

Pasta enriched with fresh microbial biomass : effect on techno-functional, nutritional and organoleptic qualities

Jeanne Verhaegen^{1*}, Mathieu De Rijdt¹, Eric Haubruge¹, Dorothée Goffin¹

¹Laboratory of Gastronomic Sciences, Gembloux Agro-Bio Tech, University of Liege, Belgium

Fresh biomass rather than dried in food products?

INTRODUCTION

Reducing animal protein consumption benefits the environment, resource efficiency and biodiversity. Spirulina, rich in protein, vitamins, minerals and antioxidants, is a promising alternative. Due to its off-flavours, dried spirulina is used sparingly in food. This study examines **fresh spirulina biomass** compared to dried spirulina biomass, using pasta as a model due to its popularity and ability to be enriched.



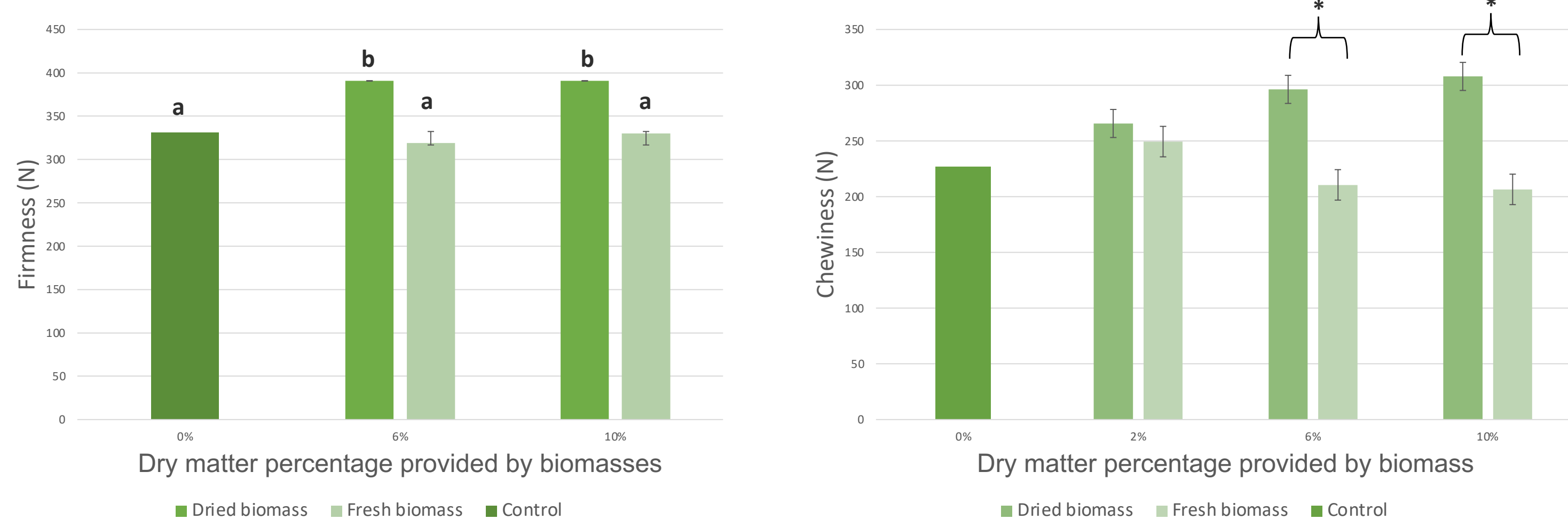
METHODS

Dry matter content in pasta is fixed at **33%**. Formulations vary according to the **quantity and form of biomass**. Analyses included: moisture preservation (dry matter, water activity, weight increase, cooking loss); Texture profile analysis (firmness, chewiness); colour; aroma analysis (organic volatile compounds).

