

Article Arrival Date**14.08.2020****Article Type****Review Article****Article Published Date****15.09.2020****Doi Number:** <http://dx.doi.org/10.38063/ejons.315>**FARKLI TİP VEGAN PEYNİR REÇETELERİNİN ÖZELLİKLERİ****PROPERTIES OF DIFFERENT TYPE VEGAN CHEESE RECIPES****Rukiye ÇOLAK ŞAŞMAZER**

Department of Food Engineering, Faculty of Agriculture, Bursa Uludağ
University, 16059 Bursa, Turkey

E-mail: rukiyecolak82@gmail.com, Orcid 0000-0002-1828-1205

Mihriban KORUKLUOĞLU

Department of Food Engineering, Faculty of Agriculture, Bursa Uludağ
University, 16059 Bursa, Turkey

E-mail: mihriban@uludag.edu.tr, Orcid 0000-0003-3043-1904

***Corresponding Author:** Rukiye ÇOLAK ŞAŞMAZER

ÖZET**699**

Küresel süt ürünleri üretimi sürekli artmaktadır. Özellikle işlenmiş süt ürünleri grubunda, peynir tüketimin en büyük payı oluşturmaya devam etmesi beklenmektedir (yıllık ortalama oran% 1,6) (OECD/FAO, 2015). Bu bağlamda peynir benzeri ürünler doğal peynirlere göre daha hızlı büyümektedir. (PM Food & Dairy Consulting, 2014).

Bu ürünler analog peynirler ve yağ dolgulu peynirler olarak kategorize edilmektedir. Analog peynirler genellikle homojen peynir benzeri bir matris içinde su, sıvı yağlar / katı yağlar, proteinler, emülsifiye edici tuzlar, hidrokolloidler, asitleştirici maddeler, koruyucular ve diğer gıda katkı maddelerinin (peynir aroması, NaCl) karıştırılmasıyla elde edilen ürünlere verilen isimdir. Analog peynirler özellikle veganların tükettiği kullanılan bileşenlerin kökenine bağlı olarak formülasyonları olan ürünlerdir (Badem ve Uçar, 2015).

Veganlık ise hayvansal ürünler tüketiminden kaçınmayı merkezine koyan bir yaşam stilidir. Post-modern dünyada vegan etik tutumuna ek olarak siyasal duruş da bu eğilimi arttırmaktadır. Euromonitor'ün 2019'da yayınladığı raporda 2016-2017 döneminde vejetaryen nüfusun en fazla arttığı 10 ülke arasında Nijerya, Pakistan ve Endonezya gibi ekonomik olarak gelişmekte olan ülkeler bulunmaktadır. Türkiye bu sıralamada 7. sırada yer almaktadır. Vegan tüketim eğiliminin daha da hızlı şekilde yayılmasına neden olan en önemli etmen piyasanın da bu talebe cevap vermesidir. Dünya çapında süt ürünleri alternatiflerinin piyasa değeri 2017'de 10,7 milyar doları geçmiş ve 2025'te bu miktarı üçe katlaması beklenmektedir. 2016'da İtalya'da tüketicilerin %22'si et ürünlerinin vegan alternatiflerini tercih etmiştir. Beslenme rejimlerinde et tüketiminin önemli bir rol oynadığı Almanya, İspanya ve Polonya gibi ülkelerde bile her on tüketiciden 1 ya da 2'si artık vegan ürün tercihinde bulunmaktadır. 2016'da dünya çapında sunulan vegan ürünlerin %18'i Almanya'daki raflarda yer almıştır (Son, T. Y. G. ve Bulut, M. 2016, Euromonitor International 2019).

Bu çalışmada vegan ürünlerden biri olan vegan peynirlere ait farklı reçete tipleri ve bu ürünlerin duyuşsal özellikleri derlenmiştir. Çok çeşitli vegan peynir türleri bulunmaktadır. Bu tür peynirler ağırlıklı olarak nişasta su, protein ve yağ karışımlarından oluşmaktadır. Süt dışındaki bu bileşenlerden üretilen vegan peynirler çok çeşitli tat ve kokuya sahiptirler. Bu nedenle bu çalışmada vegan peynir bileşenleri, oranları ve peynirin duyuşsal özelliklerine etki eden bileşenler incelenmiştir.

ABSTRACT

The global production of dairy products is constantly growing over time. In particular, within the group of processed dairy products, cheese consumption is expected to continue to account for the greatest share at an annual average rate of 1.6% (OECD/FAO, 2015).

