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Review Paper

Incorporation of microalgae in the development of innovative dairy products

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ABSTRACT

Global food demand is projected to rise in the future, increasing pressure on food systems and intensifying the search for sustainable protein sources. Microalgae are increasingly recognized as a promising alternative due to their high protein content, favourable essential amino acid profile, polyunsaturated fatty acids, vitamins, minerals, and diverse bioactive compounds with antioxidant potential. Dairy products, as widely consumed nutrient-rich foods, represent an ideal platform for microalgae incorporation to improve nutritional quality and promote more sustainable diets. The aim of this manuscript was to provide a concise overview of dairy product formulations incorporating microalgae, with an emphasis on future prospects and associated challenges. The most thoroughly studied algal species are *Arthrospira platensis* and *Chlorella vulgaris*, and the possibility of their incorporation into fermented milks, particularly yogurt, cheese and ice creams. Documented benefits include increased protein content, improved fatty acid composition, enhanced antioxidant activity, and potential stimulation of starter and probiotic bacterial growth. Nevertheless, technological and sensory challenges remain, including modifications in texture, viscosity, and colour, as well as the development of bitter, herbaceous, or marine-like flavours that may reduce consumer acceptance. Future research should focus on identifying suitable microalgal species, refining processing technologies, and developing flavour-masking approaches to enable the production of microalgae-enriched dairy products that are both nutritionally enhanced and sensorially acceptable to a broad consumer base.

1. Introduction

Global food demand is projected to rise by 35–56% by 2050, and potentially by up to 62% when the impacts of climate change are considered (*Van Dijk et al.*, 2021). The projected increase in the intake of animal-derived protein poses particular challenges for both food security and environmental sustainability. Consequently, the development and adoption of alternative protein sources for direct human consumption will be essential (*Henchion et al.*, 2017).

Microalgae are regarded as one of the most promising alternative protein sources for future. The term microalgae are not based on phylogenetic classification, but it refers to a heterogenous group of unicellular photosynthetic microorganisms, both eukaryotic and prokaryotic (*Barros de Medeiros et al.*, 2022). Microalgae are a sustainable alternative protein source and are also characterized by high

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contents of essential fatty acids and vitamins. Furthermore, due to their abundance of bioactive compounds, they are increasingly recognized as valuable ingredients in the formulation of functional foods (*Hernández et al*., 2022).

Dairy products are widely consumed across the globe and are an important source of essential nutrients. The incorporation of microalgae into dairy matrices has been proposed as a strategy to enhance their nutritional profile by providing additional proteins, essential fatty acids, vitamins, and antioxidants, thereby contributing to the development of more sustainable and health-promoting products (*Hernández et al*., 2022).

The aim of this manuscript is to provide a concise overview of dairy product formulations incorporating microalgae, with an emphasis on future prospects and associated challenges.

2. Microalgae composition

According to *AlgaeBase*, the leading global database of algal taxonomy, approximately 50,000 microalgal species have been described to date (*algaebase.org*). Nevertheless, only a limited number of these species are used in food production, with *Arthrospira* (*Spirulina*) *platensis* and *Chlorella vulgaris* being the predominant species applied in the dairy industry (*Hernández et al*., 2022).

Microalgae are a rich source of protein, which can be as high as 70% of dry biomass (*Lucakova et al*, 2022). The protein content of *Arthrospira platensis* is in the range 55-70% per dry matter and 42-55% in *Chlorella vulgaris* (*Barros de Medeiros et al*., 2022). Both species produce high-quality proteins containing all essential amino acids (*Lucakova et al*., 2022). Although they are deficient in sulphur-containing amino-acids, the amino acid profiles of these microalgae are comparable to the conventional protein sources, egg and soybean (*Becker*, 2007). The main obstacle for using microalgae as a protein source is the presence of a cellulosic cell wall, which is indigestible in the human gastrointestinal tract (*Fasolin et al*., 2019). This limitation can be addressed through various cell disruption techniques, including enzymatic hydrolysis, microwave treatment, pulsed electric fields, high-pressure processing, ultrasonication, osmotic shock, and chemical methods (*Barros de Medeiros et al*., 2022).

