# Faba Bean Fractions for 3D Printing of Protein-, Starch- and Fibre-Rich Foods

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## Background/introduction/summary

3D printing is a technique that can be used to create personalised foods.

By combining different ingredients novel textures, such as plant-based steaks with textural properties resembling those of meat can be created.

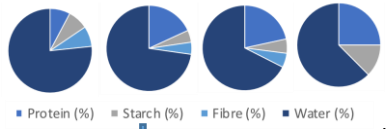
By creating new shapes and textures, 3D printing can make different foods more appealing.

In this study, the following two current trends—3D printing and plant-based foods—are combined. The objective was to produce 100% faba bean-based 3D-printed food prototypes and investigate how ink composition and object structure influence printability and texture.

## Materials and Methods

FB fraction extracted and combined to make inks:

Fibre rich, Starch rich, Protein rich, Protein & starch rich




Influence of: ink composition, direction of compression & infill pattern

Ink rheology


3D-print

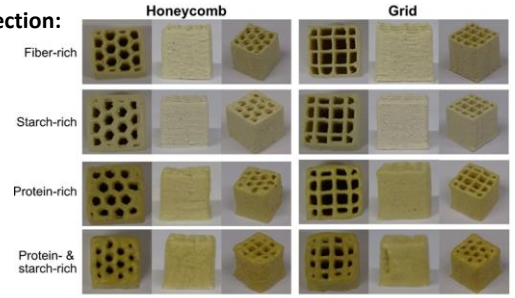
Texture Analyzer

## Results

**Ink rheology :** All inks showed elasticty-dominating behaviour. The starch rich inks had the highest storage modulus along with yield stress indicating that this ink was the most ”solid” like.

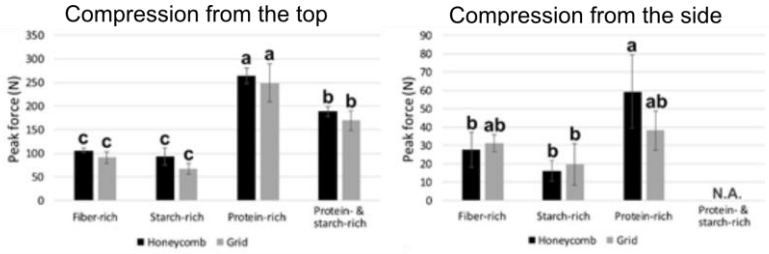
**Printability & visual inspection:**

The protein & starch-rich cubes were the most troublesome to print. Fibre- and starch rich cubes created more stable cubes with straighter walls and more defined infill patterns




**Compression testing :** when cubes were compressed from the top ~5-10 times larger force was required compared to when cubes were compressed from the side. In general the protein rich samples required more force to be compressed and would therefore be perceived as harder. No significant difference between infill patterns.

The higher force required for compression was negatively correlated with particle size ($r = -0.623$; $p = 0.002$) and positively correlated with the number of particles ($r = 0.716$; $p<0.001$) produced during compression.




## Conclusions

- Protein, starch and fibre rich fractions extracted from faba beans can be successfully combined to create nutritious printable inks for extrusion based 3D printing.
- Inks with a lower loss tangent showed a higher shape stability.
- The ink composition had a clear effect on textural properties of freeze dried 3D printed objects while the infill pattern did not.
- An increased heterogeneity of the microstructure seemed related to the decreased peak force during compression.

## Reference

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