Whole cricket powder as sustainable protein binder in pancake baking

Viktória Farkas[1], Romána Zelkó[2], Péter Gordon[3], Zoltán Kovács[4], Barnabás Kállai-Szabó[1]

1 Cornexi Food Ltd, Dorottya Str. 2, Cegléd 2700, Hungary

2 University Pharmacy Department of Pharmacy Administration, Semmelweis University, Hőgyes Endre Str. 7-9, Budapest 1092, Hungary

3 Department of Electronics Technology, Budapest University of Technology and Economics, Egry J. Str. 18, Budapest, 1111, Hungary

4 Department of Measurements and Process Control, Institute of Food Science and Technology, Hungarian University of Agriculture and Life Sciences, 14-16 Somlói Street, H-1118 Budapest, Hungary

Introduction

Insect protein has recently gained growing interest as an alternative protein source for human consumption, as it is seen as a sustainable protein source that is nutritionally similar to conventional livestock production.[1] Edible insects are extremely rich in nutrients such as protein, fat, vitamins and minerals thus the human insect-eating (anthropo-entomophagy) is common to cultures in most parts of the world, thus the EFSA approved several insects for human use.[2] Our selected insect, the house cricket (Acheta domesticus) is easy and cost-effective to raise, which making them an ideal alternative food to feed the world.[3] In scientific projects the addition of insect meal to food replacing plant-based flours was significantly Increased the protein content and the insoluble fraction of dietary fibre.

The aim of our study was to replace egg white with addition of the same amount protein as sustainable whole cricket flour in pancakes and to identify asses the impact of adding cricket powder on texture and sensory characteristics of pancakes.The ready-to use pancake mixture enriched with whole cricket flour showed higher viscosity but similar technological applicability and this Mixture resulted pancakes wih darker color but similar taste profile as the conventional egg-containing pancakes.

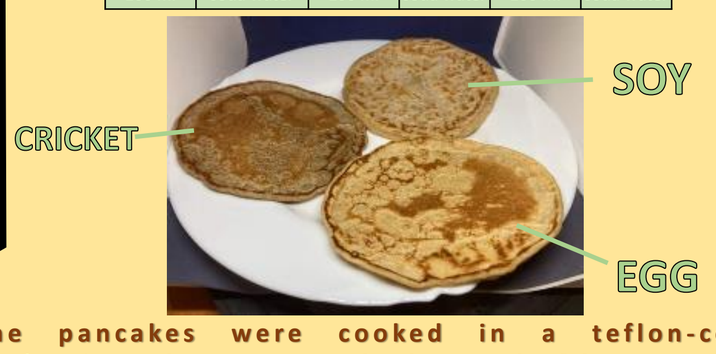
Methods

Preparation steps of cricket powder: Physical separation of the crickets from the feed and dust. Freezing at -20°C for 24 hours. Soaking with warm water. Boiling in water for 10 minutes. Drying at 100°C for 8h in owen. Grinding the crickets in a coffee grinder for 2 minutes.

Sample preparation (pancake)

The pancakes are made according to the recipes below. Eggs were replaced with cricket and soy protein as a binder.

WHOLE CRICKET POWDER		EGG		SOY PROTEIN	
100 g	oat flour	100 g	oat flour	100 g	oat flour
10 g	cricket powder	1 piece	egg	7.8g	soy protein
100 ml	soda water	100 ml	soda water	100 ml	soda water



The pancakes were cooked in a teflon-coated pan (d=22cm) using the same method: 50 ml of batter, add 2 ml sunflower oil, 120 seconds at 98 C°, flip the pancake after one minute.

Texture analysis: Three parallel pancake samples of each concentration were analyzed using a Brookfield CT3 Texture Analyzer with a 50000 g load cell (Brookfield Engineering Laboratories, Inc., USA). The test was performed with a cylindrical probe (TA11/1000, transparent delrin, diameter: 25.4mm, length:35mm) The compression test was carried out performing two cycles. The pretest, test and return speeds were set to 2, 1 and 1 mm/s. A force of 0.05 N was used as a trigger load; after reaching the trigger load, the probe compressed the samples through a depth of 20 mm. The sampling rate was 100 points/s, and Brookfield Texture Pro CT software was used for evaluation. The adhesiveness, which is the total negative area of the load-distance curve of the first cycle, was determined. Adhesive force is the maximum negative load of the first compression cycle.

Flavour-profile analysis with an αAstree electronic tongue (AlphaMOS, Toulouse, France), designed for the determination of taste patterns of liquid food. In the first series of experiments, dried and powdered cricket, peanut hulls and sunflower seed hulls were tested to determine the flavour profile of cricket powder. The electronic language studies draw on the literature and previous experience cricket powder, peanut hulls and sunflower seed hull samples 1g/100ml in aqueous solution. In the second series of experiments, crickets made with flour, eggs or soy protein pancake samples were analysed. In this case also with a dilution of 100 the samples were placed in solution. Comparison of the flavour profile of pancake samples containing cricket dust instead of egg with the flavour profile of pancakes made with egg and soy. 10 g of the pancakes were dissolved in 90 g of distilled water, of which 10 ml was filtered through MN filter paper and the filtrate was diluted to 100 ml. 100 ml of each sample filtrate was used and the electrodes were conditioned according to the suggestion of the developers before commencing the experiment. In addition, the flavour profile of dried cricket powder was compared with that of sunflower hull and peanut hull.