The lipid content in microalgae is usually in the range 20-50% per dry matter biomass, and is influenced by the metabolic status of the cells and cultivation conditions (*Barros de Medeiros et al*., 2022). Microalgae are a source of polyunsaturated fatty acids (PUFAs) ω-3 and ω-6 fatty acids, and sterols (*Randhir et al*., 2020). *C. vulgaris* is a source of α-linolenic acid (ALA, C18:3 n-3) and linoleic acid (LA, C18:2 n-6) (*Hernández et al*., 2022), whereas *A. platensis* is particularly rich in ω-6 fatty acids, with γ-linolenic acid (GLA, C18:3 n-6) being predominant (*Senila et al*., 2025). Other microalgal species, including *Nannochloropsis gaditana, Nannochloropsis oculata, Pavlova lutheri, Phaeodactylum tricornutum*, and *Tetradesmus pseudonana*, are valuable sources of eicosapentaenoic acid (EPA, C20:5 n-3), while *Pavlova lutheri* is recognized for its high content of docosahexaenoic acid (DHA, C22:6 n-3) (*Lucakova et al*., 2022). PUFAs produced by microalgae are of special interest, since they contain lower levels of contaminants (dioxins, polychlorinated biphenyls, methyl mercury) compared to fish oils (*Barros de Medeiros et al*., 2022).

Carbohydrates, which make up to 20% of the dry biomass, are usually accumulated in microalgae in the form of starch or other polysaccharides, such as glycogen, β-glucan etc, depending on the species. Exopolysaccharides are of special interest due to their beneficial health effects, such as antioxidant capacity and antitumor effects (*Barros de Medeiros et al*., 2022; Lucakova et al., 2022). Moreover, some of the carbohydrates produced by microalgae can serve as prebiotics (*Eltanahy et al*., 2021).

3. Microalgae in dairy products

Microalgae can be incorporated into dairy products, especially fermented milk, ice creams and cheeses in order to increase protein content and deliver bioactive compounds (*Behesthipour et al*., 2013). The incorporation into fermented dairy products can be done either before fermentation, directly into the milk or after fermentation into the finished product (*Hernández et al*., 2022). The approach where microalgae are added before fermentation process is preferred, since their interaction with lactic acid bacteria has a pivotal role in the product quality (*Albuquerque et al*., 2024). Yogurt was the most extensively studied fermented dairy product, in which microalgae incorporation has been shown to improve the nutritional profile, particularly by increasing the protein content (*Luwidharto et al*., 2025). *A. platensis* was most frequently used in the studies, typically at concentrations not exceeding 1% (*Barkallah et al*., 2017; *Bchir et al*., 2019;

Silva et al., 2019; *Atallah et al.*, 2020; *Khaledabad et al.*, 2020).

The addition of microalgae to yogurt can affect its functional and technological properties. Bioactive peptides formed during fermentation, together with carotenoids, chlorophylls, phycocyanin, and other pigments, as well as phenolic compounds originating from microalgae, contribute to enhanced antioxidant activity (*Albuquerque et al.*, 2024). Multiple studies (*Barkallah et al.*, 2017; *Atallah et al.*, 2020; *Khaledabad et al.*, 2020; *Mesbah et al.*, 2022; *Nazir et al.*, 2022) have reported a significant increase in antioxidant capacity when *A. platensis* is added to yogurt. However, antioxidants can change stability during processing and refrigerated storage, highlighting the need for optimized formulation strategies to preserve antioxidant potential throughout the product's shelf life (*Albuquerque et al.*, 2024). The addition of microalgae to fermented dairy products can promote the growth and survival of starter cultures and probiotic bacteria, owing to the bioavailability of trace elements, vitamins, and growth-promoting bioactive compounds (*Caporgno and Mathys*, 2018). Studies by de *Mocanu et al.* (2013), *Khaledabad et al.* (2020), and *Luwidharto et al.* (2022) demonstrated that *A. platensis* addition leads to higher viable counts of lactic acid bacteria in fermented dairy products, potentially enhancing their functional properties.

