Development of models of cooked hybrid products

Gallina, D. A.[1*], Sánchez-Molinero, F.[2], Gou, P.[2]

[1]Instituto de Tecnologia de Alimentos/ITAL, Campinas, SP, Brasil.

[2]Instituto de Investigación y Tecnología Agroalimentarias/IRTA, Monells, Girona, España

*Corresponding author email: darlila@ital.sp.gov.br

I. INTRODUCTION

Production and consumption of animal protein has more significant environmental and health impacts than plant proteins. Many researches emphasize the importance of meat alternatives and the use of plant proteins. However, the functionalities of these proteins, structure technique and sensory characteristics influence the properties, texture, nutritional value and acceptance of the final products. Despite recent advances and popularity in the market, continuous efforts and research are needed to make meat alternatives more sensorially attractive and with higher nutritional value [1]. The objective of this work was to investigate the use of some orphaned crops and other plant proteins in the development of new hybrid products, specifically, with 50% of total protein from lupine, broad bean, buckwheat, pea or soybean and the rest of protein from animal origin.

II. MATERIALS AND METHODS

Preliminary tests were carried out for the development of model system of cooked hybrid products using pork meat and vegetable protein derivatives: protein isolate (PI) of lupine, broad bean, pea and soybean; protein concentrate (PC) of broad bean, and buckwheat flour. The recipes of the nine batches manufactured are shown in Table 1.

Table 1 – Formulations of models of cooked hybrid products (g/Kg).

Formulations	**F1**	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**	**F8**	**F9***
Pork shoulder	900	450	450	450	450	450	450	450	450
Buckwheat flour	0	200	0	0	0	0	110	0	0
Broad bean PC	0	0	172	0	0	0	0	0	86
Lupine PI	0	0	0	115	0	0	0	0	0
Broad bean PI	0	0	0	0	119	0	0	0	0
Pea PI	0	87	0	0	0	115	100	0	58
Soybean PI	0	0	0	0	0	0	0	115	0
Salt	20	20	20	20	20	20	20	20	20
Water	80	243	358	415	411	415	320	415	386
Total (grams)	1000	1000	1000	1000	1000	1000	1000	1000	1000
Approximate Composition (%) **									
Proteins	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7
Starch - carbohydrates	0.0	12.3	0.3	0.0	0.0	0.0	6.7	0.0	0.15
Lipids	10.8	6.1	6.1	5.4	6.0	5.4	5.8	5.4	5.75
Fibers	0.0	1.7	2.6	0.0	0.0	0.0	0.9	0.0	1.3
Water	68.5	59.3	70.3	73.9	73.3	73.9	65.8	73.9	72.1

* F9 was prepared using 250g of F3 and 250g F6, mixed in the thermomix for 1 min.

** Based on information from the commercial product information data sheets.

The masses were produced in a Thermomix machine. Vegetable proteins with salt were added to ice water and mixed under stirring during one minute. Then the meat (previously minced in a mincer with a 4 mm hole plate) was added and there was new agitation during 1.5-2 minutes. Meat temperature: 1±1ºC, water temperature: 1±0.5ºC. The final temperature and pH of the mixture were measured (Table 2).

Table 2 – Temperature and pH of the mass mixtures.

Formulations	F1	F2	F3	F4	F5	F6	F7	F8	F9
Final temperature after the thermomix (ºC)	3.3	4.9	5.0	9.7	10.0	10.4	9.2	8.8	11.0
pH mixture	5.92	6.11	6.12	6.25	6.36	6.44	6.28	6.46	6.29

The resulting masses were vacuum packed and then placed in silicone molds to be cooked at 75 ºC (60 min.) in a Rational combined oven. The masses inside the molds were taken to a cold chamber (4-5 ºC). The texture when chewing or biting in the mouth (hardness/ firmness, pastiness, flouriness or crumbliness, springiness) were evaluated by 3 panelists, expert and trained on meat products according to ISO 8586:2023 [2] by consensus the next day after being heated in a microwave (900 watts) for 3 minutes (20 seconds per sample).

III. RESULTS AND DISCUSSION

Figure 1 shows the appearance of the samples after cooking.

Figure 1. Appearance of formulations (1 to 9 from left to right), after cooking 75 ºC/60 minutes.

F1, with 90% meat (2% salt, 8% water), presented color, firmness, stiffness and bite resistance characteristics of a meat product; F2, with 20% buckwheat flour and 8.7% pea protein isolate, showed high adhesiveness, a flour-like texture, adhering to the teeth and was a bit astringent; F3**,** with 17.2% protein concentrate of broad bean, showed good juiciness, was softer than F1, not being floury; F4, with 11.5% lupine protein isolate, was less firm than the F3; F5, with 11.9% broad bean protein isolate was softer that F4; F6, with 11.5% pea protein isolate, showed texture similar to F3; F7, with11,0% buckwheat flour and 10% pea protein, presented astringency (greater than F2), and a softer texture than F1; F8, with 11.5% soybean protein isolate, presented greater bite resistance, a slightly floury texture, soft texture); F9, with broad bean protein concentrate and pea protein isolate, had a brittle and floury texture.

IV. CONCLUSION

The main objective of this preliminary test was to select vegetable proteins to continue the studies of hybrid cooked product prototypes on a pilot scale, similar to frankfurter sausages and mortadella. The proteins with the best performance were protein isolate (PI) of broad bean and pea, and protein concentrate (PC) of broad bean.

ACKNOWLEDGEMENTS

To Fapesp for the scholarship granted, Bolsa de Pesquisa no Exterior (BPE), Process 2023/16124-2. This work was funded by the Horizon 2020 UE (CROPDIVA ref. 101000847) and CERCA programs.

REFERENCES

1. THAVAMANI, A., SFERRA, T.J. & SANKARARAMAN, S. (2020). Meet the Meat Alternatives: The Value of Alternative Protein Sources. Current Nutrition Reports, 9346–9355. https://doi.org/10.1007/s13668-020- 00341-1
2. ISO 8586:2023(E). International Standard. 2nd. Ed. Sensory analysis — Selection and training of sensory assessors. 38 p.