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3D Food Printing: effect of apricot pulp concentration on texture analysis profile and image analysis in a gel cylinder.

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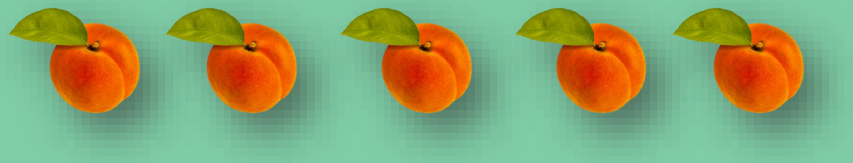
MDPI

foods

Introduction

The World Health Organization (WHO), it is recommended to consume at least **400 g per day** of fruits and vegetables for a healthy diet, but this average consumption is **only two-thirds** of the minimum recommended amounts of fruits and vegetables



- Vitamins
- Antioxidants
- Sugars
- Minerals
- Bioactive compounds

Protects against **CHRONIC DISEASES**

3D FOOD PRINTER

3D Printer

Advantages

- Customization products
- Different shapes
- Use alternative sources
- Reduction of food waste

Disadvantages

Not all foods can be extruded raw

Solution

Addition other materials as hydrocolloids

01
Objectives

Evaluate the effect of apricot pulp content on the printability and stability of bovine gelatin gels

02

Methodology

Methodology

Samples

5% Bovine Gelatin
+
- 30% apricot pulp
- 50% apricot pulp
- 70% apricot pulp

Analysis

- ˚Brix and pH
- Image Analysis
- Texture Profile Analysis

Shape Design

Cylinder

- 3 cm diameter
- 1 cm height

3D Printer

Nozzle diameter: 1.63 mm
Nozzle speed: 20 mm/s
Layer height: 1.63 mm
Infill: 100% rectilinear

03
Results and Discussion

° Brix and pH

Apricot Pulp

Brix: 10.68 ± 0.09

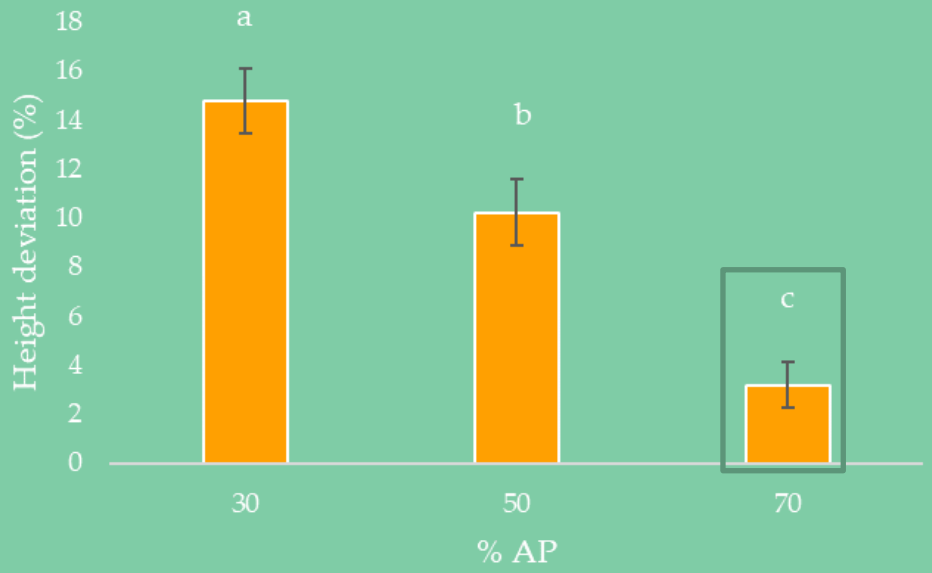
pH: 3.60 ± 0.02

Table 1. Mean values (and standard deviations) of °Brix and pH of apricot gel.

Sample	° Brix	pH
AG30%	$8.7 \pm (0.2)^{c}$	$4.457 \pm (0.006)^{a}$
AG50%	$11.4 \pm (0.3)^{b}$	$4.21\ (0.02)^{b}$
AG70%	$14.5 \pm (0.3)^{a}$	$4.013 \pm (0.006)^{c}$

* The letters (a-c= in columns indicate the homogeneous groups according to ANOVA ($p < 0.05$). (AP, apricot pulp; AG30%, apricot gel with 30% of apricot pulp; AG50%, apricot gel with 50% of apricot pulp; AG70%, apricot gel with 70% of apricot pulp).

