PHYSICAL AND CHEMICAL ANALYSIS OF GLUTEN-FREE PASTA ENRICHED WITH PUMPKIN-, FLAX- AND GRAPESEED FLOUR

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Objective

With the development of medical science, intolerance to food has developed, thus the recognition of diseases related to the digestion of gluten, along with the need for a gluten-free diet.

By using a gluten-free diet, due to the omission of gluten, nutrient deficiencies may occur in the body. Furthermore, must be solved the ensuring the cohesive, texture-improving, and stabilizing properties of gluten-free products, as well as good moisture retention.

The objective of our work was to analyze the rheology, color properties, and TPC of gluten free pasta enriched with pumpkin-, flax- and grapeseed flour.

Materials and Methods

Rheology: Cutting

- SMS TA-XTplus precision penetrometer
- Raw dough and boiled pasta
- AACC 66-50.01 measuring standard (but noodle and HDP/BSK head)
- 12 repeats on 23±1°C measuring temperature
- Determined: cutting force and cutting work

Color

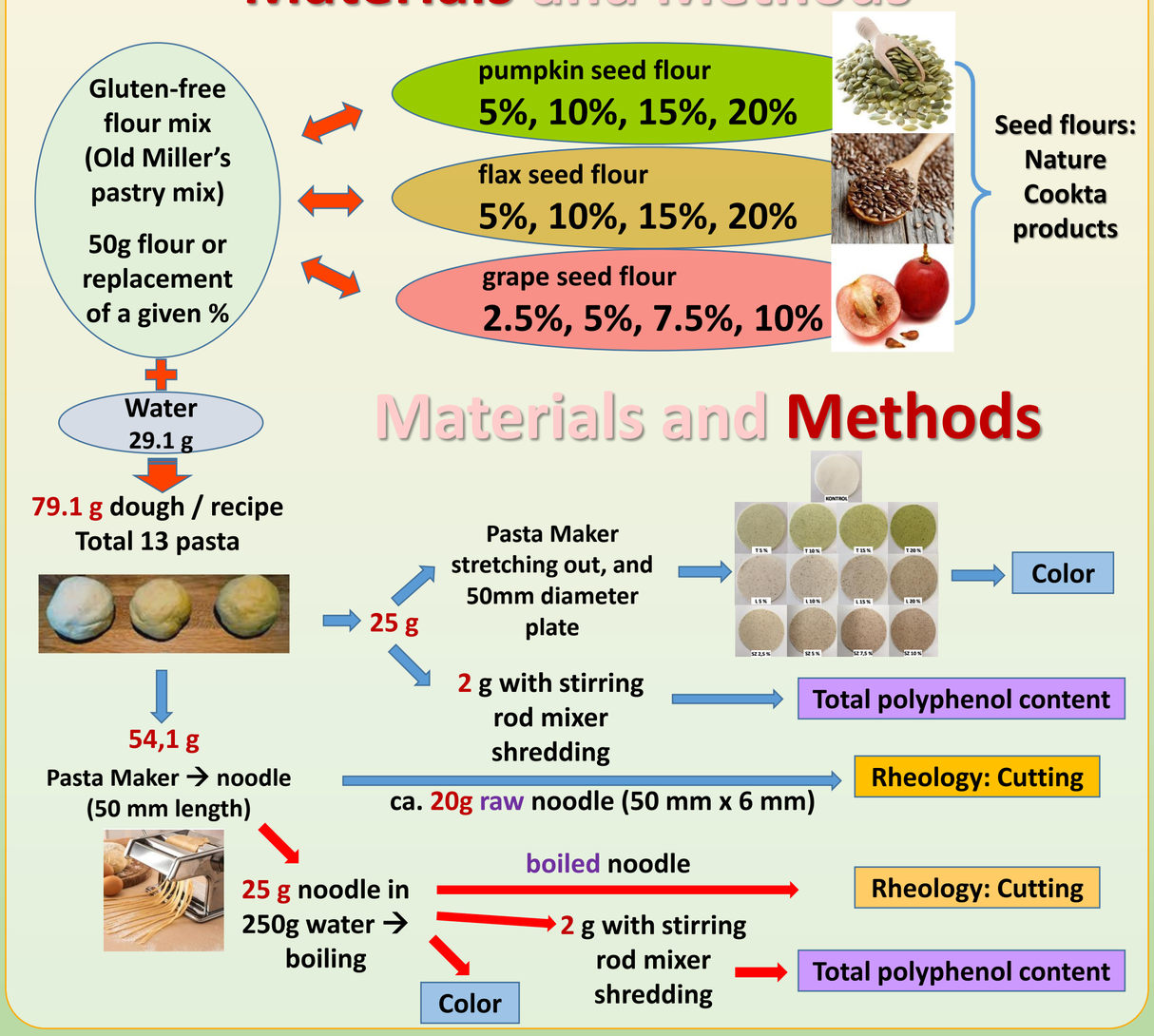
- ColorLite sph 850 spectrometer
- L* a* b* parameters
- Raw dough, boiled pasta and boiling water
- 3 repeats on 23±1°C measuring temperature

