

Peptide-rich extracts from spent yeast as potential microbiota modulators

Ana Sofia Oliveira¹, Nelson Mota de Carvalho¹, Carlos Ferreira^{1,2}, Joana Odila Pereira^{1,2}, Manuela Pintado¹, Ana Raquel Madureira¹, Ana P. Carvalho¹

¹Universidade Católica Portuguesa - Centro de Biotecnologia e Química Fina, Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal

²Amyris Bio Products Portugal Unipessoal Lda, Portugal



CATOLICA
ESCOLA SUPERIOR
DE BIOTECNOLOGIA
PORTO



amyris

Microbiome in Health & Disease: microbial diversity and host-microbes interactions

Introduction

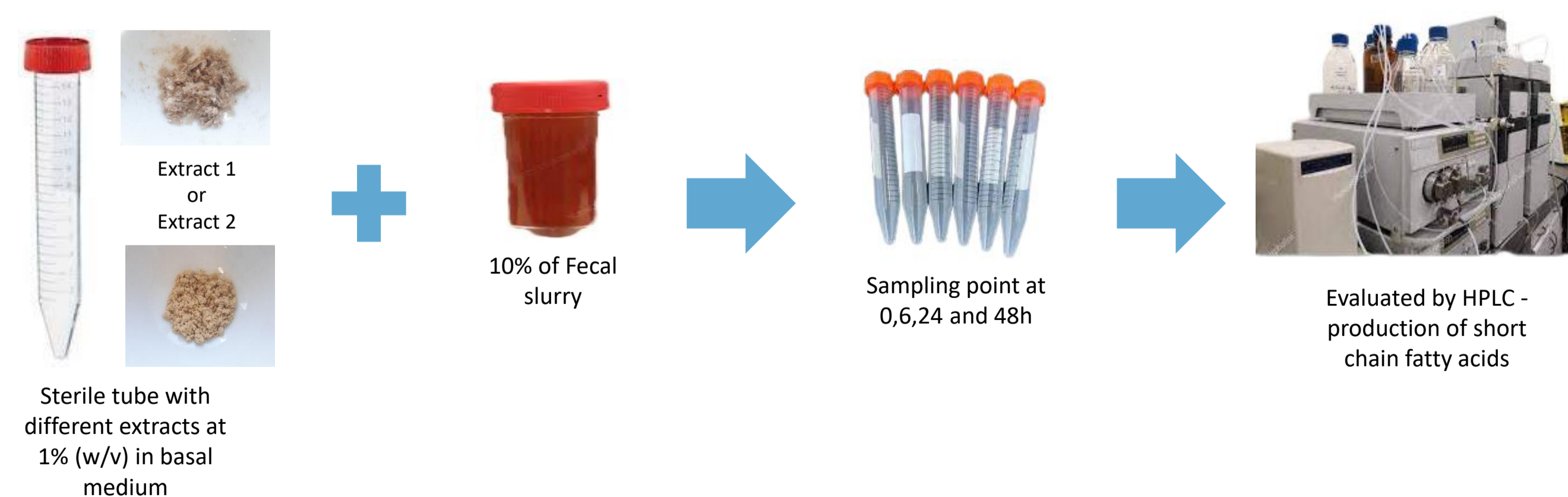
Worldwide, spent yeast (*Saccharomyces cerevisiae*) is one of the main brewing by-products obtained from different fermentation processes¹. From beer production alone, it is estimated an annual production of spent yeast in the order of 6 million tons. However, although coined as spent, this inactivated yeast has still a lot of economical potential. Therefore, the recovery of this spent yeast, for example, for the production of functional ingredients, is an important step in the increasingly demand to promote a circular economy-based industry. Spent yeast has been commercialized as food supplement for years due to its high protein content (about 45%-60%), low cost and safety². However, this use falls short of its potential, as several studies have reported biological properties of extracted yeast peptides, mainly in terms of antihypertensive, antioxidant and antimicrobial effects, although other types of bioactivities are also described. In this study we evaluated the potential of two peptide extracts from *S. cerevisiae* on the promotion of human intestinal microbiome via analysis of short chain fatty acids (SCFA) production. This was conducted in a first step by evaluation of the fermentation by human microbiota of spent yeast peptide-rich extracts.

