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CHEESE EMBRACING BOTH SIDES OF THE AEGEAN SEA: KOPANISTI CHEESE

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ABSTRACT

Local Whey cheeses, known by various names, are produced using different production techniques and different milk types according to the regions. The word kopanisti, derived from the Greek kopaniso, is kopanistos, and when translated into Turkish, it gains the meaning of "crushed, kneaded, beaten". Kopanisti cheese, produced in Karaburun and Çeşme regions where animal husbandry was advanced in the years 1950-1960, was exported only to the Greek islands due to the lack of transportation. Kopanisti cheese on both the peninsula and the Greek islands shows that this product is the product of cultural interaction between Turks and Greeks. Kopanisti cheese is made from the lor obtained from the whey released in the production of Sepet cheese from goat's milk. Cheese has yogurt consistency; its color varies between dark yellow and light brown. It has a taste reminiscent of Roqueforti cheese and appeals to a particular consumer segment due to its a salty, bitter taste with its acid flavor and sharp aroma. This review will focus on the production and properties of Turkish and Greek kopanisti cheese.

KEYWORDS: Whey, whey cheese, traditional whey cheese, Kopanisti cheese.

1. INTRODUCTION

Traditional foods, which play a significant role in developing a society's food culture and nutritional habits, are essential in revealing their cultural richness (Demirci et al., 2014; Koten and Unsal, 2014). Turkey has a huge number and variety of traditional meals as a

result of its historical past, diverse cultures, and diverse climatic aspects of its geographic location, among other factors. While traditional cheese is one of the first symbols of humanity's transition to civilization, it is also a traditional product representing cultural richness and heritage, transmitted from generation to generation and obtained by chance due to experiences. (Alichanidis and Polychroniadou, 2008; Saygılı et al., 2019). There are numerous traditional cheese kinds manufactured and consumed in Turkey and throughout the world, and these traditional cheeses serve as an indicator of the country's cultural diversity (Turkoglu et al., 2003; Demirbas et al., 2006).

In Turkey, there are more than 193 regional and regional varieties where each variety has its unique composition, taste, texture, and appearance (Cetinkaya 2005; Kamber, 2005). The production of whey cheeses is based on the traditional production method. Whey cheeses are produced all over the world, usually on a small scale and following to traditional methods, by denaturing whey proteins. These cheeses are known by different names based on the country and location from whence they are derived (Table 1). (Kirdar, 2009; Evren et al., 2011). Different types of lor cheese can be found in Turkey based on the type of milk used, the manufacturing procedure, and the region where it is produced. Lor cheese is a spreadable cheese obtained from whey and consumed without maturation. (Table 2) (Ozdemir et al., 2000; Kamber 2005; Kirdar 2009).

Table 1: Whey cheese produced in the world.

Country	Name of Whey Cheese	Reference
Argentina	Ricotta	Kandarakis, 1986
Bulgaria	Otvora	Tonguç ve Karagözlü 2012
Corcica	Broccia	Tonguç ve Karagözlü 2012
Cyprus	Anari	Williams and Syson, 1984
Czechoslovakia	Urda, Zincica	Kandarakis, 1986
Brazil	Requeijão do Norte, Ricotta fresca	Jassen-Escudero and Rodriguez-Amáya, 1981
Egyptian	Karishmain	Kalantzopoulos, 1999
ex-Yugoslavia	Scuta, Puina	Stefanovic and Djordjevic, 1969
ex-USSR	Nadigi, Kaukaz	Kandarakis, 1986
France	Serac, Brousse, Broccio, Greuil	Kandarakis, 1986
Germany	Zieger, Schottenzieger, Schabzieger	Kandarakis, 1986
Greece	Manouri, Myzithra, Anthotyros	Anifantakis, 1991
Italy	Ricott	Kosikowski, 1982
Iraq	Lour	Kandarakis, 1986
Israel	Urda	Kandarakis, 1986
Lebanon	Kariche	Kandarakis, 1986
Macedonia	Urda	Kandarakis, 1986
Malta	Cacio-ricotta	Kandarakis, 1986

Northern Africa	Nicotta	Kandarakis, 1986
Norway	Mysost, Primost, Gjestost,	Jelen and Buchheim, 1976
Peru	Regueson	Tonguç ve Karagözlü 2012
Portugal	Requeijão	Kandarakis, 1986
Romania	Ziger, Urda	Kandarakis, 1986
Spain	Requesón	Kandarakis, 1986
Switzerland	Schottenziegr, Hudelziger, Mascarpone	Kandarakis, 1986
Tunisia	Klila	Kandarakis, 1986
Turkey	Lor	Kirdar 2009
USA	Ricotone, Ricotta	Kandarakis, 1986

Table 2: Whey cheeses produced in Turkey.