Total polyphenol content

During
- the preliminary test the 3 type seed flour
- the tests
  - the raw dough samples
  - the boiled pasta samples and
  - the boiling water
  - Singleton and Rossi (1965) method Folin-Ciocalteu reagent by spectrophotometer (760 nm)
- With alcoholic extraction
- 2x3 repeats

Statistics: reheology and TPC results with one-way ANOVA ($p < 0.05$); Tukey HSD post-hoc test by IBM SPSS 27 software, color results by Past-4.03 for Windows

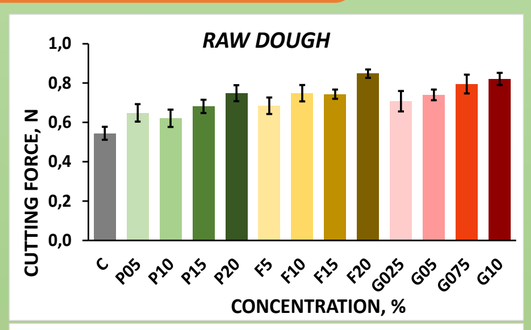
Materials and Methods



Results

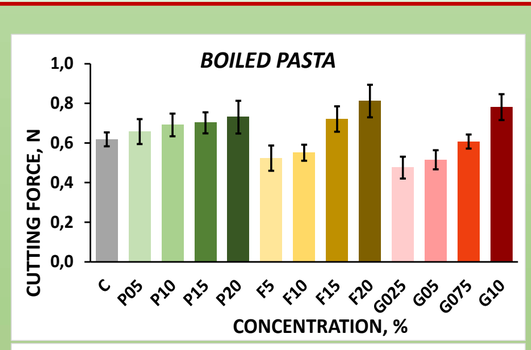
Rheology

Cutting force



ANOVA – Raw dough – ($p < 0.05$)

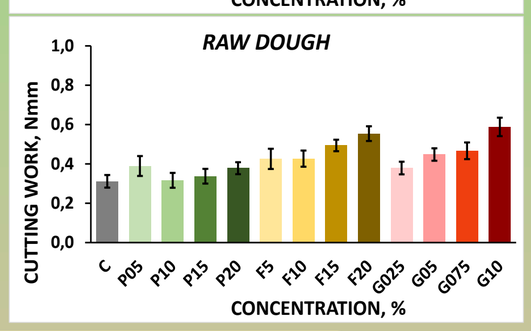
	C	P05	P10	P15	P20	F5	F10	F15	F20	G025	G05	G075	G10
C													
P05	+												
P10	+	-											
P15	+	-	-										
P20	+	+	+	-									
F5	+	-	-	-	-								
F10	+	+	+	-	-	-							
F15	+	+	-	-	-	-	-						
F20	+	+	+	+	+	+	+	+					
G025	+	+	-	-	-	-	-	-	-				
G05	+	+	-	-	-	-	-	-	+	-			
G075	+	+	+	-	-	+	-	-	+	-	+		
G10	+	+	+	+	-	+	+	+	+	+	-	+	



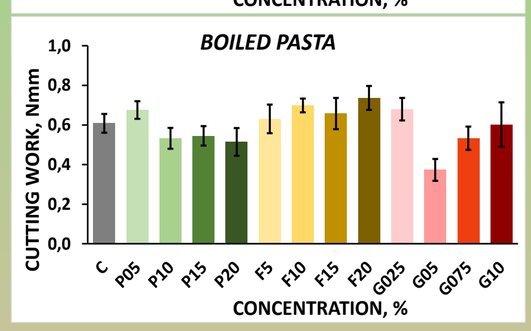
ANOVA – Boiled pasta – ($p < 0.05$)