RESULTS

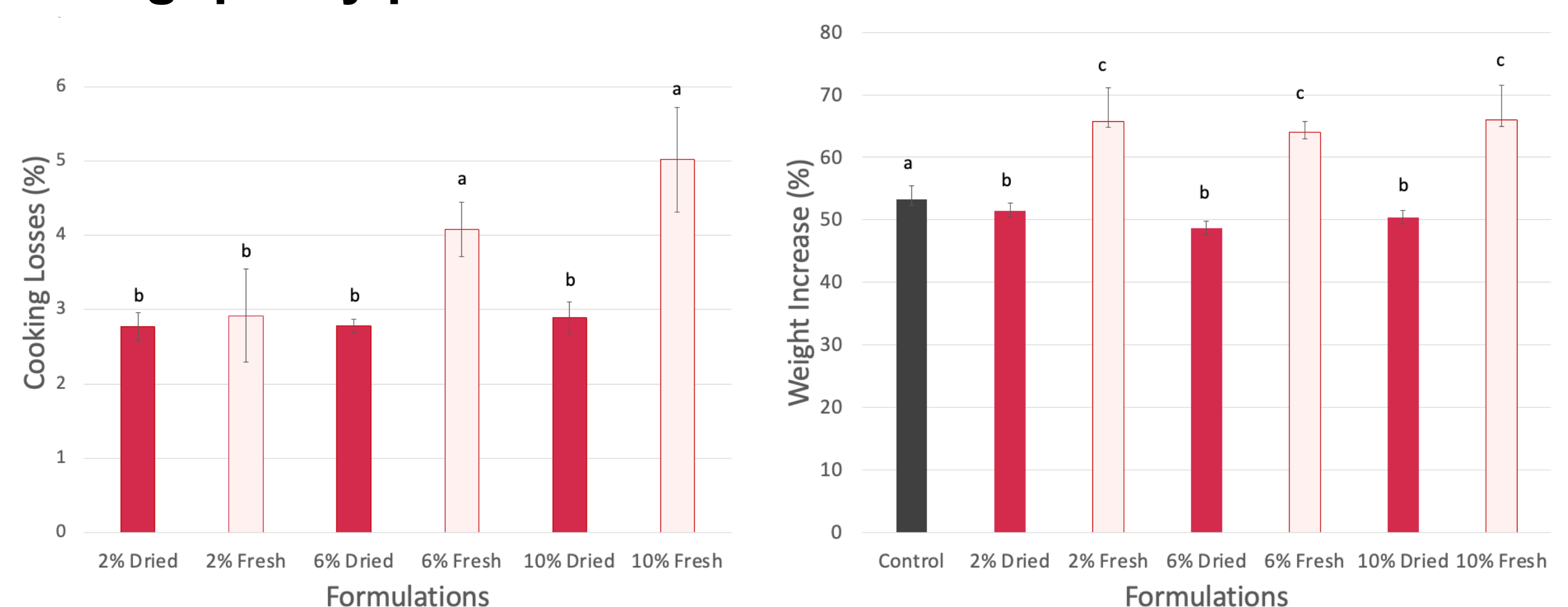
Texture Analysis Profiling

- Dried biomass increases firmness; fresh biomass doesn't affect it.
- Chewiness of control pasta is comparable to fresh biomass pasta and significantly different to dried biomass pasta.



Pasta's firmness (left) and pasta's chewiness (right) of the formulations
Different letters indicate significant differences; * indicate significantly different

Cooking quality parameters



Cooking Losses (left) and Weight Increase (right) across different pasta formulations
Means followed by different letters are significantly different

- Fresh biomass leads to an increase in pasta weight but does not increase proportionally to the amount of biomass incorporated.
- In contrast, cooking losses increase with the proportion of fresh biomass incorporated.

Volatile organic compounds in biomasses

(Expressed in relative proportions)

CHEMICAL GROUP	COMPOUND NAME	DRIED BIOMASS	FRESH BIOMASS	AROMA
Alcohols	heptan-1-ol	1	0	Chemical, green
	hexan-1-ol	5	0	Resin, flower, green
	oct-1-en-3-ol	3	0	Earthy, green, fungal, fatty
	1-methyl-4-propan-2-ylcyclohex-3-en-1-ol	1	0	Must
	(Z)-oct-2-en-1-ol	1	0	Soap, plastic
	2,6-dimethylcyclohexan-1-ol	12	0	peppermint-like
Aldehydes	(E)-2-ethylhex-2-enal	1	0	
	benzaldehyde	2	0	Almond, burnt sugar
	hexanal	3	0	Grass, tallow, fat
	heptadecane	30	61	
Alkanes	hexadecane	3	9	Odorless
	pentadecane	4	13	Odorless
	(E)-heptadec-3-ene	1	3	Odorless
	S-methyl ethanethioate	0	1	
Carboxylic Acids	2-pentylfuran	4	0	Green bean, butter
	heptan-2-one	1	0	Soap
Ketones	butane-2,3-dione	0	12	Butter
	(7aR)-4,4,7a-trimethyl-6,7-dihydro-5H-1-benzofuran-2-one	3	0	Sweet, fruity, woody
	3-hydroxybutan-2-one	0	1	Butter, cream
	6-methylhept-5-en-2-one	2	0	Sweet, green
	2,2,6-trimethylcyclohexan-1-one	2	0	Characteristic of cyanobacteria
	Pyrazines	2,3-dimethylpyrazine	1	0
2,3,5,6-tetramethylpyrazine		1	0	Cocoa, roasted nutty
2,3,5-trimethylpyrazine		2	0	Cocoa, roasted nutty
Terpenes	β-Cyclocitral	3	0	Fruits, vegetables, plants
	β-ionone	11	0	Woody, floral, alkali
	Safranal	1	0	Fresh herbal, spicy

Fresh biomass: Few compounds (6), biomass more neutral and likely more accepted by consumers.

Dried biomass: Many compounds (24), specific aromas formed during drying may negatively impact product acceptance.

CONCLUSIONS AND PERSPECTIVES

- By incorporating fresh biomass, **protein** content of pasta can be multiplied by 2: 7g of protein/100g in control pasta and 14g of protein/100g in "Formulation 10% Fresh". According to the volatile organic compound results, dried biomass could not provide these levels. Its numerous compounds and off-flavours may not be accepted by consumers. A **sensory analysis** should be carried out to confirm these findings.
- The use of biomass in any form and quantity demonstrated positive results for water activity. Fresh biomass does not affect texture unlike dried biomass. Fresh biomass colours significantly more the water and leads to higher cooking losses. An assessment of what is **released during cooking** for both forms of biomass will be conducted.

*supplied by Etika Spirulina (France)

