Improving the Nutritional Profile of Pasta Using Grass Pea (*Lathyrus sativus* L.) and Common Bean (*Phaseolus vulgaris* L.)

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INTRODUCTION

Durum wheat (*Triticum turgidum* ssp. *durum*) is considered the most suitable raw material for pasta production, due to its greater hardness compared to common wheat (*Triticum aestivum*) and its distinctive yellow endosperm.

On the other hand, legume crops have played a central role in agri-food systems, not only for their nutritional value but also for the ecosystem services they provide. These include improving soil fertility, supporting biodiversity and fostering environmental sustainability. 'Fava Feneou' (*Lathyrus sativus*) and 'Fasolia Vanilies Feneou' (*Phaseolus vulgaris*) are locally cultivated legumes in the Feneos Valley (Greece), valued for their nutritional content and their role in preserving traditional agricultural practices adapted to the valley's soil and climatic conditions.

Incorporating legumes into pasta ingredients represents an opportunity for both legume producers and consumers seeking new and healthy alternatives. The present research focus on the technological challenges of such incorporation for the pasta processing, the nutritional profiling, as well as the quality evaluation of the proposed prototypes.

MATERIALS AND METHODS

- 'Fava Feneou' – grass pea (*Lathyrus sativus* L.) (GP), 'Fasolia Vanilies Feneou' – navy bean, (*Phaseolus vulgaris* L.) (WB), and Durum wheat semolina (S).

- Development of dry pasta prototypes incorporating GP and WB flour.
- Determination of Soluble polyphenols content (SPC) and Condensed tannin content (CTC) through colorimetric assays in raw materials, roasted WB and final pasta prototypes.
- Determination of nutritional composition (proteins, dietary fibre, fats and total carbohydrates).
- Texture profile analysis
- Pasta cooking quality and colour evaluation.
- Sensory evaluation

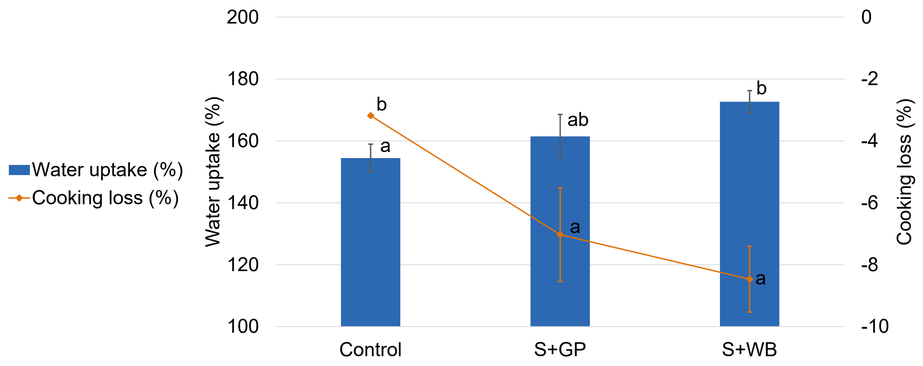
RESULTS AND DISCUSSION

Nutritional composition of 100 g of pasta prototypes (dry pasta): Control (100% semolina), (B) S+GP (50% semolina with 50 % grass pea flour), (C) S+WB (50% semolina with 50% white bean flour).

Per 100 g	Control	S+GP	S+WB
Energy (kcal)	343	338	338
Total Fat (g)	1.60	1.00	1.80
Saturated Fat (g)	0.30	0.21	0.30
Total Carbohydrate (g)	70.50	65.60	67.00
Dietary Fibre (g)	3.70	5.90	11.00
Protein (g)	13.5	19.5	18.9
Increase with respect to the control in:			
Dietary fibre (%)	-	59.45	197.30
Protein (%)	-	44.44	40.0

Nutritional profile: both prototypes qualified for a 'high in protein' claim. Additionally, the S+WB pasta's dietary fibre content enabled it to also carry a 'high in fibre' claim.

Cooking quality evaluation:



Mean values of triplicates. Error bars indicate the SD. Bar values with no letters in common are significantly ($p \leq 0.05$) different from each other.