Methods

Fecal slurry preparation



Fecal tube fermentation



Results

Production of short chain fatty acids

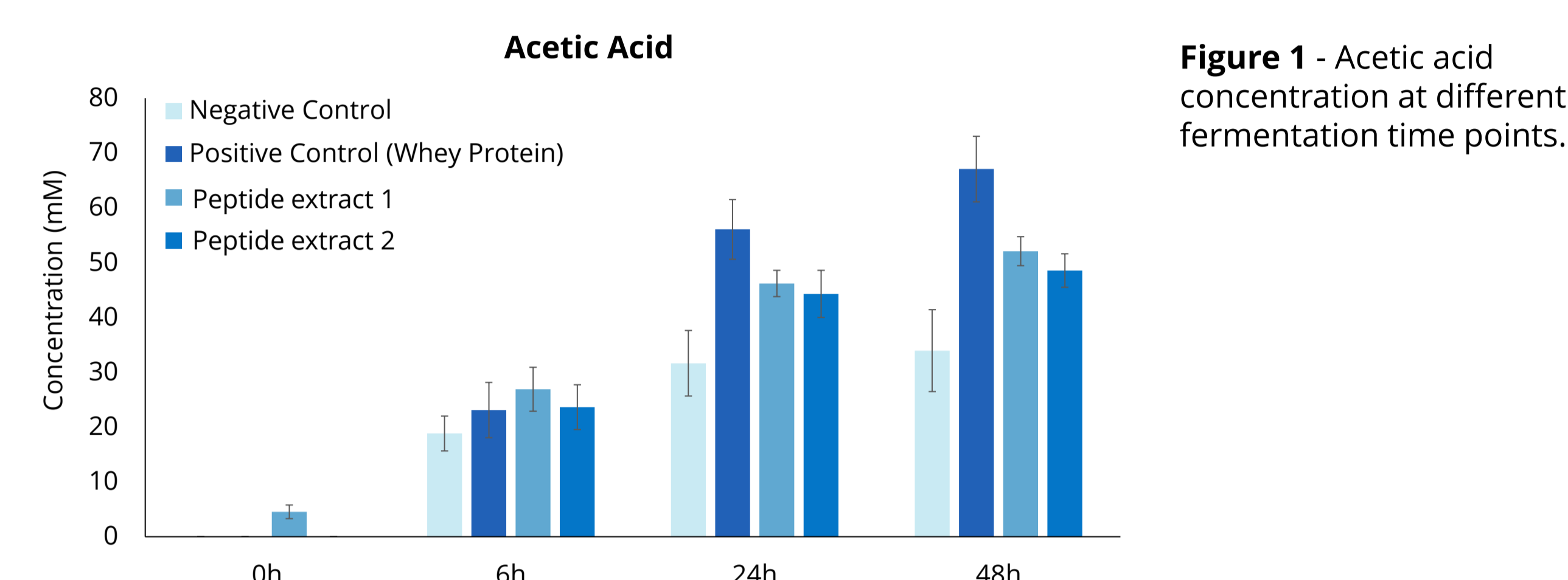


Figure 1 - Acetic acid concentration at different fermentation time points.