However, the development of yogurt-based product with microalgae comes with the challenges, especially regarding textural and sensory properties. Interactions between lipids from microalgae and milk can affect emulsion creation and the structure of yogurt with regard to the texture and stability of the final products (*Albuquerque et al.*, 2024). Interactions between proteins from microalgae and milk proteins should be also taken into consideration, since they can form protein complexes which affect yogurt viscosity. Microalgal fortification enhanced the viscosity of yogurt, which is attributed to protein and exopolysaccharide contents (*Bchir et al.*, 2019; *Luwidharto et al.*, 2022). However, the incorporation of microalgae into yogurt affects not only its nutritional value but also key sensory attributes, particularly flavour and colour, which strongly influence consumer acceptance. Unique aroma and taste notes could challenge acceptance in markets with a preference for traditional flavours (*Zarrin et al.*, 2014; *Silva and Pandolfi*, 2020). As such, the impact that microalgae can have on sensory properties can pose both as an opportunity for innovation and obstacle to broader market appeal.

Cheese is a highly versatile category of dairy product, encompassing a wide variety of types that differ in technological processes, sensory characteristics, physicochemical properties, etc. Most studies exploring the incorporation of microalgae have focused on soft white-brined cheeses, quark, and cheese spreads (*Garofalo et al.,* 2022). The microalgal species most commonly investigated for incorporation into cheese are *A. platensis* and *C. vulgaris*. Regarding cheese analogue composition, the addition of algae has the most profound impact on protein and fat content (*Agustini et al.*, 2016; *Darwish*, 2017; *Golkmani et al.*, 2019; *Bosnea et al.*, 2020). The antioxidant activity was also improved also by the addition of microalgae to cheese, mainly due to the higher levels of phenolic compounds, flavonoids, β-carotene, etc. (*Darwish*, 2017; *Ismail et al.*, 2023; *Lousada Falcão et al.*, 2023).

The addition of microalgae had effects on the starter culture and probiotic growth in cheese. Studies by *Mazinani et al.* (2016) and *Golkmani et al.* (2019) demonstrated that the inclusion of *A. platensis* can enhance bacterial growth and viability, even during prolonged storage. Microalgae addition can also markedly influence cheese texture, one of its most critical quality attributes. This effect is often linked to the water-binding capacity of microalgal proteins and exopolysaccharides (*Luwidharto et al.*, 2025). Reported textural changes differ by cheese type. *Golkmani et al.* (2019) observed reduced hardness in Feta-type cheese, whereas *Darwish* (2017) found increased hardness, cohesiveness, gumminess, and chewiness in Karaish cheese. In the study by *Falcão et al.* (2023), cream cheese and quark with added *C. vulgaris* showed decreased firmness and softer texture than the control. Regarding the sensory attributes, a bitter taste is one of the biggest challenges to overcome when microalgae are added (*Golkmani et al.*, 2019; *Bosnea et al.*, 2020). It was reported that the bitter taste was more pronounced with the increasing level of microalgae and increased storage time (*Golkmani et al.*, 2019).

Ice cream is a complex dairy product composed of milk, sweeteners, stabilizers, emulsifiers, flavours, and colourants (*Durmaz et al.*, 2020). Microalgae, rich in natural pigments and bioactive compounds, present a promising alternative to food colourants, which are perceived as "unhealthy", and certain stabilizing agents in ice cream formulations (Hernández et al., 2022). Among various microalgae species, *A. platensis* has been the most extensively studied for ice cream fortification (*Malik et al*., 2012; *Agustini et al*., 2016; *Balensiefer et al*., 2021). Fortified products have demonstrated compositional changes, including increased protein and fat content. Fortified ice creams also showed changes in other important parameters, such as prolonged melting time, and higher overrun due to enhanced air incorporation (*Malik et al*., 2012; *Agustini et al*., 2016). Rheological properties were also influenced; for instance, a reduction in viscosity was observed *(Agustini et al*., 2016), attributed to the lower water absorption capacity of *A. platensis* compared to conventional stabilizers (*Robertson*, 2014). The addition of microalgae had impact also on sensory properties, since excessive supplementation intensified bitterness (*Durmaz et al*., 2020).

