PHYSICAL AND CHEMICAL PROPERTIES OF FRUCTO-OLIGOSACCHARIDE ENRICHED WALNUT CREAMS

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Objective

Walnuts have numerous health benefits and are an important crop in the food industry. The edible part of the fruit can be eaten fresh or roasted, used on its own or in other products, or pressed into walnut oil. An increase in demand for walnut oil leads to an increase in walnut oil residue, called walnut pellet, a by-product of walnut oil production. This by-product has a high nutrient content and is often used as animal feed or compost, however, in recent years, the food industry has looked to incorporate it into other foods. For the experiment, we created walnut creams using high-nutrient walnut pellets enriched with four types of dietary fiber - inulin, glucomannan, apple fiber, psyllium - to enhance their nutritional value.

The aim of our study was to compare the physical and chemical properties of walnut creams made from high nutrient walnut pellets, a by-product of walnut oil production, enriched with four different prebiotic fibers.

Materials

The walnuts, which were purchased from a farmer, were pressed using an automatic oil press to extract walnut oil. Then, the remaining nut pellets were used to produce fibre-enriched walnut creams. The spreads were prepared using a kitchen grinder. For simplicity, the nut spreads are named after the different types of dietary fiber they contain.

Ingredients	Inulin enriched walnut cream	Glucomannan enriched walnut cream	Apple fiber enriched walnut cream	Psyllium enriched walnut cream
Walnut pellet	36.7 g	36.7 g	36.7 g	36.7 g
Sunflower oil	25.3 g	25.3 g	25.3 g	25.3 g
Icing sugar	23.3 g	23.3 g	23.3 g	23.3 g
Lecithin	0.4 g	0.4 g	0.4 g	0.4 g
Inulin	14.3 g	-	-	-
Glucomannan	-	14.3 g	-	-
Apple fiber	-	-	14.3 g	-
Psyllium	-	-	-	14.3 g
TOTAL	100 g	100 g	100 g	100 g

Table 1 Recipe for different fiber-enriched nut creams

Methods

Moisture content: Sartorius MA 100 rapid moisture analyser (Germany), 3 replicates

Optical properties: CIELAB L*, a* and b* color coordinates with ColorLite sph850 spectrophotometer (ColorLite, Germany), 3 replicates

Oil spreading: 2.0 ± 0.05 g of the sample was placed on filter paper and left to rest for one hour. Then, it was removed, and the weight of the oil-soaked filter paper was measured without residue, 3 replicates

Particle size: Particle size with using an XSP-181T-LED-PLAN biological microscope (Scopium, Hungary), microscope ToupView camera and software.
Determined parameters:

- FERET_MAX (maximum diameter over all measuring direction) and
- FERET_MIN (minimum diameter over all measuring direction) values of each sample.

Amplitude sweep: Anton Paar MCR302 modular compact rheometer, measuring system: PP50 with a layer thickness of 1.1 mm, 3 replicates, shear strain: 0.01-100%, angular frequency: 10 rad/s

Viscosity: Anton Paar MCR302 modular compact rheometer, an oscillating rheometer with a combination of a PP50 measuring system. 3 replicates. Two measuring stages:

- increasing the shear rate from 0.1 1/s to 10 1/s; 60 recorded data / curve
- second stage: 10 1/s constant shear rate, 60 s, 60 recorded data / curve
  →determined from second stage the average dynamic viscosity

Water activity: A Novasina Ms1 (Novosina AG, Switzerland) water activity meter was used for the measurement, 3 replicates

Total polyphenol content: It was determined spectrophotometrically at 760 nm according to the method of Singleton and Rossi (1965) using the Folin-Ciocalteu reagent

Conclusion

We found that all four walnut cream samples behaved as viscoelastic solids, and then liquids after the flow point. These products have a lower water activity and are therefore long-lasting. The results showed that the type of fiber significantly affects the oil retention, yield strength, and average dynamic viscosity of walnut cream. It was found that the type of ingredients influences the product's color parameters, this explains why the darker apple fiber caused a significant difference between the apple-fiber enriched walnut cream and the other samples. There were no significant differences in total polyphenol content, moisture content, or the FERET_MIN and FERET_MAX parameters among the particle sizes of the walnut creams.
The results showed that the apple fiber-enriched nut cream had one of the smallest particle sizes and the highest average dynamic viscosity at a constant shear rate. It was also considered a stable nut cream due to its low oil spreading.

