INCORPORATION OF *SPIRULINA PLATENSIS* ON TRADITIONAL GREEK SOFT CHEESE WITH RESPECT TO ITS NUTRITIONAL AND SENSORY PERSPECTIVES

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INTRODUCTION

Functional foods have raised within the industrial production era due to the increasing consumers demand for nutritious and safe foods with health benefits, particularly of natural origin. This field is growing a lot lately since bioactive natural compounds, which are parts of several natural foods, exert pharmacological effects, and therefore practically add their "functionality" to food products.

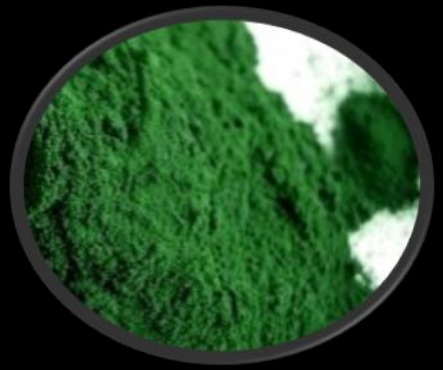
- In this context, **microalgae** have become an innovative and promising resource of nutritional supplements as they are commercially cultivated to produce valuable compounds, including
  - *protein*
  - *pigments*
  - *lipids*
  - *essential amino acids*
  - *monounsaturated and polyunsaturated fatty acids*
  - *carotenoids*
  - *vitamins*

SPIRULINA PLATENSIS

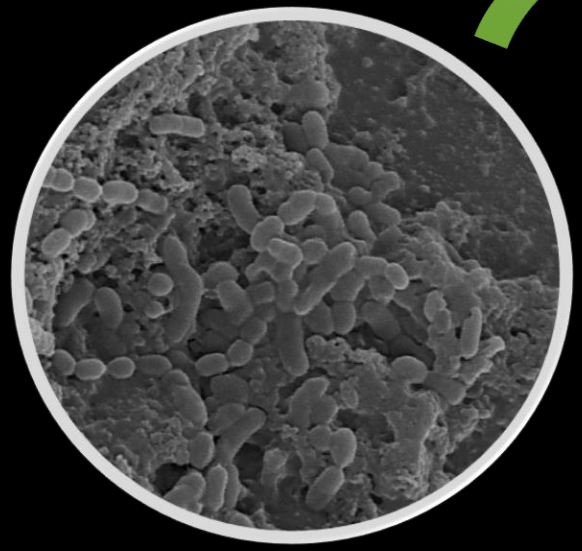
Spirulina platensis **belongs to the category of superfoods has recognized as safe (GRAS) for human consumption as it provides important properties such as:**

- ✓ ***anti-cancer,***
- ✓ ***anti-hypertensive activity,***
- ✓ ***immune system enhancement,***
- ✓ ***high content of antioxidants,***
- ✓ ***vitamins***

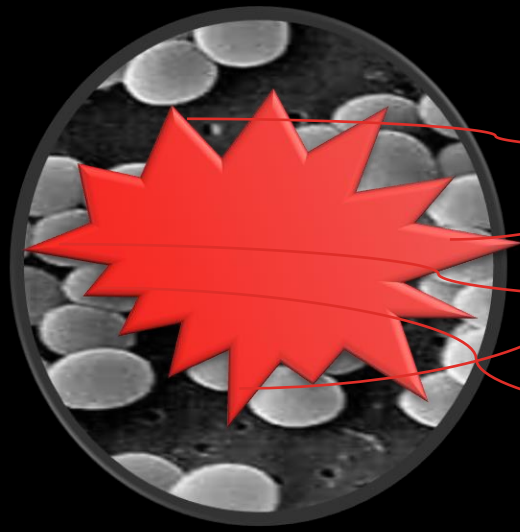
Fermentation is known to break down the polymers and release micromolecules which can be absorbed more easily by consumers. This is achieved *via* microbial metabolism and enzyme production.



Powder spirulina



Fermentation



Cell lysis

- *Pigments*
- *Bioactive peptides*
- *phenolics*
- *Free essential amino acids*
- *Antioxidants*

SPIRULINA PLATENSIS

Concerning the above the main target of the current study was to produce a novel functional Feta-type cheese with incorporated spirulina and study its effect on microflora and physicochemical properties of the produced cheeses. In addition, spirulina has been reported to enhance growth and viability of lactic acid bacteria therefore it is also expected to enforce the starter culture during Feta-type cheese production.