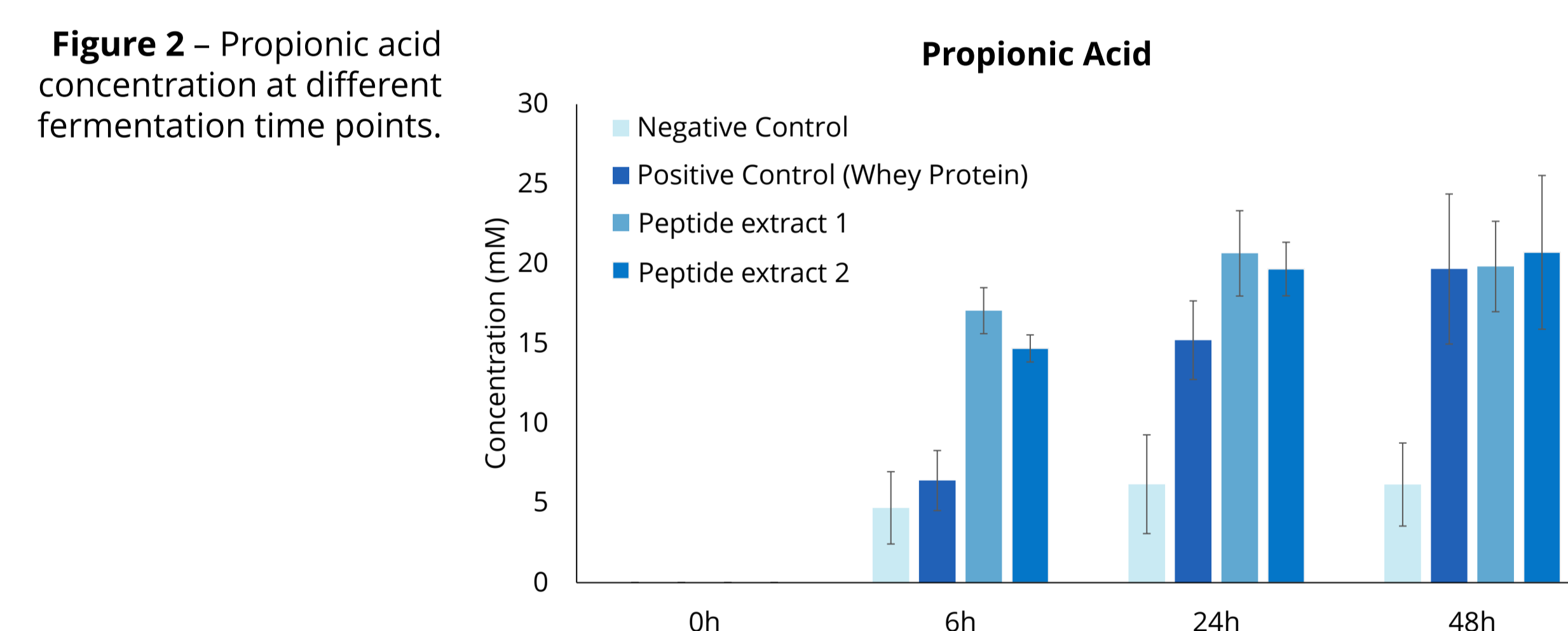


Figure 2 - Propionic acid concentration at different fermentation time points.