Results

Color – CIE L*a*b*

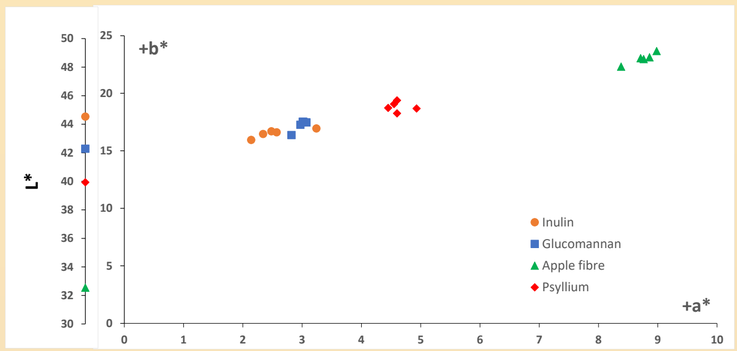

Figure 1 CIE L*a*b* results of the different fiber-enriched walnut creams ($p < 0.05$)

Particle size

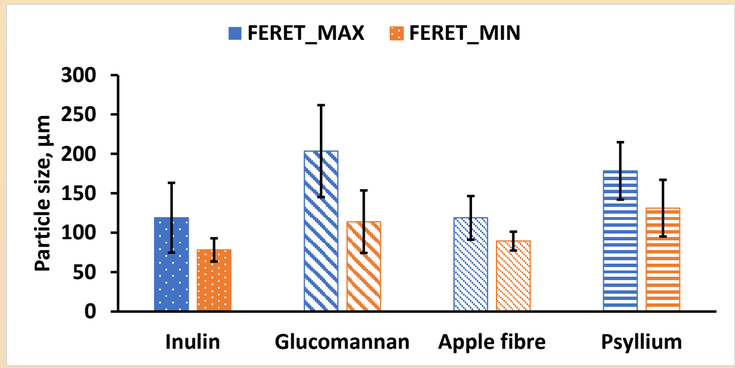

Figure 2 The particle size of different fiber-enriched walnut creams based on FERET_MIN and FERET_MAX values

Amplitude sweep

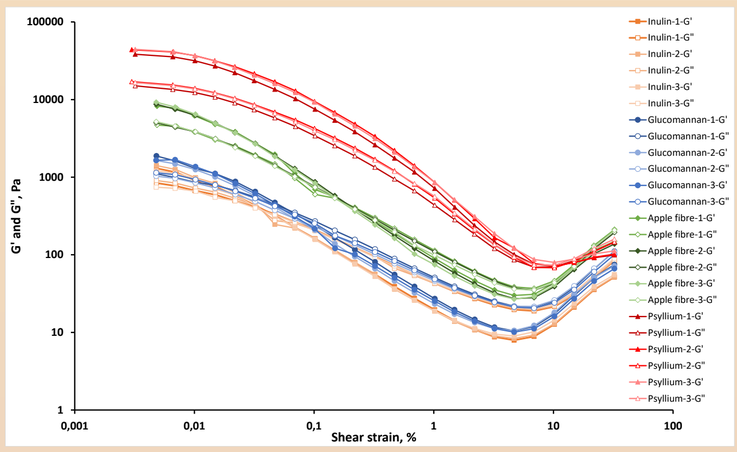

Figure 3 Storage modulus G' (Pa) and loss modulus G'' (Pa) of different dietary fiber enriched walnut spreads in the function of the shear strain (%) ($p < 0.05$)

Viscosity

Figure 4 Average dynamic viscosity of different fiber-enriched walnut creams with standard deviation at constant maximum shear rate (10 1/s) ($p < 0.05$)

Total polyphenol content

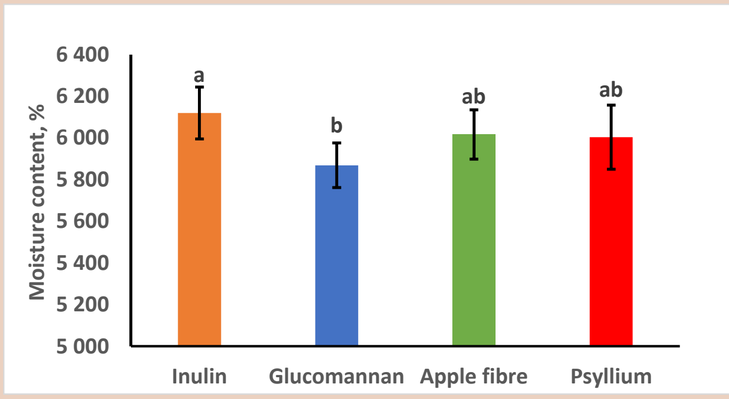

Figure 5 Average total polyphenol content of the different fiber-enriched walnut creams with standard deviation ($p < 0.05$)