The market of cheese-like products is expanding faster than that of natural cheeses. An increase in the production of new varieties including AC, fulfilling the growing demand in developing dairy markets, is expected (PM Food & Dairy Consulting, 2014).

These products are categorized as analogue cheeses (AC) and fat-filled cheeses, the former one dominating over the other. Analogue cheeses is the term generally referred to products obtained by mixing water, oils/fats, proteins, emulsifying salts (ES), hydrocolloids, acidifying agents, preservatives and other food additives (cheese flavoring, NaCl) in a homogeneous cheese-like matrix. Analogue cheeses are systematically grouped into dairy, partial dairy or non-dairy, depending on the origin of the ingredients used in their formulation (Badem & Uçar, 2015)

Veganism is a lifestyle that focuses on avoiding consumption of animal products. In the post-modern world, in addition to vegan ethical attitude, the political and the reason is its stance and increasing the orientation. In the report published by Euromonitor in 2019, economically developing countries such as Nigeria, Pakistan and Indonesia are among the 10 countries where the vegetarian population increased the most in 2016-2017 period. Turkey is also included in this ranking 7th next. The most important factor causing the vegan consumption trend to spread even faster is that the market also responds to this demand. The market value of dairy products worldwide has exceeded \$ 10.7 billion in 2017 and is expected to triple this amount in 2025. In 2016, 22% of consumers in Italy preferred vegan alternatives of meat products. Even in countries such as Germany, Spain and Poland, where meat consumption plays an important role in nutrition regimes, 1 or 2 out of every ten consumers now prefer vegan products. 18% of the vegan products offered worldwide in 2016 were on the shelves in Germany (Son, T. Y. G. ve Bulut, M. 2016, Euromonitor International, 2019).

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In this study, different recipe types of vegan cheeses, which are one of the vegan products, and their sensory properties are compiled. There is a wide variety of vegan cheese types. Such cheeses consist mainly of starch water, protein and fat mixtures. Vegan cheeses produced from these components other than milk have a wide variety of flavors and flavors. Therefore, in this study, vegan cheese components, their proportions and the components affecting the sensory-texture properties of cheese were examined.

Key Words: Cheese, recipe, vegan

1. INTRODUCTION

Veganism is a lifestyle that focuses on avoiding consumption of animal products. This avoidance does not only cover foods such as meat, milk and eggs, and clothing such as fur, cotton and leather. In addition, cosmetics and cleaning products, in which animals are used as subjects, are products that should be considered in consumption. The term vegan was first used for Vegan Society, an association founded in England by Donald Watson and 24 friends in 1944. This association described veganism as a lifestyle and philosophy aimed at countering animal exploitation and persecution for human needs. In later periods, veganism was reinterpreted with different philosophical traditions. With discussions such as Gary Francione, Tom Regan and Peter Singer, the vegan lifestyle has become an ethical attitude justified by a philosophical look (Castells, 2006, Harvey, D. 2010).

In the post-modern world, where consumption habits have become a basic identity marker, veganism is a movement that includes a political and cultural stance as well as an ethical attitude. Although there are Asian and African countries where the vegan diet is common with references such as tradition and religion, the reaction accumulated against industrial animal cruelty, especially in the last thirty years, also increases the inclination towards vegan and vegetarian nutrition at the base. This trend is getting stronger as scientific studies on the consequences of vegan nutrition in terms of human health increase and alternatives to animal-based products increase in the market (Barrett, K. 2009, Gelderloos, 2011).

According to a study by Nielsen in 2016, 9 % of the population in the Asia-Pacific region follows a vegan diet. This rate is 6 % in Africa and the Middle East and 2 % in Europe. It is observed that the middle classes of developing countries, as well as the European and North American countries, where vegan consumption is apparently widespread, increasingly make vegan choices. In the report published by Euromonitor in 2019, economically developing countries such as Nigeria, Pakistan and Indonesia are among the 10 countries where vegetarian population increased the most in 2016-2017 period. Turkey in this ranking # 7. When we read this ranking with the population of the countries, we see that 6 out of every 1,000 people in Nigeria and Pakistan turned towards vegetarianism in the period of 2016-2017, and in other countries, In a survey conducted in 2019 results in about 5% of the population in Turkey fed vegan, vegetarian of 4%, and 4% of the pesketary (who do not eat meat except fish) shows that following a diet (Kekevi, S. ve Kılıçoğlu, G. 2012, Nielsen, 2019).

