Strategies to increase *Akkermansia muciniphila* viability during simulated gastrointestinal conditions and stability storage

Freitas, Ana[1], Almeida, Diana[1,2], Machado, Daniela[1], Mendo, Sónia[2], Andrade, José[3] , Gomes, Ana[1]

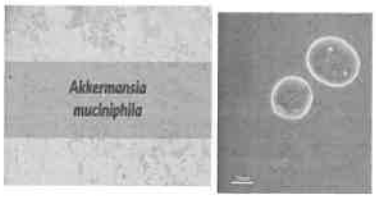
[1] Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Arquiteto Lobão Vital, 172, 4200-374 Porto, Portugal -mail address: afreitas@porto.ucp.pt
[2] Biology Department and CESAM, University of Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal
[3] CESPU, Instituto de Investigação e Formação Avançada em Ciências e Tecnologias da Saúde, Rua Central de Gandra, 1317, 4585-116 Gandra PRD, Portugal

CATÓLICA PORTO BIOTECNOLOGIA

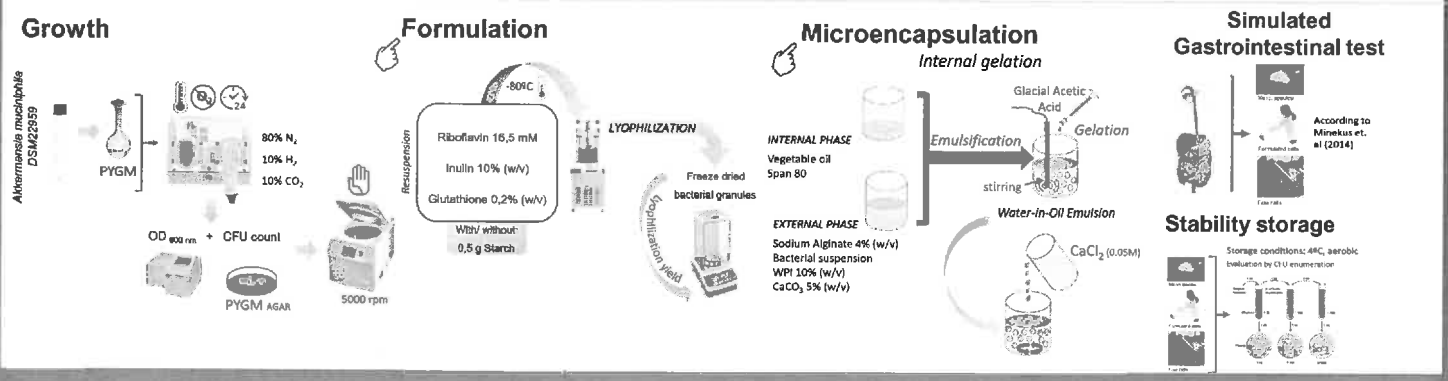
6th World Congress on Targeting Microbiota – Towards Clinical Revolution

Introduction

Akkermansia muciniphila is currently considered a potential novel probiotic due to its beneficial effects in prevention/treatment of inflammatory/cardio-metabolic disorders as consequence of gut dysbiosis [1]. However, this strain is highly sensitive to aerobic and low pH conditions [2]. Thus, microencapsulation and formulations with antioxidants/prebiotic/bulking agents were explored as strategies to increase its viability during gastrointestinal passage and stability storage.



Material and Methods



Results

I) Microencapsulation

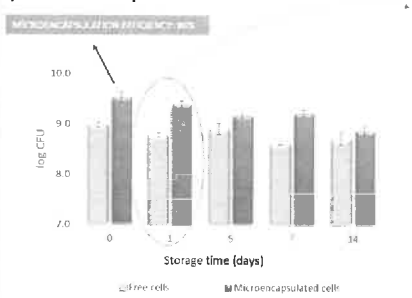


Figure 1. Viable cell numbers (mean±SD) of free [Log (CFU/mL)] and microencapsulated [Log (CFU/g)] *A. muciniphila* during 7 days of aerobic storage at 4ºC.

Lower decrease in viable cell numbers of encapsulated versus free *A. muciniphila* cells throughout 7 days of storage at 4ºC and under aerobic conditions (Fig. 1).

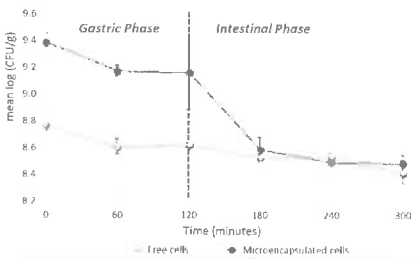


Figure 2. Viable cell numbers (mean±SD) of free [Log (CFU/mL)] and microencapsulated [Log (CFU/g)] *A. muciniphila* during simulated gastrointestinal conditions.

Parallel and similar resistance of free and encapsulated cells of *A. muciniphila* throughout gastric conditions (Fig. 2). However, simulated intestinal conditions cause an accentuated decrease of encapsulated viable cell numbers. Similar values of 8.42 and 8.48 log CFU per mL or g were recorded for free and encapsulated cells upon simulated gastrointestinal tract (300 min), respectively.

II) Formulation

Table 1. Lyophilized weight (mean±SD) and viable cell numbers of *A. muciniphila* in both formulations and throughout 7 days of storage at 4º and under aerobic conditions

Formulation	Lyophilized weight (g)	Mean log CFU/g±SD	
		After lyophilization	Storage (7d)
With starch	0,49± 0.02	6,31 ± 0,03	5,83 ± 0,17
Without starch	0,046 ± 0,006	10,21 ± 0,02	Not determined

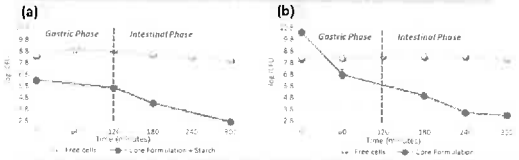


Figure 3. Viable cell numbers (mean±SD) of *A. muciniphila* free [Log (CFU/mL)] and present in lyophilized formulations [Log (CFU/g)] with (a) or without starch (b) during simulated gastrointestinal conditions.

After lyophilization, formulation without starch contained higher number of viable cell numbers than the starch counterpart. Viable cell numbers of *A. muciniphila* in both formulations revealed much higher susceptibility to the simulated gastrointestinal conditions than free cells (Fig. 3a,b).

Conclusion

Alginate-WPI microcapsules are able to protect *A. muciniphila* against detrimental gastrointestinal conditions and storage conditions (4 ºC; aerobic) for 7 days, revealing microencapsulation to be a better strategy to repopulate gut microbiota with this strain than the actual formulation.

References

1. Naito Y, Uchiyama K, Takagi T. J Clin Biochem Nutr. 2018;63(1):33-35
2. Derrien M et al. Int J Syst Evol Microbiol. 2004;54(Pt 5):1469-1476.
3. Minekus et al. Food & Function. 2014;5:1113.

Acknowledgements

This work was supported by national funds through FCT/MEC (PIDDAC), project reference IF/00588/2015 and by Operational Program Competitiveness and Internationalization in its FEDER component and by the budget of the Foundation for Science and Technology, I.P. (FCT, IP) in its OE component, project reference POCI-01-0145-FEDER-031400 with scientific collaboration of CBQF under the FCT project UID/Multi/50016/2013.

COMPETE 2020 PORTUGAL 2020 FCT Fundação para a Ciência e a Tecnologia Governo da República Portuguesa