Name of Whey Cheese	**City**
Dolaz cheese	Isparta
Armola cheese	İzmir
Kirli hanım cheese	Ayvalık
Kopanisti cheese	**İzmir- Çeşme- Foça- Karaburun**
Kuru Çökelek	İzmir-Aydın
Sepet loru	Ayvalık- Foça
Tire Çamur cheese	İzmir-Tire
Otlu Lor cheese	Van
Şor Lor cheese	Kars
Sırvatka Lor cheese	Bursa-Balıkesir-manyas
Nor cheese	Kıbrıs, Mersin, Silifke
Ekşi(siyah) cheese	Çankırı

2. Kopanisti cheese

Kopanisti cheese on both the peninsula and the Greek islands shows that this product is the product of cultural interaction between Turks and Greeks. The word kopanisti, derived from the Greek kopaniso, is kopanistos, and when translated into Turkish, it means "crushed, kneaded, beaten". Although it is not difficult to make kopanisti cheese, which has a sharp smell, it is a cheese that requires patience and time (Dag, 2020). Kopanisti cheese, known as the cheese that rises as it is kneaded, is made in İzmir's Çeşme, Karaburun, Foça and Urla districts, but today Kopanisti cheese is mostly made by a few families in Karaburun, Chios (Khios) and Lesbos (Lesbos) with traditional methods (Figure 1, 2) (Onen, 2017). It is not known in the villages (such as Reisdere, Ildırı, Uzunkuyu), where the Balkan immigrants settled here after the Greeks left the region. On the other hand, it appears as a traditional taste in many villages of Karaburun and Germiyan, Zeytineliler, and Kadıovacık, the settled Turkish villages that existed here a hundred years ago. (Kamber, 2005). It has a taste reminiscent of Roqueforti cheese and appeals to a certain consumer segment due to its bitter

taste. Kopanesti cheese, which is called "Tiryaki cheese", is loved by the local people and consumed as an appetizer. (Kamber, 2008; Kirdar, 2009; Slow-Food, 2015).

Figure 1: Regions where Kopanisti cheese is produced in the World.

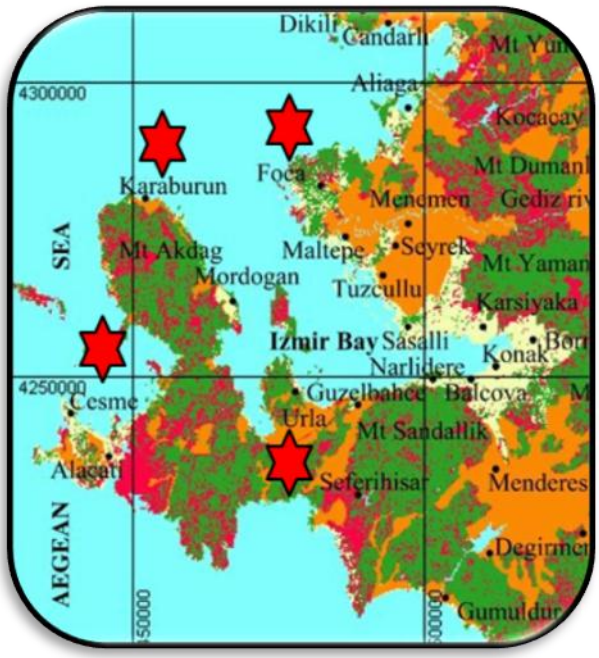

Figure 2: Kopanisti cheese producing in Aegean region in Turkey.