In recent years, particularly of products and services for those who prefer vegan in major cities of Turkey has increased visibly. Although there is no clear statistics about this, it is possible to understand this from the increasing number of vegan products in large supermarkets or the increase in cafes offering products for vegans. When we look at the tendencies to search on Google, it is seen that the frequency of searching vegan and vegetarian terms has increased approximately 8 times especially after 2013 (Lyotard, F. J. 2013, @veganturkiye).

Additional advantages of vegan cheese lies in compositional and nutritional flexibility, health and dietary benefits, tailored manufacture to customize functionalities (textural, cooking) and finally convenient packing and ease-of-use. Non-dairy AC (largely obtained from vegetable proteins and fats) represent a market opportunity for vegan cheeses (Fox, Guinee, Cogan, & McSweeney, 2017a, pp. 589–628).

2. RECIPES AND PROPERTIES OF VEGAN CHEESE

2.1. Ingredients

Various types of imitation cheese exist. Such cheeses are usually based on various mixtures of water, protein and fat, which may further comprise starch. Starch in such imitation cheese is often modified starch, which precludes their marketing as a “clean-label” product. In addition, known imitation cheeses have the drawback that they have poor melting characteristics, so that the imitation cheese when present on a heated food product does not display the stretch associated with regular molten cheese. Furthermore, known imitation cheeses generally have an off-taste, which in itself is unattractive, and masking of which by odors and flavors may require labelling of such compounds, which is also unattractive in view of the generally health-conscious consumer market for imitation cheese products (International Publication Number WO 2017/150973 A1).

Cheese analogue contains comprising water, a root or tuber starch, native potato protein and a fat component. Starch can be a modified starch, such as a degraded, enzymatically modified or stabilized starch. It is preferred, that the starch used in the cheese analog is a non-modified starch. Non-modified, in this context, means that the starch has not been chemically or enzymatically modified, although it may have been pre-gelatinized. Native starch means a native, granular starch, such as obtained from the root or tuber. The advantage of using a non-modified or native starch is that such starches can be applied label-free in food products, which is an advantage for cheese analogues targeted at health-conscious consumers (Vegan Cheese Analog US 2019 / 0037872 A1).

A native potato protein to be used in cheese analogs. Optionally, native potato protein can be further fractionated to obtain separate protein fractions. Preferably, native potato protein is a dry potato protein powder, such as with a moisture content of at most 10 wt. Stretch, shredability, and body are optimal at a concentration of potato protein of around 2 wt. %. Higher concentrations of potato protein result in a rather turbid appearance, although stretch and body improve. Lower concentrations than around 2 wt. % result in a slightly watery/runny product after melt. In the whole range claimed, taste is not affected by the quantity of potato protein (Schinner, M. N. 2012).

The quantity of native potato protein is 0.5-8 wt. %, based on the total weight of the composition. Stretch, shredability, and body are optimal at a concentration of potato protein of around 2 wt. %. Higher concentrations of potato protein result in a rather turbid appearance, although stretch and body improve. Lower concentrations than around 2 wt. % result in a slightly watery/runny product after melt. In the whole range claimed, taste is not affected by the quantity of potato protein (Schinner, M. N. 2012).

The cheese analogue may further comprise various optional components, among which flavors, odors and colorants. Suitable flavors include various salts, such as sodium or potassium chloride, as well as organic flavors and odors such as citric acid and various esters and aldehydes (Mangels, R. A. ve Messina, V. 2001, Schinner, M. N. 2012).

Table – 1. Standard recipe for production of 1 kg cheese analogue

Ingredient	Amount (g)	wt. %
Water	558	55.8
Starch	170	17
Native potato protein	20	2
Salt	2	0.2
Oil	250	25

2.2. Making Vegan Cheese

The mixture is heated to a temperature of 70-90 °C. During heating, gelatinization of the starch occurs resulting in increased viscosity. This occurs at a temperature of 50-70° C. While further increasing the temperature to beyond about 70° C., the gelatinized starch starts to dissolve so that the viscosity decreases again and the mixture becomes thinner (overcooking). Heating is continued to the intended target temperature, so as to overcook the starch. Heating is preferably slow heating, such as with a heating rate of less than 1° C./min, preferably less than 0.5° C./min. Heating can be done indirect or direct ([Lightowler, H.](#) and [Davies, J.](#) 1998, [Steinkraus, K. H.](#) 2002).

