis, 1-month survival was

17.2% (54/314) in those with suffocation caused by rice cake and 13.4% (400/2,980) in those with suffocation due to other causes. In the multivariable analysis for all-cause suffocation, younger age, arrest witnessed by bystanders, and earlier EMS response time were significantly related to better 1-month survival. The data show that approximately 10% of OHCAs due to suffocation were caused by rice-cake choking, and 25% of these occurred during the first 3 days of the New Year. Further efforts for establishing preventive measures as well as improving the early recognition of choking and encouraging bystanders to call EMS sooner are needed **(1).**

Gerfaud-Valentin & al. (2) mentioned that bakers are exposed daily to flour and may be susceptible to immunologic occupational diseases. A 30-year-old, nonsmoking, female baker was referred for progressive dyspnea on exertion, basal crackles on auscultation, restrictive lung function, decreased diffusing capacity of the lung for carbon monoxide, ground glass hyperdensities with a mosaic pattern on high-resolution CT scan, 25% lymphocytosis by BAL, and cellular chronic bronchiolitis with peribronchiolar interstitial inflammation by lung biopsy specimen. Cultures from flours isolated nine species, including Aspergillus fumigatus. Twenty-six antigens were tested. Serum-specific precipitins were found against A fumigatus, the flour mite Acarus siro, and total extracts from maize and oat. Outcome was favorable with cessation of occupational exposure to flours and transient therapy with prednisone and immunosuppressive agents. This report is a well-documented case of hypersensitivity pneumonitis (HP) due to sensitization to fungi- and mite-contaminated flours. HP, and not only asthma and allergic rhinitis, should be suspected in bakers with respiratory symptoms **(2)**.

Paris & al. (3) reported that argan is now used worldwide in numerous cosmetic products. Nine workers from a cosmetic factory were examined in the occupational medicine department, following the diagnosis of a case of HP related to handling of argan cakes. Operators were exposed to three forms of argan (crude granulates, powder or liquid) depending on the step of the process. All workers systematically completed standardized questionnaires on occupational and medical history, followed by medical investigations, comprising, in particular, physical examination and chest X-rays, total IgE and a systematic screening for specific serum antibodies directed against the usual microbial agents of domestic and farmer's HP and

antigens derived from microbiological culture and extracts of various argan products. Subjects with episodes of flu-like syndrome several hours after handling argan cakes, were submitted to a one-hour challenge to argan cakes followed by physical examination, determination of Carbon Monoxide Diffusing Capacity (DLCO) and chest CT-scan on day 2, and, when necessary, bronchoalveolar lavage on day 4. Six of the nine workers experienced flu-like symptoms within 8 hours after argan handling. After challenge, two subjects presented a significant decrease of DLCO and alveolitis with mild lymphocytosis, and one presented ground glass opacities. These two patients and another patient presented significant arcs to both granulates and non-sterile powder. No reactivity was observed to sterile argan finished product, antigens derived from argan cultures (various species of Bacillus) and Streptomyces marokkonensis (reported in the literature to contaminate argan roots). HP is related to argan powder in two patients. This implies preventive measures to reduce their exposure and clinical survey to diagnose early symptoms. As exposure routes are different and antibodies were observed against argan powder and not the sterile form, consumers using argan-based cosmetics should not be concerned **(3)**.

TO SUM UP: this chapter **(1-3)** demonstrates side effects of cakes that include suffocation due to Japanese rice cake, HP due to sensitization to fungi- and mite-contaminated flours, and HP due to handling argan cake.

Humans and animals are potentially at high risk of exposure to aflatoxins, a mycotoxin found in maize and peanuts associated with liver cancer, acute toxicosis, and growth impairment in humans and animals, through sunflower seeds and cakes from micro-scale millers in Tanzania.

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INHIBITORY EFFECT/DETOXIFICATION

Lee & al. (1) determined the antimicrobial effects of green tea and rosemary added to foods as antagonists to foodborne pathogens were determined in laboratory media and oriental-style rice cakes. The growth of each pathogen (Bacillus cereus, Salmonella Typhimurium, Enterobacter sakazakii, Escherichia coli O157:H7, Staphylococcus aureus, and Listeria monocytogenes) in tryptic soy broth or rice cake with or without addition of green tea or rosemary leaf powders before autoclaving or cooking, respectively, was investigated after inoculation. The addition of 1% green tea or rosemary produced similar results for inhibiting the growth of pathogens in tryptic soy broth. However, green tea was more effective than rosemary for inhibiting the growth of L. monocytogenes. Both botanicals had inhibitory effects against all pathogens tested in this study. Green tea was particularly effective against B. cereus, S. aureus, and L. monocytogenes, and rosemary was strongly inhibitory against B. cereus and S. aureus. The addition of 1 or 3% green tea or rosemary to rice cakes did not significantly reduce total aerobic counts; however, levels of B. cereus and S. aureus were significantly reduced in rice cakes stored for 3 days at room temperature (22 degrees C). The order of antimicrobial activities against B. cereus in rice cake was 1% rosemary < 1% green tea < 3% rosemary = 3% green tea. These results indicate that the use of natural plant materials such as green tea and rosemary could improve the microbial quality of foods in addition to their functional properties **(1)**.

