

Review

Production of couscous using the traditional method in Turkey and couscous in the world

Fatma Coskun

Department of Food Engineering, Faculty of Agriculture, Namik Kemal University, Tekirdag/Turkey.

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Couscous is a semi-prepared foodstuff produced since the ancient times within the scope of winter preparations. It is known by many different names in different countries. In Turkey, first, bulgur is rubbed with egg white and allowed to swell. After which, a handful of flour is sprinkled on it. Then, it is rolled right-left by hand. An amount of egg-milk mixture is sprinkled on it and rolled right-left by hand. The process of flouring and sprinkling egg-milk mixture continues until couscous reaches an adequate size. Couscous is laid on a sheet where there is airflow and shade; and then it is dried. Generally, semolina used in production of couscous in others countries. The moistened semolina is rolled and rubbed with palms and fingers until the desired size is formed. Because it is easy to prepare for eating and being nutritious, couscous is quite popular in many countries. This article aims to introduce the traditional Turkish couscous and to emphasize the importance of couscous in the world.

Key words: Couscous, cereal-based product, bulgur, semolina.

INTRODUCTION

Generally, flour, fine cracked wheat (bulgur) or semolina, milk, egg and salt are used for producing homemade couscous in Turkey. Bulgur is a quick-cooking form of whole wheat (*Triticum aestivum*) that is cleaned, boiled, dried, dehulled, reduced and sifted into distinct particle sizes (Elgun and Ertugay, 1995). Its nutritional value and versatility make bulgur an ideal food in a vegetarian diet. Moreover, it is an excellent meat extender or meat substitute in vegetarian dishes and a component of many varieties of meatless burgers found on supermarket shelves everywhere (Celik et al., 2004). Couscous has a great nutritional value due to its ingredients. Flour is one of the main ingredients used in the production of couscous. Quality flour must be used to obtain good results in production of couscous. Flour is inadequate in terms of some of the essential amino acids (lysine, threonine and methionine). Flour can be enhanced by the addition of legume flour. Amino acids balance of legume flour is good and its protein content is high (Lee et al.,

1998). Cooked milk is preferred more in production of couscous. Milk is a good source of protein and contains other important nutrients. Salt is added so as to give it more taste and improve its strength. Egg yolk improves the color of the product. Egg white improves texture of the product (Demir, 2008). The main purpose of supplementation of eggs is to increase the nutritional value. Egg improves the physical and sensory properties of the products. Couscous is classified into 2 categories as homemade and machine made. The homemade couscous is preferred more among consumers. If couscous is produced by the persons who know how to produce it, you may have better results. Couscous needs to be subjected to drying process properly in order to store it for longer periods. Couscous is a dish prepared and dried at the end of summer season and it is a popular dish stored among winter products.

It can traditionally be made by hand as North African women and Turkish women with Caucasus origins do. In



Figure 1. Pouring on bulgur of homogenized egg whites and rubbing bulgur.

North Africa, it is made from 2 parts of semolina, one part of flour, salt and water. Some handfuls of semolina are put on a plate or on the ground, after which it is watered with salt solution. It is rolled in the hand, while flour is added. This operation continues until the material is the size of maize grains and they are then sun-dried (Celik et al., 2004). The studies on couscous recently started to increase.

PRODUCTION OF COUSCOUS USING TRADITIONAL METHOD IN TURKEY

Mixing materials and forming couscous

For the production of couscous, wooden boats are used in making bread dough (average of 60 × 120 cm in sizes). Bulgur or semolina, wheat flour, eggs and milk are used as materials. 1 kg of coarse bulgur, 25 pieces of eggs (the amount of egg is optional), 3 kg boiled and cooled milk, 35 g of salt and 10 kg wheat flour are the ideal amounts. First, the egg, milk and salt mixture is prepared. Mixture should be homogenous. If the mixture is non-homogenous, couscous is lumpy. 4 egg whites are not added to the mixture. Bulgur is put into the boat. 4 egg whites homogenized (as divided into 3 parts) are poured into the bulgur and then, bulgur is rubbed (Figure 1). Bulgur gets wet and swells. Thus, becomes ready for coating with flour at the end of this transaction. This process helps the coarsening of couscous. If the process is started with mixture of milk instead of egg whites, clumping occurs. A handful of flour is sprinkled on the bulgur. Then, it is mixed right-left by hand and placed at the bottom of the boat for 15 to 20 s (Figure 2). After the whole bulgur is coated with wheat flour, it is collected in the middle of the boat; and 5 ml of egg milk mixture is sprinkled on bulgur using a dry bunch of corn husk. If too much of the egg milk mixture is added, couscous become