3.1. Kopanisti producing method

The production method of the cheese is not standardised and producers may employ methods that are slightly different from each other. Unlike Turkey, the cheese has a PDO status in Greece. The composition of this cheese variety varies considerably due to the different

methods used for production and the use of different kinds of milk mixtures (Unsal 2017; Kamber 2005).

3.1.1 Turkish sytle

Kopanisti cheese is made from the lor obtained from the whey released in the production of Sepet cheese from goat's milk. The main feature of its production is that the lor is transferred to earthen pots and kneaded in these pots until the desired sensory properties are obtained. In the production of Kopanisti cheese, basket cheese is obtained by using goat's milk first, and the remaining whey is heated to 80-85°C in a separate boiler. In the meantime, 10-20% of fresh goat's milk is added, continuing the heating process. The heating is then stopped. After a while, the clot, which starts to collect on the surface, is transferred to the baskets. It is left to drain for a few days. It is then placed in cheesecloths and allowed to drain thoroughly. The curd obtained is taken into glazed and thoroughly cleaned earthenware pots called "Dahar" or "taar" and kneaded thoroughly (Fig.3).

Figure 3: Dahar.

The kneading process varies according to the season and takes 40 days in winter and 25 days if it is produced in summer. However, if the air temperature is low, the time between two kneading processes is longer, and if the air temperature is high, it is kneaded every day. In the last stages of the kneading process, the upper surface of the cheese acquires a shiny, slippery appearance, cracks appear in places, and it begins to emit a heavy odor. At this stage, salt is added to the cheese and kneaded again. The salting process is generally carried out in three phases. In the first salting, some salt is added to the cheeses, kneaded well, and left for three days. The second salting is done on the third day, and the third salting is done 7-10 days after that. The amount of added salt is at least 5% in dry matter. Kopanisti cheese, which can be consumed after the salting process, is stored in containers where the kneading process is done. (Fig.4). (Ergullu et al., 1998; Kamber 2005). Cheese has yogurt consistency; its color

varies between dark yellow and light brown. It has a salty taste with its acid flavor and sharp aroma.

