The Potential of Spirulina in the Production of Food Products with Functional Properties

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55–70%
protein in spirulina dry biomass

3
food matrices: labneh, bread and yogurt

57%
antioxidant activity in labneh with 1% spirulina (control: 12%)

16.1%
protein in bread with 8% spirulina (control: 11.2%)

Introduction

Functional foods provide bioactive compounds with beneficial physiological effects beyond basic nutrition, such as polyphenols, carotenoids, fibre and probiotics.

Spirulina (Arthrospira platensis, A. maxima) is a cyanobacterium with ~55–70% protein in dry biomass, plus phycocyanin, carotenoids and phenolics that give it antioxidant capacity.

Aim
To review spirulina in fermented dairy and bakery products: nutritional, antioxidant and technological effects.

Materials and methods

Probiotic labneh

0.2 · 0.4 · 0.7 · 1% spirulina + control

Protein (Kjeldahl) · antioxidant activity (DPPH) · pH · titratable acidity · lactic acid bacteria · sensory

Fortified bread

2 · 4 · 6 · 8% spirulina + control

Powder added to flour before kneading. Protein (Kjeldahl) · antioxidants (spectrophotometry) · iron (atomic absorption) · technological and sensory traits

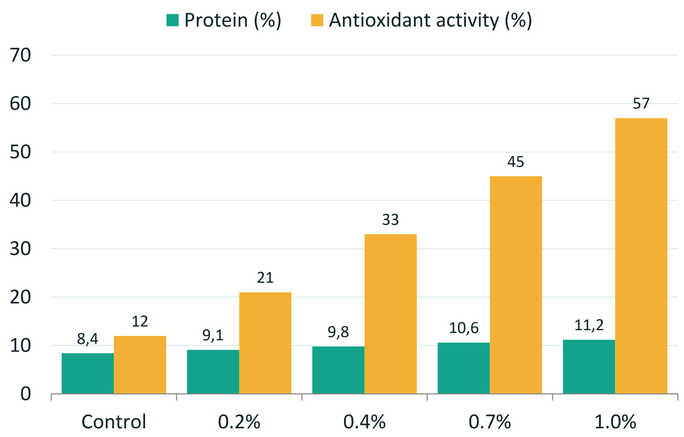
Probiotic yogurt

0.25 · 0.5 · 0.75 · 1% spirulina + control

Antioxidant activity (DPPH + UV) · viable lactic acid bacteria · viscosity (Brookfield viscometer)

Analysis of results reported in published studies on spirulina-enriched foods.

Probiotic labneh

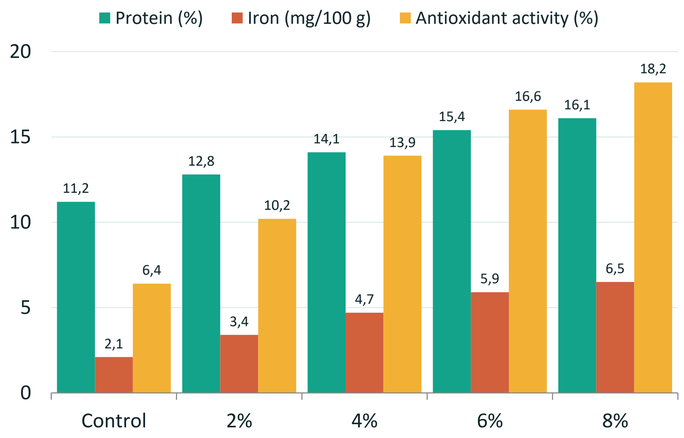


4.62 → 4.47
pH, control → 1% spirulina

8.4 → 11.2%
protein, control → 1%

Concentration-dependent gains; the lower pH reflects a more intense fermentation and favourable lactic acid bacteria development.

Fortified bread

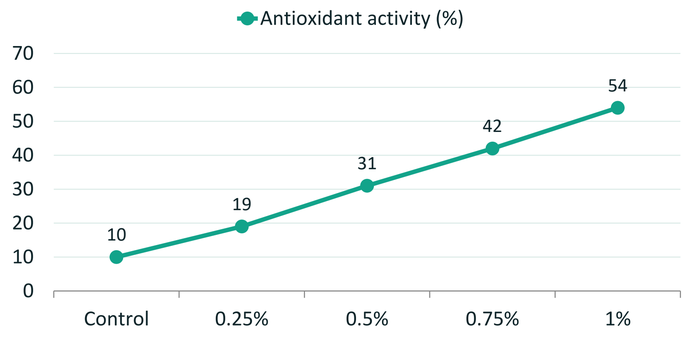


2.1 → 6.5
iron (mg/100 g), control → 8%

6.4 → 18.2%
antioxidant activity → 8%

High concentrations may adversely affect the technological and sensory characteristics of the bread.

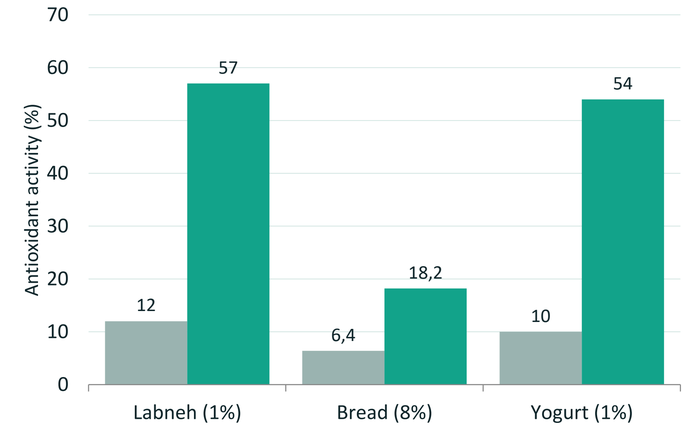
Probiotic yogurt



6.1 → 7.6
lactic acid bacteria (log CFU/g)

1540 → 1890
viscosity, control → 1%

Across matrices



Finding the balance

High doses may impair colour, taste and consumer acceptability. The dose must balance four factors:

- **Nutrition**
- **Function**
- **Technology**
- **Sensory quality**

Conclusions

1. Spirulina increased protein content and antioxidant activity in a concentration-dependent manner in labneh, bread and yogurt.
2. In fermented dairy products it also raised lactic acid bacteria counts (yogurt: 6.1 → 7.6 log CFU/g) and improved viscosity.
3. In bread, 8% spirulina lifted protein from 11.2 to 16.1% and iron from 2.1 to 6.5 mg/100 g.
4. Elevated doses may impair colour, taste and acceptability, so the supplementation level must be optimized.

Take-home message
Spirulina is a promising ingredient for value-added functional foods, provided the dose balances nutrition, function and sensory quality.

Selected references: Barkallah M. et al., 2017, LWT 84 · Saharan V., Jood S., 2017, Int. J. Agric. Sci. 7(3) · Belay A., 2007, Spirulina in Human Nutrition and Health · Martirosyan D.M., Singh J., 2015 · Hasler C.M., 2002 · Arai S., 1996.