Figure 2. Sprinkling on bulgur of flour and rolling bulgur.



Figure 3. Pouring on bulgur of the egg milk mixture and rolling bulgur.

glutinous. If too much flour is used, couscous will be lumpy and unstable. Additionally, if bulgur is fine, couscous becomes glutinous, chunky and very soft at the first stages of the process. The same problems occur when using semolina also. In order to avoid this, the amount of egg milk mixture must be less when semolina and fine bulgur is used. After adding the egg milk mixture, the bulgur is rolled right-left by hand and placed at the bottom of the boat for 15 to 20 s (Figure 3). Then a handful of flour is sprinkled on the bulgur and rolling process is applied again (Figure 2). Thus, the bulgur starts to transform into couscous. If the rolling process is not done when the bulgur is in contact with the bottom of the boat by hand, a layer of flour at the bottom of the boat forms. Pressure should not be too much during the rolling process. If pressure is too much, couscous becomes tight and cooking process takes longer. If 2 people roll together, they must roll it in the same direction; otherwise, the couscous will not be large. When the couscous reaches the ideal size, it must be divided into 2 parts. If the volume of couscous stack increases, rolling process will not be carried out properly. A part of the



Figure 4. Sieving couscous.



Figure 6. Serving couscous.



Figure 5. Laying and drying couscous.

couscous is left in the wooden boat. The process for the other part will continue later. The couscous in the wooden boat is sieved. Before couscous is sieved, it is sprinkled 2 consecutive times with egg milk mixture without flouring and then rolled. The couscous after it starts shining is pulled to one side of the boat. On the other side of the boat, sieving is done. Couscous placed on top of sieve is then sieved. It is better to sieve by hands (Figure 4). The process of flouring and sprinkling egg milk mixture continues for small couscous passing through the sieve. Sieve, with holes of ideal size for couscous and made from animal skins, stretching across a hoop, is used to separate couscous of different sizes. Couscous remaining on the sieve is separated to dry. The same procedures are repeated for the second half of the couscous.

Couscous remaining on the sieve is laid on a sheet at a location with air flow and shade (Figure 5). After sieving is made for a number of times, the amount of couscous decreases. The other half of the couscous is added to the one inside the boat. The same process continues. Couscous is sieved again as optional after drying for 7 to 8 h. So, the extremely large and pseudomorph couscous are separated. Making couscous using 1 kg bulgur takes approximately 3 h.

Drying

The drying process can be done on a sheet (Figure 5) or in the form of baking. Couscous is stirred occasionally for a good drying process. Although drying on sheets is completed within 2 to 3 days, drying in the form of baking is completed within 1 h. Most people prefer drying on sheet under shade. These people think that the product will not have the original natural scent and flavor after being baked in oven. As a result of oven drying, the number of microorganisms of the product reduces, but sometimes the smell and taste of burnt dough can occur. Couscous is stored in cloth bags.

Cooking

About 1/3 of water is used to cook couscous. When water begins to boil in saucepan, couscous is added to boiling water. Or couscous is fried in oil and water is added. Also water can be added to hot oil, with the water boiling at the same time. Then couscous is added. Cooking process takes about 20 minutes. Salt is added during cooking. Butter is added after fat-free cooking. After taking water from couscous, in other words, after cooking, the pots are covered first with a cloth and then with pot lid. So couscous is infused. While couscous is around 3 to 4 mm in diameter before cooking, it is around 5 to 6mm in diameter after cooking. Optionally, It can be served plain or with sauce (Figure 6) (Coskun, 2010).