	C	P05	P10	P15	P20	F5	F10	F15	F20	G025	G05	G075	G10
C													
P05	-												
P10	-	-											
P15	+	-	-										
P20	+	-	-	-									
F5	+	+	+	+	+								
F10	-	+	+	+	+	-							
F15	+	-	-	-	-	+	+						
F20	+	+	+	+	-	+	+	+					
G025	+	+	+	+	+	-	-	+	+				
G05	+	+	+	+	+	-	-	+	+	-			
G075	-	-	+	+	+	+	-	+	+	+	+		
G10	+	+	+	-	-	+	+	-	-	+	+	+	

Cutting work

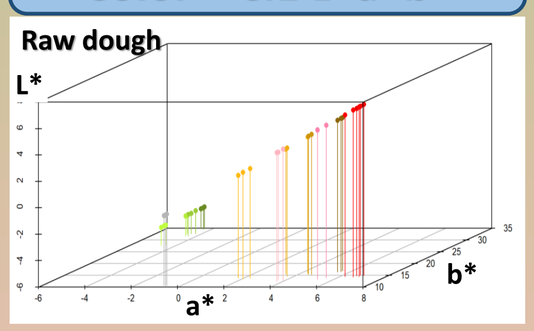


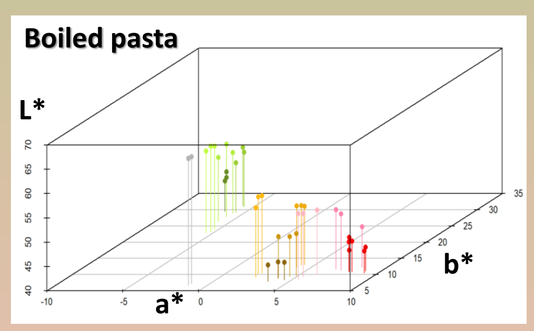
	C	P05	P10	P15	P20	F5	F10	F15	F20	G025	G05	G075	G10
C													
P05	+												
P10	-	+											
P15	-	-	-										
P20	-	-	-	-									
F5	+	-	+	+	-								
F10	+	-	+	+	-	-							
F15	+	+	+	+	+	-	-						
F20	+	+	+	+	+	+	+	-					
G025	-	-	-	-	-	-	-	-	+				
G05	+	-	+	+	-	-	+	-	+	+			
G075	+	-	+	+	-	-	-	-	+	+	-		
G10	+	+	+	+	+	+	+	+	-	+	+	+	

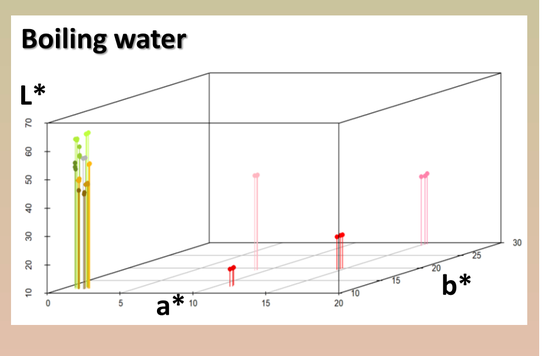


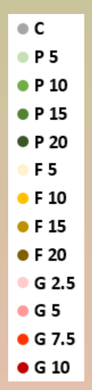
	C	P05	P10	P15	P20	F5	F10	F15	F20	G025	G05	G075	G10
C													
P05	-												
P10	-	+											
P15	-	+	-										
P20	-	+	-										
F5	-	-	-		-								
F10	-	-	+	+	+	-							
F15	-	-	-	+	+	-	-						
F20	+	-	+	+	+	-	-	-					
G025	-	-	+	+	+	-	-	-	-				
G05	-	+	+	+	+	-	+	+	+	+			
G075	+	+	+	-	-	-	+	+	+	+	+		
G10	-	-	-	-	-	-	-	-	-	-	+	-	