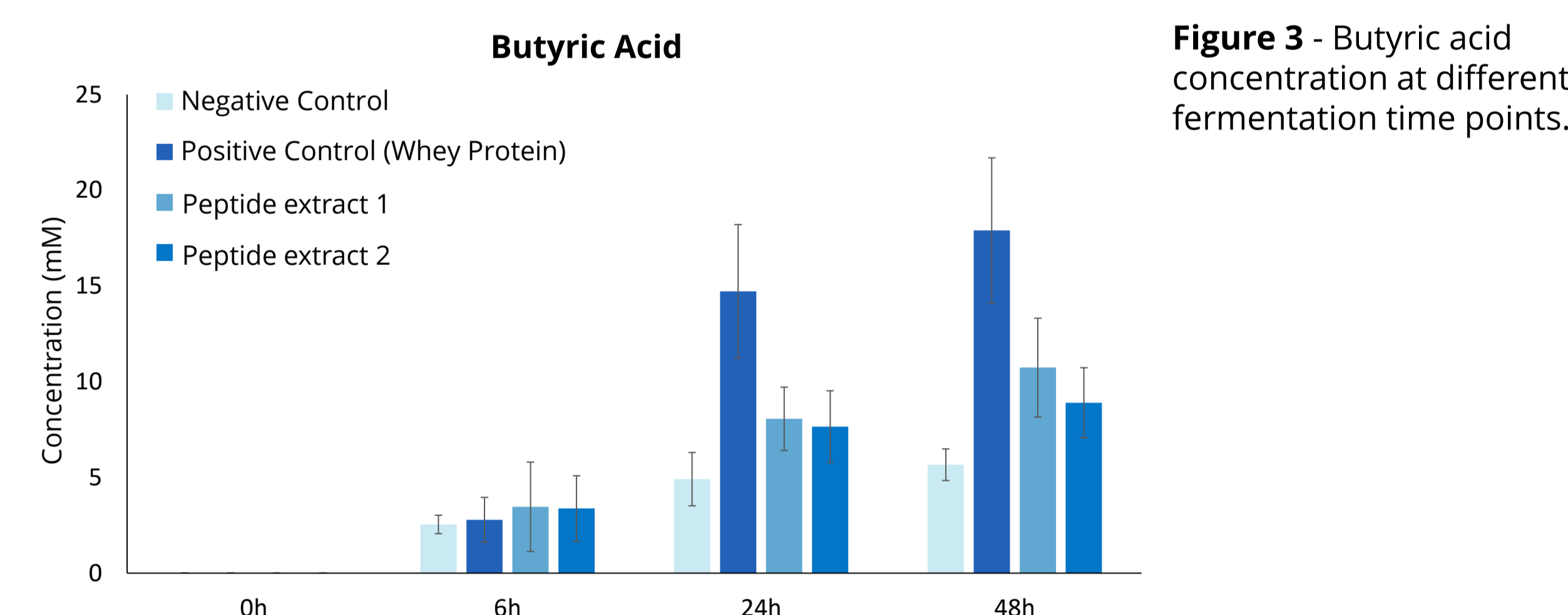


Figure 3 - Butyric acid concentration at different fermentation time points.

Table 1 Approximate molar ratios at different fermentation time points, based on butyric acid concentration

Time point	Molar Ratios	Acetic	Propionic	Butyric
6h	Extract 1	8	5	1
		6	3	1
24h	Extract 2	2	4	1
		2	3	1

Results

Spent yeast extracts characterization

Table 2 Spent yeast extracts chemical and biological characterization

Samples	Extract 1	Extract 2
Purity (protein, % w/w)	67	68
Cytotoxicity against Caco-2 (mg/mL)	Non-Toxic < 1.25	Non-Toxic < 1.29
Cytotoxicity against HaCaT (mg/mL)	Non-Toxic < 5	Non-Toxic < 1.36
Cytotoxicity against HDF (mg/mL)	Non-Toxic < 2.69	Non-Toxic < 0.34
Water solubility (mg/L)	approx. 1mg/mL	approx. 1mg/mL
Total aminoacids (mg/g extract)	770	688
Free amino acids (mg/g extract)	19.6	363
Molecular weight (Da)	> 1000 Da (39%); <1000 Da (61%)	> 1000 Da (12%); <1000 Da (88%)
Sugars (% w/w)	23	5
Ash (% w/w)	0.12	0.12
Minerals	P, Mg, Ca and K	P, Mg, Ca, Na and K

Conclusions

The results demonstrated an increasing trend along time in the production of SCFA in the presence of both peptide extracts from spent *S. cerevisiae*. Furthermore, a decreasing trend in the ratio between the different organic acids (acetic: propionic: butyric), is also indicative of a successful fermentation by the intestinal microbiota. These results suggest a potential prebiotic capacity of the tested peptide extracts from spent yeast. Given these results, the use of these extracts for commercial application to provide health benefits through regulation of intestinal flora is promising, although further studies of their commercial viability are needed.

References

- Rakowska, R., Sadowska, A., Dybkowska, E. & Świdorski, F. Spent yeast as natural source of functional food additives. *Rocz. Panstw. Zakl. Hig.* 68, 115-121 (2017).
- Amorim, M. et al. Nutritional ingredients from spent brewer's yeast obtained by hydrolysis and selective membrane filtration integrated in a pilot process. *J. Food Eng.* 185, 42-47 (2016).

Acknowledgements
This work was co-financed by European Regional Development Fund (ERDF), through the Operational Program for Competitiveness and Internationalization (POCI) under Alchemy project - Capturing high value from industrial fermentation bio products (POCI-01-0247-FEDER-027578).