After the heating step, the mixture is a viscous mixture comprising overcooked starch, as well as native potato protein and a fat component. This mixture is subsequently cooled, such as to a temperature of below 25° C., preferably below 15° C., more preferably below 10° C., such as for instance 1-8° C. Cooling results in solidification of the mixture into a solid block ([Robertson, R.](#) 2003).

The solid block is subsequently ripened. Ripening is achieved by leaving the cooled block at low temperature, such as a temperature of below 25° C., preferably below 15° C., more preferably below 10° C., such as for instance 1-8° C., for at least 1 day, preferably at least 2 days, more preferably at least 3 days. This is important, because results in the solid block to further solidify and equilibrate the separate components. This results in sufficient hardness to allow the cheese analogue to be shredded ([McAthy, K.](#) 2017).

In a preferred embodiment, the viscous mixture comprising overcooked root or tuber starch comprising water, potato protein and a fat component is poured into a suitable mold after the heating step and prior to the cooling step. This has the advantage that the cheese analogue can be formed in any particular shape, such as square or rectangular blocks or cylindrical objects ([Craig, J. W.](#) 2009, [Urbonaviciene, D et al.](#) 2015).

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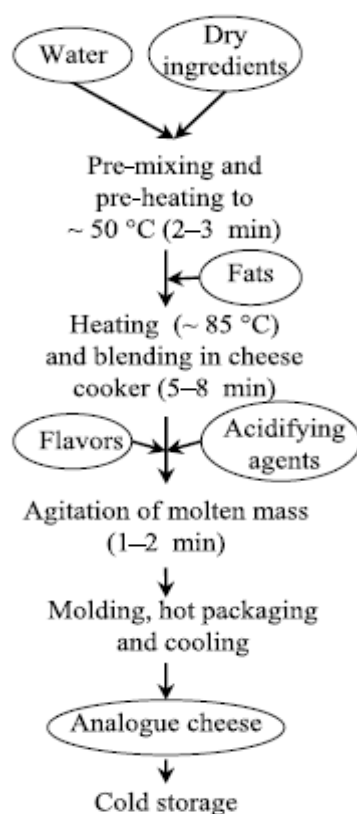


Fig. 2. Generalized manufacturing protocol for analogue cheese.

Most protocols are patented, but a general description of each step has been reported in literature (Fox et al., 2017a, pp. 589–628). For the sake of simplicity, process flowchart for the preparation of AC has been depicted in Fig. 2. Hot packaging and refrigerated storage follows after 1–2 min of blending. Through cooling, the homogeneous and viscous mass sets to form a structure, varying from soft and spreadable to firm and sliceable matrix. Molding and hot packing are followed after the cooling step (Fig. 2). The subsequent storage conditions of vegan cheese are important because such storage can affect the physical properties and final texture (Mulsow et al., 2007).

2.3. Vegan Cheese Properties

Specific attributes are required in AC to perform the desired end-use application (Guinee, 2016). The functional characteristics of AC, both when directly consumed and when used as ingredient, play a major role for its successful acceptance by the consumers/food service providers. The functionality of AC is influenced by micro- and macro-structure, which in turn are affected by factors such as processing conditions and composition of the AC (Fox et al., 2017b, pp. 629–680) (Fig. 1).

Type (fat, CN, whey proteins, ES) and physico-chemical properties (degree of protein aggregation or hydration, size distribution of emulsified oil droplets) of ingredients and interrelations among components (protein-to-fat ratio, calcium-to-CN ratio) are major determinants of rheology and functionalities of the end product (Guinee, 2016).

In addition, vegan cheese should have defined organoleptic (i.e. flavor and texture) properties both in direct (during mastication) and indirect consumption (as an ingredient) (Guinee, 2016). Cooking properties of vegan cheese are a composite of different functionalities, including softening, flowability, tendency to brown, oiling off and/or stretchability (the latter for pasta filata varieties) (Guinee, 2011). Both unheated and heat-induced functionalities are strictly related to physical (rheological) characteristics (hardness, elasticity, adhesiveness, brittleness or crumbliness) of vegan cheese (Guinee, 2016) (Fig. 1).