Color – CIE L*a*b*

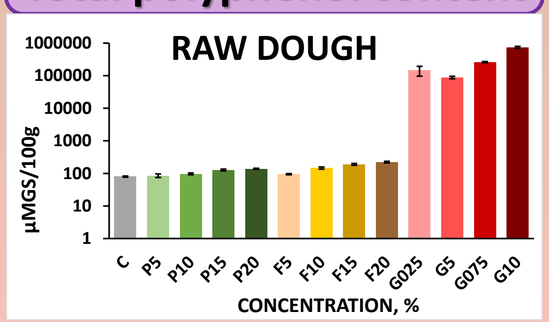


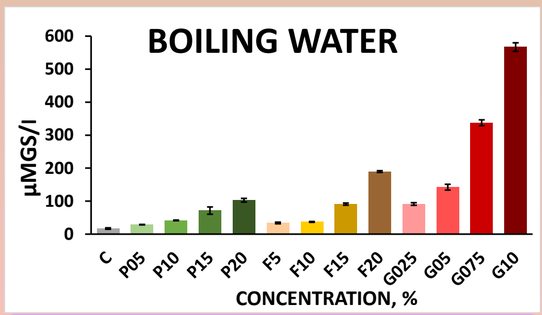


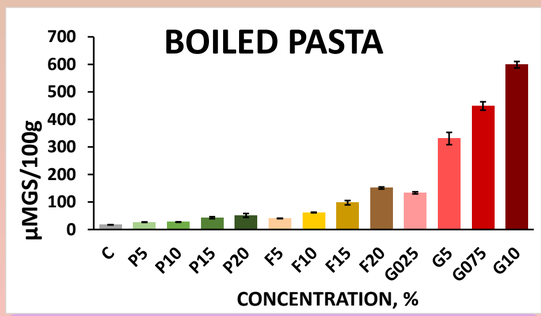




Total polyphenol content







ANOVA – Raw dough – ($p < 0.05$)

	C	P05	P10	P15	P20	F5	F10	F15	F20	G025	G05	G075	G10
C													
P05	+												
P10	+	+											
P15	+	+	+										
P20	+	+	+	+									
F5	+	+	+	+	+								
F10	+	+	+	+	+	+							
F15	+	+	+	+	+	+	+						
F20	+	+	+	+	+	+	+	+					
G025	-	-	-	+	+	-	-	+	+				
G05	+	-	+	+	+	+	+	+	+	+			
G075	+	-	+	+	+	+	+	+	+	+	+		
G10	+	+	+	+	+	+	+	+	+	+	+	+	

ANOVA – Boiling water – ($p < 0.05$)

	C	P05	P10	P15	P20	F5	F10	F15	F20	G025	G05	G075	G10
C													
P05	+												
P10	+	-											
P15	+	+	+										
P20	+	+	+	-									
F5	+	-	-	+	+								
F10	+	+	+	+	+	+							
F15	-	+	+	+	+	+	+						
F20	+	-	-	+	+	+	+	+					
G025	+	-	+	+	+	+	+	+	+				
G05	+	+	+	+	+	+	+	+	+	+			
G075	+	+	+	+	+	+	+	+	+	+	+		
G10	+	+	+	+	+	+	+	+	+	+	+	+	

ANOVA – Boiling pasta – ($p < 0.05$)

	C	P05	P10	P15	P20	F5	F10	F15	F20	G025	G05	G075	G10
C													
P05	-												
P10	+	+											
P15	-	-	+										
P20	-	-	+	-									
F5	+	+	+	+	+								
F10	+	+	+	+	+	+							
F15	-	-	+	+	-	+	+						
F20	+	+	+	+	+	+	+	+					
G025	+	+	+	+	+	+	+	+	+				
G05	+	+	+	+	+	+	+	+	+	+			
G075	+	+	+	+	+	+	+	+	+	+	+		
G10	+	+	+	+	+	+	+	+	+	+	+	+	

Conclusion

Color: doughs enriched with linseed flour have the best color retention ability.

Total polyphenol content: Total polyphenol content: pasta enriched with grape seed flour is the richest in polyphenolic components, but most polyphenolic compounds were removed / degraded from these pasta. The amount of loss was the lowest for pasta enriched with flaxseed flour.

Cutting: based on its parameters, the cutting force and cutting work increased proportionally with the increasing concentration of the raw doughs, the results were affected by the uneven heat distribution during cooking, based on the measured parameters, the flaxseed flour doughs with different concentrations were best separated from each other.

OVERALL: Based on the total polyphenol content and the favorable physical measurement results, the pasta enriched with flaxseed flour proved to be the most suitable.