Couscous of the world

The couscous is defined that husked and crushed, but unground, semolina of hard wheat (*Triticum durum*); although it can be prepared with barley, millet, sorghum, or corn in Encyclopedia of the Modern Middle East and North Africa. Semolina is the hard part of the grain of hard-wheat, which resists millstone grinding. Couscous is processed from a fine and coarse grain of semolina. The

fine grain affixes to the coarse grain by sprinkling water and salt by hand (although mechanization is used for mass production). The grains are rolled and rubbed with the palms and fingers until the desired size is formed. The couscous may be dried and stored, or it may be steamed over water or broth in a *couscouillère*. Couscous is served in a pile on a large platter with meat, chicken, or fish and vegetables and spices. It is also served in bowls as a loose stew with similar ingredients included (Clifford, 2004).

Couscous is known by different names in different countries. It is known as *kuskus* in Turkey; *couscous* in Morocco; *maftoul*, *moghrabieh* in Lebanon; *seksu* in Berber; *kusksi* in Libya; *keskesu* in Tuareg; *kouskousaki* in Greece. In some small regions of North Africa, it is made from pearl millet or barley rather than hard wheat. A West African variety called *Attiéké* is made from cassava and in Brazil couscous is made from pre-cooked flakes of sweetcorn couscous produced in Marrakech, Morocco; it is typically 0.06 inch / 1.5 mm. This form is traditionally made by rolling moistened semolina between the hands and sieving the result until a uniform size is obtained. It is always steamed; never boiled. Levantine pearl couscous is often erroneously called "Israeli couscous", which name properly belongs to a rice grain shape unique to Israel. The pearl shape is indigenous to Lebanon and Jordan. The small one called "maftoul" (about 0.14 inch / 3.5 mm) is made in Jordan. The larger one (about 0.22 inch / 5.5 mm) called "moghrabieh" is made in Lebanon. These forms are boiled or used in soups and stews like regular pasta rather than steamed (Anonymous, 2012a).

Women in the Region of Constantine City (North East of Algeria) prepare couscous by hand. Traditional utensils are used to produce it. Couscous-cooker has two compartments: a steam generator that uses boiled water, and above it, a container or steam receiver named "*keskess*" where heat treatment occurs. Rolling done to aggregate the semolina is realized in a large wooden dish called "*guessâa*". Four different sieves named "*dekkak*", "*reffad*", "*meâaoudi*" and "*sekkat*" are utilized in sieving or sizing operations and correspond respectively to 500, 1000, 1130 and 1280 μm mesh opening. The procedure starts with a quantity of 500 g of coarse semolina ($>500 \mu\text{m}$) steam pre-cooked in "*keskess*" for 8 min at 95°C. Salted water and fine semolina ($\leq 500 \mu\text{m}$) are progressively added for rolling in the "*guessâa*". A sizing operation with "*sekkat*" sieve (1280 μm) is practised before drying under shade and natural air convection (Benatallah et al., 2008).

A new and improved shelf-storable couscous food product, satisfying traditional couscous granular mouthfeel is made by extruding a wheat-based doughy mass and cutting the extrudate into particles of uniform couscous size (that is, between 0.85 and 2.5 mm mesh). When examined under a magnification 12 times, the new particles, although lacking the agglomeration structure of

traditional couscous, have a mouthfeel structure characterized by substantially smooth surfaces on the exterior thereof and angularly projecting edges on the exterior thereof. Further, the particles are substantially translucent, have a water absorption index greater than 4.7, and have a substantially uniform and dense extrusion compacted composition that consists essentially of the starches and gluten-forming proteins in a blend of durum wheat flour or middlings or semolina and an optional content of flours or middlings or farinas of cereal grains other than durum wheat. At least about 80% of the dry solids weight of the starches in the product are gelatinized. The product is quickly hydratable in preparing it for consumption (Donnelly et al., 1995).