Image Analysis



AG70% lower height deviation

Higher shape stability

Higher definition of the printing lines

Figure 1. Deviations of the height parameter of the samples

Image Analysis

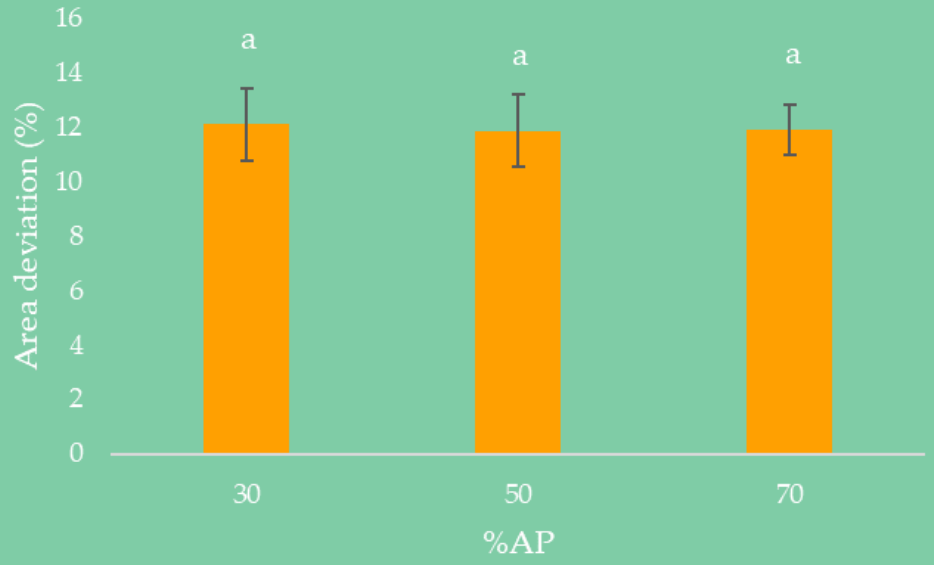
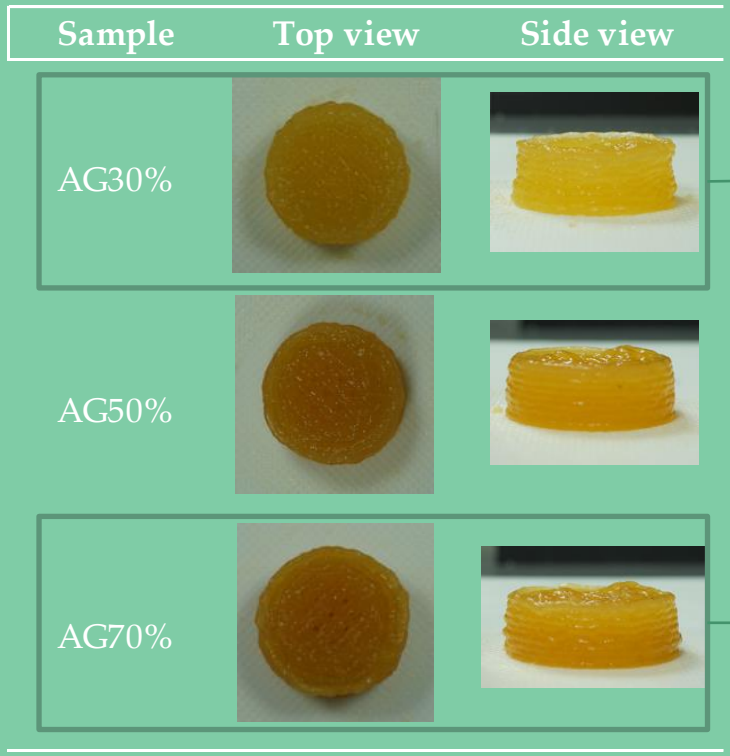


Figure 2. Deviations of the area parameter of the samples

No significant differences
($p < 0.05$)

Deviation of around 12%

Image Analysis



Less stable figure, low definition of print lines

Higher definition of the printing lines

Figure 3. 3D printed samples top and side view just after printing

Texture Profile Analysis

Table 2. TPA test parameters.

Sample	H (N)	A (N·s)	C	S	G (N)	R
AG30%	1.04 ± 0.09^{c}	-0.45 ± 0.07^{a}	0.78 ± 0.02^{a}	0.878 ± 0.015^{b}	0.83 ± 0.06^{b}	0.46 ± 0.03^{a}
AG50%	1.39 ± 0.16^{b}	-0.3876 ± 0.1016^{a}	0.758 ± 0018^{ba}	0.91 ± 0.03^{a}	1.06 ± 0.14^{a}	0.442 ± 0.016^{a}
AG70%	1.73 ± 0.15^{a}	-0.71 ± 0.16^{b}	0.74 ± 0.06^{b}	0.88 ± 0.02^{b}	1.2 ± 0.2^{a}	0.37 ± 0.03^{b}

* The letters (a-c= in columns indicate the homogeneous groups according to ANOVA ($p < 0.05$). (H, hardness; A, adhesiveness; C, cohesiveness; S, springiness; G, gummies; R, resilience; AG30%, apricot gel with 30% of apricot pulp; AG50%, apricot gel with 50% of apricot pulp; AG70%, apricot gel with 70% of apricot pulp).

- AG70% needs the highest force to be deformed
- AG50% presented a higher elasticity with respect to the rest.
- AG70% and AG50% are the samples with the highest gumminess

Increasing the AP content in the gels helps to maintain a better structure of the printed sample.

04

Conclusions

- As the pulp concentration in the gels increased, the ˚Brix and pH were **similar to the apricot pulp values**.
- The samples with the least deviations concerning height were the **AG70%** samples, the ones with the best structural stability.
- The **higher the concentration of apricot pulp** in the gelatin gels, the greater the increase in soluble solids content and therefore the greater the structural stability and firmness of the sample.

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Thanks!

Do you have any questions?
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