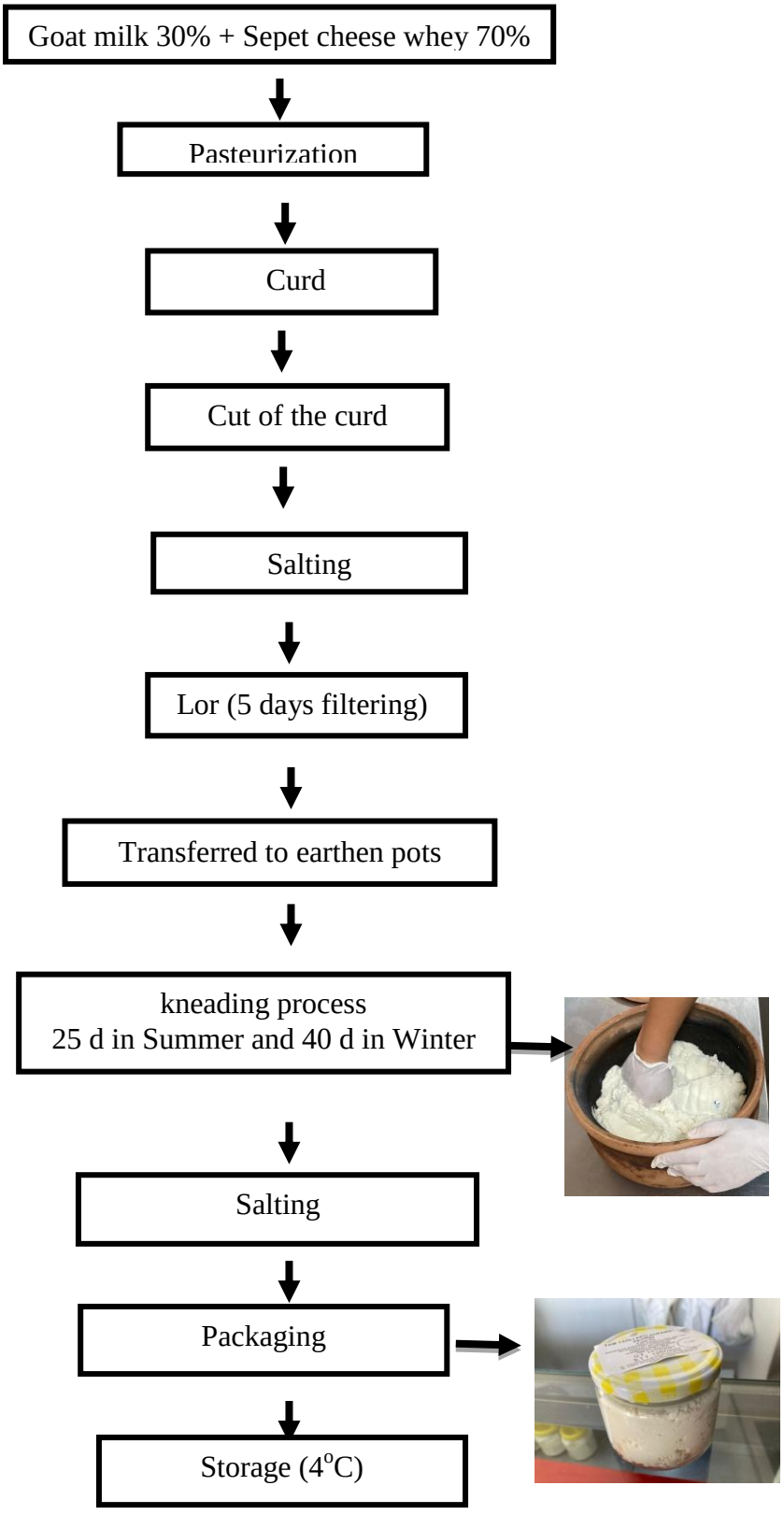

Figure 4: Production steps of Kopanisti cheese in Turkey.

3.1.2. Greek Sytle

Kopanisti (Greek: Κοπανιστή) is a salty, spicy cheese, with protected designation of origin (PDO) produced in the Greek islands of the Cyclades in the Aegean Sea such as Mykonos, Tinos, Andros, Syros, Naxos. The geographical area where 'Kopanisti' is produced is defined by the administrative boundaries of the Regional Unit of the Cyclades in Greece, which is made up of 24 inhabited islands and over 100 uninhabited islands and rocky islets and is located in the southern Aegean Sea.

Traditionally in Mykonos this cheese is homemade by farmers from raw goat and sheep milk, although some also use cow's milk or a mixture of different types of milk, in varying proportions. Kopanisti has been produced in Mykonos for at least 300 years and was the most popular cheese among the island's sailors, who carried it with them during long journeys in the Mediterranean and the Black Sea. In fact, it can be stored for many months, even years, without refrigeration. The kopanisti seems to be very precious to the people of Mykonos: it was included among the gifts that mothers and relatives gave to girls before marriage. The flavor of this white to slightly pink cheese is often described as spicy, pungent, peppery, and reminiscent of Roquefort due to fermentation of bacteria such as penicillium and lactobacilli. The best-known types of Kopanisti are from Tinos and Mykonos. At the Olympics of 1859 and 1870, there is a reference to the prizes distributed to the various products exhibited. In the cheese products category, there is a reference to the award of a prize to 'Kopanisti' from Syros (Onen 2018).

The method of production, as it is currently used in modern cheese dairies in Greece, has been improved and differs slightly from domestic Kopanisti making so as to facilitate production, improve quality, use the raw materials available on each island and reduce costs. There has been a recent amendment to EC regulation about Kopanisti, which allows for the use of synthetic sacks made of food-grade material (in place of sacks made of fabric) and the addition of fresh butter up to 15% to improve the texture, flavor and the aroma of the cheese. In accordance with Greek legislation, the general technology employed in the production of Kopanisti cheese is as follows (Figure 5) (Official Journal of European Union, 2012).