Couscous or more affectionately known as *seksu* or *sikuk* is the national dish of Morocco. While in most Moroccan families this rolled semolina cereal is prepared and eaten on Fridays, a few incorporate couscous into their diet at least a few times a week. Couscous is also a celebratory dish eaten at weddings, funerals, or the end of festivals or holidays like the 27 of September, an important date in Ramadan (Anonymous, 2012b).

According to a cooking method applied in Morocco, couscous is washed in a large shallow pan thrice with much water and stirred briefly by hands. Then, excess water is strained out quickly when the grains are still wet. Couscous is spread in a rimmed baking sheet or similar appliance and allowed to swell for 10 min. It is then worked with by fingers to break up all lumps which may have formed and allowed to rest at least another 10 min. Stew or broth is added and allowed to boil in the bottom of the pot. The steamer pan is placed on top, sealed as necessary and 1/4 of the couscous is poured in. The steamer is uncovered for 5 min, then the rest of the couscous is gently added. The heat is lowered moderately and the couscous is steamed for 20 minutes, uncovered. The couscous is dumped into a shallow pan and spread with a wooden spatula or spoon. A mixture of 1 teaspoon salt and about 3/4 cup of water (for 2 cups of couscous) is sprinkled evenly over the couscous. As soon as the couscous is cool enough to handle, it is coated with olive oil by hands, and the grains are worked on again to break up any lumps. Oil is added very lightly to the couscous to help separate the grains. If it is too dry, a little more water is sprinkled. Then, couscous must be allowed to rest for at least another 10 min. At this point the couscous can be covered with a damp cloth and be held for several hours. The couscous is put back into the steamer pan and be steamed for an additional 20 min. Couscous is mounded onto a serving plate and a deep depression is made on top of the mound and some of the stew is put there (Anonymous, 2012c).

In Morocco, Algeria, and Tunisia, couscous is generally served with vegetables (carrots, potatoes, turnips, etc.) cooked in a spicy or mild broth or stew, and some meat (generally chicken, lamb or mutton). In Morocco and Algeria, it is also served, sometimes at the end of a meal

or just by itself, as a delicacy called "*seffa*". Couscous is usually steamed several times until it is very fluffy and pale in color. It is then sprinkled with almonds, cinnamon and sugar. Traditionally, this dessert will be served with milk perfumed with orange flower water, or it can be served plain with buttermilk in a bowl as a cold light soup for supper. In Libya, it is mostly served with meat. Another way to eat couscous is as a dessert; it is prepared with dates, sesame, and pure honey, and locally referred to as "maghrood. In Egypt, couscous is eaten more as a dessert. It is prepared with butter, sugar, cinnamon, raisins, nuts and topped with cream. Couscous is also very popular in France, where it is now considered a traditional dish, and has also become popular in Spain, Portugal, Italy, and Greece. Packaged sets containing a box of quick-preparation couscous and a can of vegetables and, generally, meat are sold in French, Spanish, Italian, and Portuguese grocery stores and supermarkets. In North America, Australia and the United Kingdom, couscous is available most commonly as either plain or pre-flavoured, quick preparation boxes. In the United States, it is widely available, but largely confined to the ethnic or health-food section of larger grocery stores. There are recipes from Brazil and other Latin American countries that use boiled couscous molded into a timbale with other ingredients. In Northeastern Brazil and among the diaspora of its population in other Brazilian regions, a steamed cake of couscous and corn flour is a popular meal, served in many forms: with sugar and milk, with varied meats, with cheese and eggs and so on (Anonymous, 2012d).

The instant couscous that is sold in most Western supermarkets is pre-steamed and dried; the package directions usually include adding 1.5 measures of boiling water or stock and butter to each measure of couscous and to cover tightly for 5 min. The couscous swells and within a few minutes it is ready to fluff with a fork and serve. Pre-steamed couscous takes less time to prepare than regular couscous, most dried pasta, or dried grains (such as rice) (Anonymous, 2012d).