4. Conclusion

The incorporation of microalgae into dairy products can significantly enhance their nutritional and functional properties, most notably through increased protein content, enrichment with essential fatty acids, vitamins, minerals, and a boost in antioxidant capacity. Additionally, microalgae contribute bioactive compounds, such as phycocyanin and carotenoids, which could offer health-promoting effects. However, their application also introduces technological and sensory challenges. Fortification often alters rheological characteristics and product stability, while sensory attributes can be negatively affected with the development of increased bitterness, herbaceous and marine-like aromas, which can limit consumer acceptance. These drawbacks can be mitigated through careful selection of microalgal species, optimization of cultivation and processing conditions, and adjustment of inclusion levels to balance functionality with sensory appeal. Future research should focus on species screening, microalgae pre-treatment (e.g., cell disruption, deodorization), and integration with flavour-masking strategies to develop dairy products that are both functionally enhanced and organoleptically acceptable to a broad consumer base.

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References

Agustini, T. W., Ma'ruf, W. F., Widayat, A., Suzery, M., Hadiyanto, L., & Benjakul, S. (2016). Application of *Spirulina platensis* on ice cream and soft cheese with respect to their nutritional and sensory perspectives. *Jurnal Teknologi*, 78, 245–251. https://doi.org/10.11113/jt.v78.8216

Albuquerque, R. C. V., Silva, C. E. de F., Carneiro, W. de S., Andreola, K., da Gama, B. M. V., & Silva, A. E. de. (2024). Incorporation of cyanobacteria and microalgae in yogurt: Formulation challenges and nutritional, rheological, sensory, and functional implications. *Applied Microbiology*, 4(4), 1493–1514. https://doi.org/10.3390/applmicrobiol4040103

Algabase.org, Accessed Aug 5 2025

Atallah, A., Morsy, O., & Dalia, G. (2020). Characterization of functional low-fat yogurt enriched with whey protein concentrate, Ca-caseinate and *Spirulina*. *International Journal of Food Properties*, 23, 78–91. https://doi.org/10.1080/10942912.2020.1823409

Balensiefer, C., Tiepo, V., Gottardo, F. M., Bertol, C. D., Reinehr, C. O., & Colla, L. M. (2021). Addition of *Spirulina platensis* in handmade ice cream: Physicochemical and sensory effects. *Brazilian Journal of Development*, 7, 88106–88123. https://doi.org/10.34117/bjdv7n9-121

Barkallah, M., Dammak, M., Louati, I., Hentati, F., Hadrich, B., & Mechichi, T. (2017). Effect of *Spirulina platensis* fortification on physicochemical, textural, antioxidant and sensory properties of yogurt during fermentation and storage. *LWT*, 84, 323–330. https://doi.org/10.1016/j.lwt.2017.05.071

Barros de Medeiros, V. P., da Costa, W. K. A., da Silva, R. T., Pimentel, T. C., & Magnani, M. (2022). Microalgae as source of functional ingredients in new-generation foods: Challenges, technological effects, biological activity, and regulatory issues. *Critical Reviews in Food Science and Nutrition*, 62(18), 4929–4950. https://doi.org/10.1080/10408398.2021.1879729

Bchir, B., Felfoul, I., Bouaziz, M. A., Gharred, T., Yaich, H., & Noumi, E. (2019). Investigation of physicochemical, nutritional, textural, and sensory properties of yoghurt fortified with fresh and dried *Spirulina* (*Arthrospira platensis*). *International Food Research Journal*, 26, 65–76.

Becker, E. W. (2007). Micro-algae as a source of protein. *Biotechnology Advances*, 25(2), 207–210. https://doi.org/10.1016/j.biotechadv.2006.11.002

Beheshtipour, H., Mortazavian, A. M., Mohammadi, R., Sohrabvandi, S., & Khosravi-Darani, K. (2013). Supplementation of *Spirulina platensis* and *Chlorella vulgaris* algae into probiotic fermented milks. *Comprehensive Reviews in Food Science and Food Safety*, 12(2), 144–154. https://doi.org/10.1111/1541-4337.12004

Bosnea, L., Terpou, A., Pappa, E., Kondyli, E., Mataragas, M., & Markou, G. (2020). Incorporation of *Spirulina platensis* on traditional Greek soft cheese with respect to its nutritional and sensory perspectives. *Proceedings*, 70, 99. https://doi.org/10.3390/foods_2020-07600

Caporgno, M. P., & Mathys, A. (2018). Trends in microalgae incorporation into innovative food products with potential health benefits. *Frontiers in Nutrition*, 5, 58. https://doi.org/10.3389/fnut.2018.00058