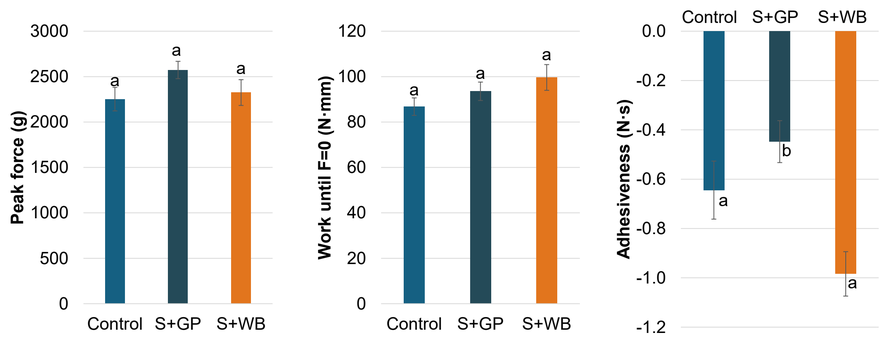
Potential adverse effects on pasta texture can be inferred from the observed increase in water uptake and cooking loss, such as a tendency toward greater stickiness, either due to overhydration or through starch leaching into the cooking water.

Pasta colour: changes may be attributed to the higher ash content and polyphenol levels introduced by the addition of legume flours. The development of Maillard reactions during the drying process may contribute to reduced brightness and increased redness in the pasta.

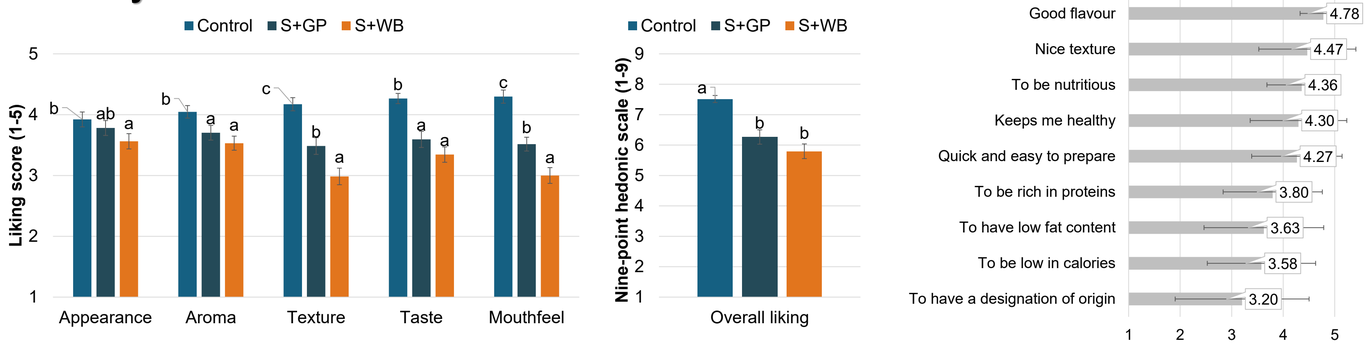
	Uncooked pasta		Cooked pasta	
Sample	S+GP	S+WB	S+GP	S+WB
ΔL*	-0.45	-4.51	-2.80	-3.14
Δa*	1.60	1.69	3.37	4.04
Δb*	-4.54	-8.48	-7.77	-10.02
*ΔE**	4.83	9.75	8.92	11.25

Appearance of cooked pasta: A) Control B) S+GP C) S+WB

Texture profile analysis: peak force (resistant to compression) and work for the first bite are not strongly affected by incorporation of legume flours. However, S+WB pasta shows the highest adhesiveness, possibly due to the higher fibre and water uptake.



Sensory evaluation:



Mean preference scores for 15–20 g samples of cooked pasta served with a spoon of tomato sauce. Error bars indicate the SEM. Different letters above the bars indicate significant differences ($p < 0.05$). Comparisons done by Friedman test.

Mean differences for the importance given by consumers in a food product. Error bars indicate the SD. Scale: 1: Nothing important 5: Very important.

CONCLUSIONS

- There is potential to develop nutritionally enhanced pasta products, and to help small-scale agricultural organizations like Dykotylon.
- Technological adaptations are essential when incorporating legume flours.
- Sensory evaluation results for S+GP pasta were more favourable than for S+WB pasta, especially in terms of texture and mouthfeel.

FUTURE PERSPECTIVES

- ✓ Texture optimization: further trials should explore the use of hot extrusion technology to improve texture, as this is one of the sensory attributes for consumer acceptance that still need improvement in the prototypes.
- ✓ Protein digestibility assessment: in the final pasta products and compared with the raw materials, to better understand nutritional improvements or losses during processing.

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