Raw bovine, ovine or caprine milk or a mixture there of is used and no lactic cultures are added. The coagulation of milk takes place at 28–30º C with the addition of a small amount of rennet so that the process is completed in about 2 h. The cheese curd remains in the vat for about 20–24 h. It is then divided and placed in cloth bags in order to remove the whey. The

cheese curd that is formed is called Petroma. The Petroma is then mixed with 4–5 g dry salt per 100 g and placed in wide clay pots, which remain in a cool place with relatively high humidity until an abundant microbial flora is formed on the cheese surface. Kneading by hand is required so that a uniform distribution of microbial flora is achieved. Afterwards, it is left to rest until an abundant microbial flora is present again on the surface. This is repeated three or four times until the cheese matures. This process lasts between 30 and 40 days According to Greek legislation The maximum moisture content should be 56 g per 100 g, while the minimum fat content in dry matter should be 43 g per 100 g (Karali et al., 2013)

Raw goat, sheep or cow's milk or mixture of them

↓

Milk is coagulated at 28-30°C with the addition of rennet to bring curdling to completion in about 2 hours (no lactic cultures are added)

↓

Cheese curd is left to stand in the vat for 20-24 hours and is then broken up and put into cloth sacks for draining

↓

Drained cheese mass is mixed with salt in the proportion of 4-5% of the net weight

↓

Cheese mass is placed in wide-necked clay pots and stored in a cool and humid place

↓

Cheese mass is kneaded by hand to facilitate the even distribution of the microflora (repeated 3-4 times during the ripening period of 30-40 days)

Figure 5: Production steps of Kopanisti (Greek style).

3.2. Microbiological flora of Kopanisti cheese

Lactobacillus plantarum and *L. casei* were the most frequently isolated bacteria strains (Tzanetakis et al., 1987). *Lactobacillus rennini* and *L. acidipiscis*, were isolated from Kopanisti cheese and Mana Mana is over-mature Kopanisti cheese, which is traditionally added to the drained acid curd of new Kopanisti cheese in order to accelerate ripening (Asteri et al., 2009).

The most dominant microflora was reported to be composed of *L.suebicus, L. sanfransisco and L.casei* in Kopanisti cheese from Çeşme province of İzmir, Turkey (Karabıyıklı and Karapınar, 2008).

The predominant species of yeast were found to be *Trichosporon cutaneum (T. beigli)* and *Kluyveromyces lactis* (Kl. *Marxianus* var. *lactis*) (Kaminarides & Anifantakis, 1989). Another study reported *Pichia membranefasciens* and *P. fermetans* as the predominant species accounting for the 69 and 17% of the isolates, respectively (Tzanetakis et al., 1987).

Molds were also detected in Kopanisti, and the most common mold was reported to be *Penicillium commune* (Tzanetakis et al., 1987).

In a study carried out to determine the numerical changes of molds and yeasts during fermentation in Kopanisti cheese and to identify lactic acid bacteria isolated from different stages of fermentation, the compliance of the microorganism numbers in the final product with the cheese standards in the Turkish Food Codex was investigated. While the average number of molds was $3.05x10^9$ cfu/g in the cheese samples taken from Çeşme, the average number of yeast was $6.13x10^6$ cfu/g, the average number of molds in the Kopanisti cheese sample produced in the laboratory was $6.50x10^8$ cfu/g, and the average yeast count was $9.26x10^6$ cfu/g.

The total bacterial count of Kopanisti cheese ranged from $1.0x10^4$ cfu/g to $8.0x10^5$ cfu/g, with an average of $3.2x10^5$ cfu/g. Coliform group bacteria were not found (Ergullu et al., 1998).

As a result of the identification based on their phenotypic characteristics, The isolated lactic acid bacteria were found to be *Lactobacillus brevis, Lactobacillus buchneri, Lactobacillus casei, Lactobacillus collinoides, Lactobacillus johnsonii, Lactococcus lactis subsp. cremoris, Lactobacillus mali, Lactobacillus minor, Lactobacillusoris, Lactobacillus parabuchneri, Lactobacillus reuteri, Lactobacillussanfrancisco, Lactobacillus sharpeae, Lactobacillus suebicus, Lactobacillus vaginalis* and *Lactobacillus viridescens* species; to Kluyveromyces lactis and Debaryomyces hanseni species of yeast isolates; mold isolates were found to belong to the genus Aspergillus and Geotrichum (Karabıyıklı 2006).