Molecular weight determination of proteins by polyacrylamide gel electrophoresis. 100 mg/ml protein powder solution was made from the grinded and dried pea, soy and cricket samples. After ultrasonicaction, the solutions were filtered on filterpaper. SDS-PAGE was carried out using a 10 % Tris- Glycin gel and a vertical Novex Minigelelectrophoretic system.

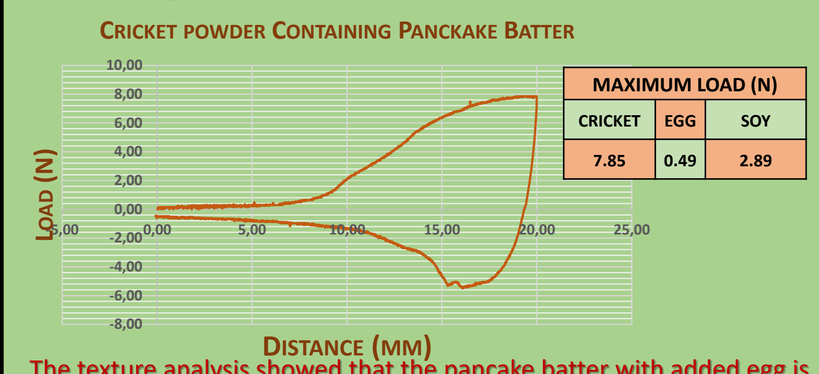
Results

Polyacrylamide gel electrophoresis (PAGE):

The results show that cricket protein has the highest molecular weight, which is why the batter is thicker.

AVERAGE PROTEIN MOLECULAR WEIGHT (kDa)			
PEA	SOY	EGG	CRICKET
46	46	48	76

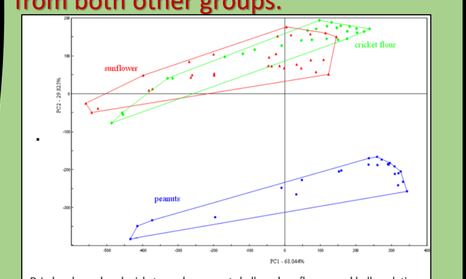
Texture analysis:



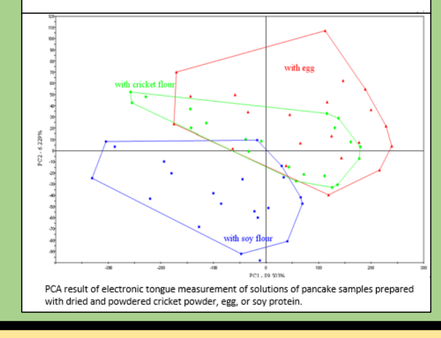
MAXIMUM LOAD (N)		
CRICKET	EGG	SOY
7.85	0.49	2.89

The texture analysis showed that the pancake batter with added egg is the thinnest and the pancake with soy protein is the densest, while the density of the pancake batter with cricket powder is in between the two samples.

Electronic tongue: Our measurement with an electronic tongue looked for a flavour profile similar to cricket powder. The peanuts samples were well separated from sunflower seed and cricket dust samples by the instrument. The groups of sunflower seed and cricket powder samples as more similar to sunflower samples and more different from peanut hull samples. Our aim was to find a similar taste to pancakes containing eggs. Based on the results of the electronic tongue measurements of pancake samples made with cricket powder, egg or soy protein, it can be concluded that pancake samples made with cricket flour were found to be more similar to pancake samples made with egg according to the instrument. The group of pancake samples made with soy protein was well separated from both other groups.



Dried and powdered cricket powder, peanut shells and sunflower seed hulls, solutions of samples prepared from electronic tongue PCA result



PCA result of electronic tongue measurement of solutions of pancake samples prepared with dried and powdered cricket powder, egg, or soy protein.

Conclusion

Edible insects have great potential to contribute to the world's food supply, world food security. They represent a complementary opportunity to provide nutrients of animal origin, in particular proteins, especially in developing countries of the world. Insects can not only be farmed sustainably, but also have a higher nutrient and trace element content than livestock, which can cover the daily food supplement Crickets are easy, fast, sustainable and cheap to breed. It can be used as a substitute for a protein source such as eggs without any change in taste. Cricket powder is a suitable substitute for animal and plant proteins due to its high and high quality protein content. Although the pancake batter containing cricket powder is noticeably more dense, but it was easy to cook, there was no noticeable difference between the taste of the sample compared the egg-containing (regular) pancake. Cricket powder can be preserve in dried form, thus it can be an alternative not only to eggs but also to egg powder.

References

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Acheta domesticus (Linnaeus)