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3. RESULTS

Veganism has turned into a popular trend in contemporary societies. Vegans who abstain from eating animal food and products differ from vegetarians with their radical stances such that they prefer not to consume milk and other dairy products. Castells defines identity as power and in postmodern societies, veganism is also discussed through the concept of identity. Hence, veganism develops as a “global resistance identity” parallel to the related opposition and tries to legitimize itself on social media in postmodern life. In conclusion, it has been noticed that rather than veganism or vegan diet, equality between species have been mostly emphasised in Vegan Turkey’s messages on Twitter. Furthermore, animal rights and love for animals have been identified as the main messages of this specific account (Yegen C. ve Aydın, Oğuz B., 2018).

Over the years, the image of vegan cheese changed from products made with ingredients of inferior quality to functionalized ingredients, fulfilling desirable nutritional-dietary properties (cholesterol free, reduced saturated fats, reduced sodium, enriched with vitamins/minerals). Besides the development of products meeting consumers' expectations also costeffectiveness represents a key driver explaining the positive outlook for vegan cheese market. Such updated scientific information could improve the feasibility of industrial scale-up manufacture of AC. The optimization of sensory

properties, being crucial for sales and marketing, represents the leitmotif for today's manufacturers, as a way, for instance, to improve the consumers' perception of low-fat AC. The use of new value-added ingredients could entail the development of new versatile and cost-reduced cheese varieties.

For making a good vegan cheese;

- A. Have a good structure is related with well-gelatinized starch (optimum heat parameter)
- B. Have a good mouthfeel is related with type of ingredient, well-melted dough.
- C. Homogenization is very important effect on structure of cheese.
- D. Ripening should be 1-8 °C at least 3 days. This is important, because results in the solid block to further solidify and equilibrate the separate components. This results in sufficient hardness to allow the cheese analogue to be shredded, so that cheese analogue shreds can be more readily obtained by for instance grating.
- E. The viscous mixture comprising overcooked root or tuber starch comprising water, potato protein and a fat component is poured into a suitable mold after the heating step and prior to the cooling step. This has the advantage that the cheese analogue can be formed in any particular shape, such as square or rectangular blocks or cylindrical objects.

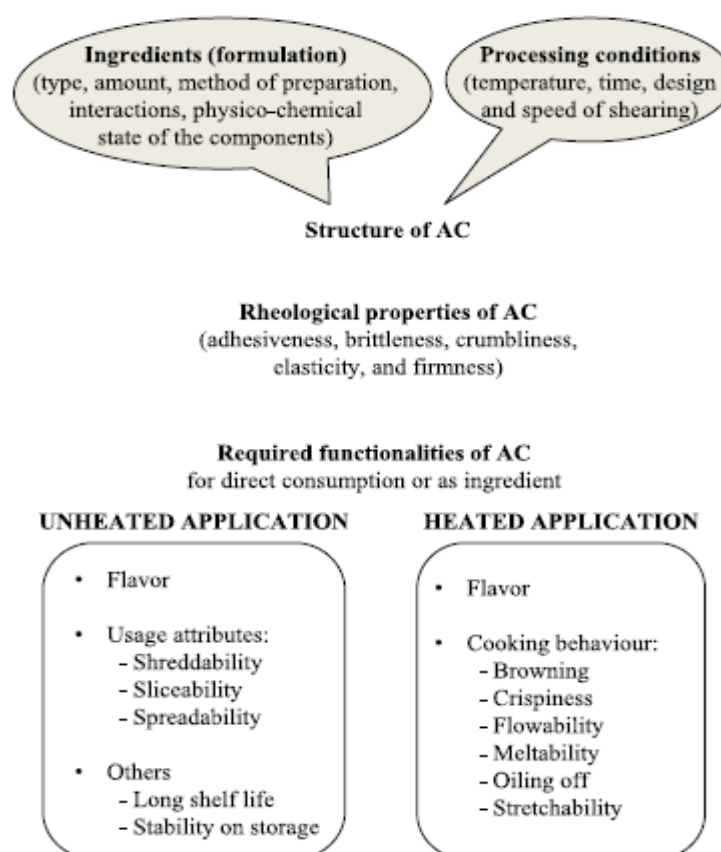


Fig. 1. Factors affecting the rheology of analogue cheeses (AC).

The formulation of vegan cheese consists of a combination of protein sources, fats/oils and water as key ingredients. Other ingredients include emulsifying salts, hydrocolloids, acidifying agents, flavors and preservatives (Guinee, 2007; Jana & Upadhyay, 2001; Jana, Upadhyay, & Solanky, 2005).

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