Nutritional value of couscous and some of the studies conducted on couscous

The nutrition value per 100 grams cooked couscous includes: water, 72.57 g; energy, 112 kcal; protein, 3.79 g; total lipid (fat), 0.16 g; ash, 0.26 g; carbohydrate by difference, 23.22 g; fiber, total dietary, 1.4 g; total sugars, 0.10 g; Ca, 8 mg; Fe, 0.38 mg; Mg, 8 mg; P, 22 mg; K, 58 mg; Na, 5mg; Zn, 0.26 mg; Cu, 0.041 mg; Mn, 0.084 mg; Se, 27.5 µg; thiamin, 0.063 mg; riboflavin, 0.027 mg; niacin, 0.983 mg; pantothenic acid, 0.371 mg; vitamin B-6, 0.051 mg; vitamin E (alpha-tocopherol), 0.13 mg; fatty acids, total saturated, 0.029 g; fatty acids, total monounsaturated, 0.022 g (USDA, 2011).

Several studies have been carried out by researchers

to improve the nutritional value and structure of couscous. Celik et al. (2004) produced traditionally Turkish couscous using different flours (soyflour and oat flour) and eggs. The nutrient composition of traditional couscous was 90.6%; dry matter, 11.27%; protein, 2.58%; fat, 71.80%; carbohydrate, 42.25 mg; sodium, 365.62 mg; potassium, 2.73 mg; iron and calcium, 48.30 mg. The calorie content of traditional couscous is about 1487.41 kJ 100 g. The addition of soy and oat flours increased protein content and Ca, K and Fe levels. Sensory properties were also affected. Panellists preferred traditional couscous and couscous with eggs or soyflour over couscous without flour.

In Hamdaoui et al. (1992)'s studies, the influence of a diet of couscous with chickpeas, a traditional Tunisian meal or using iron as ferrous sulfate on the utilization of ⁵⁹Fe was evaluated in studies with rats. The iron content of the couscous and chickpea preparation was 30 mg/kg dry weight. Couscous and chickpeas consumption in Tunisia is estimated at 13.3 and 3.2 kg per capita/year, respectively. Based on its results in rats, it shows that these foods could contribute a large proportion of an individual's iron requirement.

Rahmani and Muller (1996) investigated the fate of thiamin and riboflavin during the preparation of couscous. The proximate and particle size analysis of 5 traditional and 4 commercial samples is given. Characteristically, the commercial samples were less homogeneous than the traditional ones. The initial thiamin content for both sets of samples was similar (0.26 ± 0.07 mg/100 g and 0.22 ± 0.02 mg/100 g). The riboflavin content of the traditional sun-dried samples tended to be lower than that of the commercial samples (0.037 ± 0.006 g/100 g and 0.066 ± 0.01 pg/100 g). Average losses during steaming amounted to $15.4 \pm 2.7\%$ for thiamin and $36.1 \pm 5.7\%$ for riboflavin. It is suggested that eye problems common in supra-Saharan Africa are caused by the sun-drying of couscous which is the cereal staple.

In a research, chickpea flour (CPF) was used to improve the nutritional status of couscous. Technological properties of couscous were affected negatively by the increasing CPF amounts in couscous formulation. The color values of couscous samples with 75 to 100% CPF were darker than the others. The ash, protein and cellulose contents of the couscous increased with increasing amount of CPF. Rich phytic acid (PA) content of CPF significantly ($P < 0.05$) affected the PA content of the end products. PA contents of 100% CPF added to couscous samples were found 4.4 times higher than the control sample. Ca, Mg, K, P, Fe and Zn amounts increased at different degrees with CPF addition. CPF affected flavor, firmness, stickiness and overall acceptability of couscous significantly ($P < 0.05$). Acceptable substitution level was found as 50% for the technological, nutritional and sensory properties (Demir et al., 2010).