Darwish, A. M. I. (2017). Physicochemical properties, bioactive compounds and antioxidant activity of Kareish cheese fortified with *Spirulina platensis*. *World Journal of Dairy & Food Sciences*, 12, 71–78. https://doi.org/10.5829/idosi.wjdfs.2017.71.78

Durmaz, Y., Kilicli, M., Toker, O. S., Konar, N., Palabiyik, I., & Tamtürk, F. (2020). Using spray-dried microalgae in ice cream formulation as a natural colorant: Effect on physicochemical and functional properties. *Algal Research*, 47, 101811. https://doi.org/10.1016/j.algal.2020.101811

Eltanahy, E., & Torky, A. (2021). Microalgae as cell factories: Food and feed-grade high-value metabolites. In *Microalgal Biotechnology: Recent Advances, Market Potential, and Sustainability* (pp. 1–35). Royal Society of Chemistry.

Falcão, R. L., Pinheiro, V., Ribeiro, C., Sousa, I., Raymundo, A., & Nunes, M. C. (2023). Nutritional improvement of fresh cheese with microalga *Chlorella vulgaris*: Impact on composition, structure and sensory acceptance. *Food Technology and Biotechnology*, 61(2), 259–270. https://doi.org/10.17113/ftb.61.02.23.7851

Fasolin, L. H., Pereira, R. N., Pinheiro, A. C., Martins, J. T., Andrade, C. C. P., Ramos, O. L., & Vicente, A. A. (2019). Emergent food proteins—Towards sustainability, health and innovation. *Food Research International*, 125, 108586. https://doi.org/10.1016/j.foodres.2019.108586

Garofalo, C., Norici, A., Mollo, L., Osimani, A., & Aquilanti, L. (2022). Fermentation of microalgal biomass for innovative food production. *Microorganisms*, 10(10), 2069. https://doi.org/10.3390/microorganisms10102069

Golmakani, M. T., Soleimanian-Zad, S., Alavi, N., Nazari, E., & Eskandari, M. H. (2019). Effect of *Spirulina* (*Arthrospira platensis*) powder on probiotic bacteriologically acidified feta-type cheese. *Journal of Applied Phycology*, 31, 1085–1094. https://doi.org/10.1007/s10811-018-1611-2

Henchion, M., Hayes, M., Mullen, A. M., Fenelon, M., & Tiwari, B. (2017). Future protein supply and demand: Strategies and factors influencing a sustainable equilibrium. *Foods*, 6(7), 53. https://doi.org/10.3390/foods6070053

Hernández, H., Nunes, M. C., Prista, C., & Raymundo, A. (2022). Innovative and healthier dairy products through the addition of microalgae: A review. *Foods*, 11(5), 755. https://doi.org/10.3390/foods11050755

Ismail, H. A., El-Sawah, T. H., Ayyash, M., Adhikari, B., & Elkot, W. F. (2023). Functionalization of ricotta cheese with powder of *Spirulina platensis*: Physicochemical, sensory, and microbiological properties. *International Journal of Food Properties*, 26(1), 1968–1983. https://doi.org/10.1080/10942912.2023.2238916

Khaledabad, M., Ghasempour, Z., Kia, E. M., Bari, M. R., & Zarrin, R. (2020). Probiotic yoghurt functionalised with microalgae and Zedo gum: Chemical, microbiological, rheological and sensory characteristics. *International Journal of Dairy Technology*, 73, 67–75. https://doi.org/10.1111/1471-0307.12625

Lucakova, S., Branyikova, I., & Hayes, M. (2022). Microalgal proteins and bioactives for food, feed, and other applications. *Applied Sciences*, 12(9), 4402. https://doi.org/10.3390/app12094402

Lousada Falcão, R., Pinheiro, V., Ribeiro, C., Sousa, I., Raymundo, A., & Nunes, M. C. (2023). Nutritional improvement of fresh cheese with microalga *Chlorella vulgaris*: Impact on composition, structure and sensory acceptance. *Food Technology and Biotechnology*, 61(2), 259–270. https://doi.org/10.17113/ftb.61.02.23.7851