3.3. Chemical properties of Kopanisti cheese

Production stages and some chemical and microbiological properties of Kopanisti cheese taken from Karaburun were investigated. The chemical properties of Kopanisti cheese are given in Table 3 (Ergullu et al., 1998; Danezis et al., 2020).

Table 3: Chemical properties Kopanisti cheese.

Parameters	Greek Kopanisti cheese	Turkish Kopanisti Cheese
pH	4.49	5.35
Dry Matter	48.1	42.22
Fat	19.2	14.28
Fat in Dry Matter	50.1	34.26
NaCl	2.76	6.30
Protein	11.6	16.8

The main aromatic groups detected in Kopanisti were alcohols, esters and volatile fatty acids. The intense lipolysis in Kopanisti cheese is responsible for its strong taste. The TFFA content averaged 48 979 mg kg^{-1} cheese. The main volatile carboxylic acids found in Kopanisti were acetic, butyric and capric acids. Palmitic acid was the predominant long-chain fatty acid found in Kopanisti cheese. Eight-one different volatile compounds were identified in Kopanisti cheese, comprising alcohols, aldehydes, ketones, hydrocarbons and esters. Some of the main volatile compounds were ethanol, 2-butanol, 2-butanone, pentanal and several ethyl esters. Alcohols accountedfor 60% of the total volatile compounds owing to the high concentration of ethanol found in the samples. Esters were the second most significant group of aromatic compounds in Kopanisti after alcohols, representing 26% of the total aromatic compounds. The intense lipolysis contributes greatly to the strong flavour and peppery taste of Kopanisti cheese. The flavour of Kopanisti is attributable mainly to the volatile fatty acids and various other volatile compounds as well as to the interactions occurring between them (Karaali et al., 2012).

3.4. Consumption of cheese

Turkish Kopanisti cheese

Since Kopanisti is soft enough to be spread on bread, has a creamy consistency and a Roquefort flavor, it is generally used as an additive and appetizer. Especially as an appetizer, melon, raki, and Kopanisti are a traditional trio. Apart from breakfast, melon and white grapes are mixed with additives, especially in summer (Uhri, 2017; Onen, 2018).

Greek Kopanisti cheese

Kopanisti cheese has a powerful salty and peppery flavor, a soft and spreadable texture, and a rich flavor similar to Roquefort. The cheese is mainly served as an appetizer alongside a glass of ouzo, retsina, or raki, and is often used in traditional dishes and sandwiches due to its creamy and spreadable texture. One of the most popular ways to use it is in a Myconian variation of *ntakos* - a barley rusk that's softened in olive oil and water, topped with chopped tomatoes, Kopanisti cheese, olive oil, and oregano. The most popular way of serving is in a dish called "mostra" which contains dry bread with kopanisti cheese, chopped tomatoes and olive oil or with grapes, figs or watermelon. In Mykonos the flavor is sweetened with the addition of glina (pork lard). Locals prepare a dish called "Mykonianrusks" by spreading Kopanisti moistened with a bit of water and a little olive oil on the bread and topping it with tomatoes.

Figure 6: Kopanisti cheese.

CONCLUSION

Kopanisti cheese, known as the cheese that rises as it is kneaded, is made in İzmir's Çeşme, Karaburun, Foça and Urla districts in Turkey. The most famous of these cheeses is Kopanisti of Mykonos island, followed by that from the islands of Tinos, Andros, Syros and Kythnos. It is also found on Astypalaia and Chios in Greece. Kopanisti cheese on both the peninsula and the Greek islands shows that this product is the product of cultural interaction between Turks and Greeks.

Kopanisti cheese is made from sepet cheese whey and without the use of starter cultures. The ripening conditions and the kneading of the cheese curd after the development of an abundant microbial flora on the cheese surface lead to a uniform distribution of the microbial flora in the cheese mass, which favours the formation of volatile compounds. It is a spicy cheese with a pungent, intense peppery taste, reminiscent of Roquefort and Munster-Géromé but also distinct, since it has no particular shape and is spreadable, with a characteristic tan and,

sometimes, a pale pink color that darkens as it matures. It owes its special peppery and spicy taste to rapid and extensive lipolysis and proteolysis caused by abundant microbial growth encouraged by repeated kneadings performed during the ripening process.

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