In another research, sorghum grain was decorticated to

remove 10, 20, 30 and 40% of the kernel for the purpose of improving flour colour, couscous colour and yield, and porridge texture. Flour lightness increased while its yellow colour decreased with increased level of decortication. Processing of the flours into couscous caused a considerable drop in lightness and increased yellow colour in couscous at all levels of decortication. As decortication level increased, couscous colour became lighter. Yellow colour progressively increased up to 30% kernel removal and dropped at 40%. Couscous yield, as measured by the proportion of particles of 1 to 2 mm size, also increased up to 30% kernel removal. This improvement in yield was attributed to decreased proportion of bran as indicated by ash content. However, the yield dropped at 40% kernel removal due to formation of large chunks of agglomerated flour particles. Thick porridge became harder as decortication level increased and this was strongly associated with the concomitant increase in starch concentration (Aboubacar et al., 2006). A comparison of the characteristics of traditional and commercial wheat couscous has been made by Guezlane et al. (1986). These authors found a higher elasticity in the traditionally prepared sample and a lower one in the commercially processed one.

Flours from eight sorghum cultivars were evaluated for their couscous making ability with the objective of finding predictive relationships between flour physicochemical properties and couscous quality. A laboratory procedure was used to prepare couscous. Couscous properties were evaluated and compared to a laboratory prepared and a commercial durum wheat couscous. Hard grain produced flours containing a high proportion of coarse particles with low ash and high damaged starch content and yielded a higher proportion of desirable sorghum couscous granules. A variety of colors ranging from brown to yellow were obtained when flours were processed into couscous. Cooked sorghum couscous stickiness was positively correlated ($r = 0.89$, $P < 0.01$) with the amount of damaged starch in flour. Cooked couscous hardness correlated positively ($r = 0.79$, $P < 0.05$) with apparent amylose content of flour and correlated negatively ($r = -0.75$, $P < 0.05$) with flour peak viscosity. Durum wheat couscous was lighter and had more yellow color than sorghum couscous. Sorghum couscous was stickier and harder than durum wheat couscous. Addition of 2% oil to the cooking water considerably improved the texture of some sorghum couscous to a level comparable to that of durum wheat couscous (Aboubacar and Hamaker, 1999).

Benatallah et al. (2008) tried to produce gluten-free couscous. In this research, technological feasibility to obtain gluten-free couscous based on rice-leguminous supplementation was studied. Cereal-leguminous of 2/1 weight/ weight ratio was chosen to supplement semolina of rice (*Oryza sativa*) with each of chickpea (*Cicer arietinum*) or proteaginous pea (*Pisum arvense*) or field bean (*Vicia faba*). A traditional procedure in Constantine

region (North East of Algeria) was performed in this study. Wheat semolina (*Triticum durum vulgare*) was used to produce control couscous. The 3 gluten-free products and the control one were compared on the basis of productivity, granulometry, swelling, disintegration level and structure. Feasibility was confirmed for the three formulae, and comparison of the obtained products in accordance with tasters preference placed the rice-field bean couscous (RFC) as best after the hard wheat couscous (HWC), followed by the rice-chickpea couscous (RCC) and the rice-proteaginous pea couscous (RPC).

In a study conducted by Tarim (2012), tomatoes, carrots, red pepper, beetroot, spinach and nettle (*Urtica* spp.) purees have been used in couscous production in order to increase its nutritional value, appearances and consumption. According to the analysis result of fresh couscous samples moisture contents changed between 10.59 and 11.48%; titratable acidity, 0.062 to 0.071%; ash content, 1.10 to 1.18%; salt, 0.74 to 0.88%; fat, 1.80 to 2.56%; protein, 9.41 to 11.08%; L* color value, 24.24 to 60.57; a* value, -1.70 to 27.77; b* value, 1.83 to 24.83 and for cooked couscous samples, these values were found between 52.03 to 69.60; 1.65 to 20.56; 11.35 to 27.64, respectively. Cooking results of the samples fell within the following averages: water absorption, 260 and 295 %; total organic matter in cooking water, 8.340 to 11.201% and volume increase, 368 and 457%. Optimum cooking time of couscous has been determined as twenty minutes. In sensorial evaluation, red pepper puree added to couscous sample gained the highest total score.

CONCLUSION

There is a special place for couscous in the kitchen in terms of being nutritious and practical. Especially, the Turkish couscous is very nutritious due to the addition of milk and eggs. In addition to being conventional, couscous is progressing towards becoming a world-renowned foods as the working population increases. Increase in the commercial production of couscous and its recognition all over the world will be supported by the studies of couscous.

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