Luwidharto, J. C. N., Kurniaditya, V. H., Rizkaprilisa, W., & Bumi, S. A. P. (2025). Potential for microalgae as a superfood in fermented dairy products: A review. *Food Science and Technology Journal (Foodscitech)*, 127–140. https://doi.org/10.25139/fst.vi.9228

Luwidharto, J. C. N., Rahayu, E. S., Suroto, D. A., Wikandari, R., Ulfah, A., & Utami, T. (2022). Effects of *Spirulina platensis* addition on growth of *Lactobacillus plantarum* Dad 13 and *Streptococcus thermophilus* Dad 11 in fermented milk and physicochemical characteristics of the product. *Applied Food Biotechnology*, 9(3), 205–216. https://doi.org/10.22037/afb.v9i3.37013

Malik, P., Kempanna, C., & Paul, A. (2012). Quality characteristics of ice cream enriched with *Spirulina* powder. *International Journal of Food and Nutritional Sciences*, 2, 44–50.

Mazinani, S., Fadaei, V., & Khosravi-Darani, K. (2016). Impact of *Spirulina platensis* on physicochemical properties and viability of *Lactobacillus acidophilus* of probiotic UF feta cheese: Microalgal incorporation probiotic UF feta cheese. *Journal of Food Processing and Preservation*, 40, 1318–1324. https://doi.org/10.1111/jfpp.12717

Mesbah, E., Matar, A., & Karam-Allah, A. (2022). Functional properties of yoghurt fortified with *Spirulina platensis* and milk protein concentrate. *Journal of Food and Dairy Sciences*, 13, 1–7. https://doi.org/10.21608/jfds.2022.114135.1032

Mocanu, G. D., Botez, E., Nistor, O. V., Georgeta, D., & Vlăsceanu, G. (2013). Influence of *Spirulina platensis* biomass over some starter culture of lactic bacteria. *Journal of Agroalimentary Processes and Technologies*, 19, 474–479.

Nazir, F., Saeed, M. A., Abbas, A., Majeed, M. R., Israr, M., Zahid, H., Ilyas, M., & Nasir, M. (2022). Development, quality assessment and nutritive valorization of *Spirulina platensis* in yogurt spread. *Applied Food Biotechnology*, 5, 106–118. https://doi.org/10.30721/fsab2022.v5.i2.173

Randhir, A., Laird, D. W., Maker, G., Trengove, R., & Moheimani, N. R. (2020). Microalgae: A potential sustainable commercial source of sterols. *Algal Research*, 46, 101772. https://doi.org/10.1016/j.algal.2019.101772

Robinson, R. K. (2014). *Encyclopedia of Food Microbiology* (2nd ed., p. 3248). Academic Press.

Senila, L., Kovacs, E., & Roman, C. (2025). Chemical characterization, lipid profile, and volatile compounds in *Chlorella* sp. and *Spirulina platensis*: A promising feedstock for various applications. *Molecules*, 30(7), 1499. https://doi.org/10.3390/molecules30071499

Silva, I. S. C., & Pandolfi, M. A. C. (2020). Análise das principais tendências no mercado brasileiro de iogurtes. *Revista Interface Tecnologia*, 17, 523–534. https://doi.org/10.31510/infa.v17i2.899

Silva, S. C., Fernandes, I. P., Barros, L., Fernandes, Â., Alves, J. M., & Calhelha, R. C. (2019). Spray-dried *Spirulina platensis* as an effective ingredient to improve yogurt formulations: Testing different encapsulating solutions. *Journal of Functional Foods*, 60, 103427. https://doi.org/10.1016/j.jff.2019.103427

van Dijk, M., Morley, T., Rau, M. L., & Saghai, Y. (2021). A meta-analysis of projected global food demand and population at risk of hunger for the period 2010–2050. *Nature Food*, 2(7), 494–501. https://doi.org/10.1038/s43016-021-00322-9

Zarrin, R., Ghasempour, Z., Rezazad Bari, M., Alizadeh, M., & Moghaddas, K. E. (2014). Investigating the effects of microalgae *Spirulina platensis* and Zedo gum on probiotic yogurt. *Research, Innovation and Food Science & Technology*, 3, 197–210. https://doi.org/10.22101/JRIFST.2014.10.23.331

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