Hong & al. (2) mentioned that there has been an increasing interest in the use of natural plant materials as alternative food preservatives. The antimicrobial effects of natural plant materials used as additives against foodborne pathogens were examined in laboratory media and Sulgidduk, oriental-style rice cakes. Cinnamon, mugwort, and garlic powder solutions (3%) were tested for their antimicrobial activities against pathogens in laboratory media. Sulgidduk prepared with different amounts of cinnamon powder (1,

3, and 6%) was inoculated with a Staphylococcus aureus or Bacillus cereus cocktail. The samples were air or vacuum packaged and stored at 22 ± 1°C for 72 hours, and microbial growth was determined. Cinnamon powder showed more inhibitory properties against pathogens such as Salmonella enterica serovar Typhimurium, Escherichia coli O157:H7, Listeria monocytogenes, S. aureus, and B. cereus than did mugwort or garlic powder. The populations of S. aureus and B. cereus in Sulgidduk containing cinnamon powder were significantly lower than in the control during storage time. Different packaging methods did not result in a significant difference in pathogen growth. In a sensory evaluation, Sulgidduk containing 1 and 3% cinnamon powder did not significantly differ from the control sample in any of the attributes tested other than flavor. These results indicate that natural plant materials such as cinnamon powder could be used as food additives to improve the microbiological stability of rice cakes **(2)**.

Samarakoon & al. (3) evaluated the antibacterial effect to determine the benefits of high speed drying (HSD) and far-infrared radiation drying (FIR) compared to the freeze drying (FD) method. Citrus press-cakes (CPCs) are released as a by-product in the citrus processing industry. Previous studies have shown that the HSD and FIR drying methods are much more economical for drying time and mass drying than those of FD, even though FD is the most qualified drying method. The disk diffusion assay was conducted, and the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were determined with methanol extracts of the dried CPCs against 11 fish and five food-related pathogenic bacteria. The disk diffusion results indicated that the CPCs dried by HSD, FIR, and FD prevented growth of all tested bacteria almost identically. The MIC and MBC results showed a range from 0.5-8.0 mg/mL and 1.0-16.0 mg/mL respectively. Scanning electron microscopy indicated that the extracts changed the morphology of the bacteria cell wall, leading to destruction. These results suggest that CPCs dried by HSD and FIR showed strong antibacterial activity against pathogenic bacteria and are more useful drying methods than that of the classic FD method in CPCs utilization **(3)**.

Giddey & al. (4) studied the process described up to an industrial pilot scale. In this article, the basic knowledge on the process and the technological conditions of pilot application for detoxifying peanut

cakes polluted by up to 3,500 ppb Aflatoxine (2,300 ppb B1) was summarized. The nutritional experiments carried out on rats and other mammals are described, and the toxicological and biochemical evaluation of the cakes on Bacillacea are reported and discussed. The data collected show that the MMA/Ca(OH)2 process offers promising possibilities for industrial application on the basis of technological and economic criteria, as well as from the point of view of efficiency and safety **(4)**.

Lee & al. (5) mentioned that fresh cooked rice cakes for retail sale are typically held at room temperature because refrigeration dramatically reduces their quality. Room temperature, high water activity, and a pH of > 4.6 provided an environment conducive to pathogen growth. To date, no studies have been published regarding survival and growth of foodborne pathogens in fresh cooked rice cakes. This study was undertaken to investigate the effect of steam cooking on foodborne pathogens and their subsequent growth in five varieties of rice cakes made from flours of regular rice, sweet rice, white rice, tapioca, and mung bean. Bacillus cereus spores were detected in white rice, tapioca, and mung bean samples. The rice cake flours were inoculated with non-spore-forming foodborne pathogens (Escherichia coli O157:H7, Salmonella enterica serovar Typhimurium, Listeria monocytogenes, and Staphylococcus aureus) or spore-forming bacteria (Bacillus cereus) and steam cooked (100 degrees C) for 30 min. Steam cooking significantly reduced (> 6 log CFU/g) non-spore-forming foodborne pathogens in all samples and inactivated spores of B. cereus by 1 to 2 log CFU/g. Although spores of B. cereus survived steam cooking and germinated during 3 days of storage at room temperature, populations in most rice cakes remained below 106 CFU/g, which is the threshold for producing toxin. Rice cakes made from mung bean flour supported growth and germination of B. cereus spores above that critical level. In mung bean rice cakes, enterotoxin production was detected by the second day, when B cereus cell populations reached about 6.9 log CFU/g. The toxin concentration increased with storage time. However, the results suggest that rapid growth of total mesophilic microorganisms by more than 7 to 8 log CFU/ml during the first day of storage produced off flavors and spoilage before B. cereus was able to grow enough to produce toxins. Therefore, steam-cooked rice cakes made from a variety of flours including mung bean flour are safe for sale for

up to 1 day after storage at room temperature and are free of B. cereus toxins **(5)**.