OBJECTIVES

The main objectives of the current study were:

- to produce a novel functional white brined cheese fortified with powdered Spirulina,
- to evaluate the effect of spirulina on the physicochemical, microbiological and sensory properties of produced Feta-type cheeses.

Incorporation of Spirulina platensis on traditional Greek soft cheese

RAW MATERIAL

Sheep Raw Milk
6% fat

Powder spirulina

Feta-type cheese production

Pasteurization of sheep milk (63°C/30min)

Standardization of milk to 6% fat, heating at 37°C/1h

Add and mix starter culture (0.02 g kg^{-1}) in milk;
Coagulation for approx. 30min

Add 0.02ml kg^{-1} of rennet enzyme and 0.02ml kg^{-1} of $CaCl_2$ (40% w/v)
Coagulation for approx. 30min

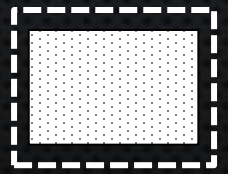
Invert curd every 30 min (whey drain)

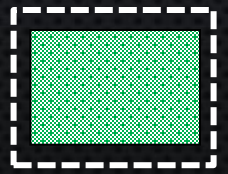
cheese curd was cut into small pieces (cubes of 2 cm side)

Curd transferred into 2 rectangular molds

In one of the molds powdered spirulina (0.25%) was spread

Cheese storage for maturation





Spirulina powder

Addition of *Spirulina platensis* powder
&
mix

Cheese quality assurance

- ✓ *Microbiological evaluation*
- ✓ *Physicochemical evaluation*
- ✓ *Sensory evaluation*

RESULTS

Table 1. Chemical composition of cheese during maturation for 60 days.

Cheese type	Days of storage	Moisture (%)	Salt
Control (Feta)	1	64.45	3.69
	15	63.29	2.8
	60	62.27	2.46
Spirulina 0.25%	1	62.71	3.25
	15	62.47	2.56
	60	59.33	2.22

RESULTS

Table 2. Microbiological profile of Feta-type cheese during maturation and storage at 4°C.

Cheese	Days	Mesophilic lactobacilli	Mesophilic lactococci	Staphylococci	Total coliforms	Total enterobacteria	Molds and yeasts
Feta	1	9.00	9.98	0.00	3.42	3.45	0.00
	15	6.70	8.08	0.00	2.66	2.71	1.70
	30	4.60	7.40	1.00	1.30	1.60	3.34
	60	4.48	7.81	0.00	0.00	0.00	2.34
Feta with Spirulina 0.25%	1	9.65	9.86	1.30	1.78	2.36	0.00
	15	6.28	8.85	1.30	1.48	1.60	2.81
	30	5.11	8.69	0.00	0.00	0.00	4.18
	60	4.85	8.61	0.00	0.00	0.00	2.08

SENSORY EVALUATION

Spirulina is a blue-green filamentous prokaryotic cyanobacterium known for its algae-like odor [4]. In the present study, odor of incorporated spirulina in feta type cheese samples was characterized as insignificant by evaluators. This results probably came as an outcome of fermentation and Feta cheese volatile by-products which eliminated the algae odor of spirulina. Incorporation of spirulina affected the color and mouthfeel of produced cheeses. Moreover, the green color of the novel spirulina-enriched Feta-type cheese was positively grated by evaluators. Finally, all cheese samples received high scores of preferences and were characterized as acceptable for consumption by the expert's evaluation panel.

CONCLUSION

Spirulina platensis is one of the most nutritious microalgae. The bioactive peptides deriving from Spirulina may posse antibacterial, antihypertensive, antitumor, antiallergic, and immune modulation properties while its protein content can reach up to 70%. Fermentation generally breaks down the polymers into micro-molecules through microbial metabolism and enzyme production promoting nutrient availability and functional value of spirulina. As a result, spirulina can be successfully applied as functional fortification supplement in dairy products.

In the present study the moisture, salt, microbiological stability, and consumers acceptance were tested after the production of cheese containing powder spirulina (0.25%) and compared with traditional Feta cheese used as control. The novel cheese achieved exceptional organoleptic, physicochemical, and microbiological characteristics. As a result, **spirulina has great industrialization potential as an additive in Feta-type cheese while enhancing products nutritional value in parallel**

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