Okahisa & al. **(6)** evaluated the risk of food poisoning and growth of spoilage bacteria in Awa-Uirou, a sticky rice cake containing sweet red bean paste. Toxin-producing bacteria such as Staphylococcus aureus and Bacillus cereus are the main causes of food poisoning linked to this kind of food. The water activity in this product is in the range suitable for growth of S. aureus, B. cereus, and B. subtilis. The viable count of S. aureus or B. cereus spore cocktail was significantly reduced to 2.3 log colony-forming units (CFU)/g after 70 minutes steaming treatment at 100 degrees C. However, the heat-resistant endospores of B. subtilis germinated during storage at 30 degrees C to cause appreciable syneresis of the starch gel matrix in 4 days. The addition of 0.5% glycine before steaming treatment was found to effectively suppress the growth of B. cereus but was not effective in controlling S. aureus throughout the 7 days incubation period at 30 degrees C. On the other hand, S. aureus and B. cereus could grow > 5.0 log CFU/g in an inoculated sample without glycine within 3 days when stored at 30 degrees C. Addition of 0.5% glycine before the steaming process did not have any significant effect on color, texture, or taste of sticky rice cake. Therefore, results of this study demonstrated that the addition of 0.5% glycine before the steaming process could inhibit B. cereus and B. subtilis multiplication in the steamed rice confection which in turn may help reduce the risk of food poisoning or quality loss **(6)**.

Baek & al. (7) mentioned that the antifungal activity of organic acids greatly improves the shelf life of bread and bakery products. However, little is known about the effect of lactic acid fermentation on fungal contamination in rice cakes. Lactic acid fermentation in rice dough can greatly retard the growth of three fungal species when present in rice cakes, namely Cladosporium sp. YS1, Neurospora sp. YS3, and Penicillium crustosum YS2. The antifungal activity of the lactic acid bacteria against these fungi was much better than that of 0.3% calcium propionate. Organic acids including lactic and acetic acid, which are byproducts of lactic fermentation or can be artificially added, were the main antifungal substances. Some Leuconostoc citreum and Weissella confusa strains could be good starter species for rice dough fermentation. These results imply that

these lactic acid bacteria can be applicable to improve the preservation of rice cakes **(7)**.

TO SUM UP: this chapter **(1-7)** shows that green tea is effective against B. cereus, S. aureus, and L. monocytogenes, and rosemary is inhibits B. cereus and S. aureus.

Cinnamon powder shows more inhibitory properties against pathogens such as Salmonella enterica serovar Typhimurium, Escherichia coli O157:H7, Listeria monocytogenes, S. aureus, and B. cereus than do mugwort or garlic powder.

CPCs dried by HSD and FIR shows strong antibacterial activity against pathogenic bacteria and are more useful drying methods than that of the classic FD method in CPCs utilization.

Detoxifying process can be used for peanut cakes polluted by up to 3,500 ppb Aflatoxine (2,300 ppb B1).

Steam-cooked rice cakes made from a variety of flours including mung bean flour are safe for sale for up to 1 day after storage at room temperature and are free of B. cereus toxins.

Addition of 0.5% glycine before the steaming process could inhibit B. cereus and B. subtilis multiplication in the steamed rice confection which in turn may help reduce the risk of food poisoning or quality loss.

Lactic acid fermentation in rice dough can retard the growth of three fungal species present in rice cakes, namely Cladosporium sp. YS1, Neurospora sp. YS3, and Penicillium crustosum YS2.

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SUMMARY

Cake is a form of sweet dessert that is typically baked. In its oldest forms, cakes were modifications of breads, but cakes now cover a wide range of preparations that can be simple or elaborate, and that share features with other desserts such as pastries, meringues, custards, and pies.

Cake is often served as a celebratory dish on ceremonial occasions, such as weddings, anniversaries, and birthdays. There are countless cake recipes; some are bread-like, some are rich and elaborate, and many are centuries old.

The Biblical description studied in this research shows that cakes were already used in Biblical times to receive guests. Over the years, thanks to scientific evaluation of this delicious food, the production of cakes reached professional level. Many types of cakes are produced all over the world, each with their own special taste and appearance. Cakes can reflect the norms and culture of each society. Their external appearance with special decorations attracts special attention.

The consistency of cakes is being continuously improved, and it is now possible to find cakes with low fat content, and the use of alternatives to sugar for sweetening.

In spite of occasional contamination and very rare adverse reactions, cakes similarly to the described in the Bible play a part in human nutrition.