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## Driving the nitrogen/carbon ratio of the culture medium determines *Propionibacterium freudenreichii* survival during spray-drying.

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Floriane Gaucher, Houem Rabah, Koffigan Kponouglo, Sylvie Bonnassié, Philippe Blanc, et al.. Driving the nitrogen/carbon ratio of the culture medium determines *Propionibacterium freudenreichii* survival during spray-drying.. IDF WDS 2018 Dairy for the next generation, Sep 2018, Daejeon, South Korea. , 2018. hal-01908153

**HAL Id: hal-01908153**

**<https://hal.science/hal-01908153v1>**

Submitted on 29 Oct 2018

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# DRIVING THE NITROGEN/CARBONE RATIO OF THE CULTURE MEDIUM DETERMINES *PROPIONIBACTERIUM FREUDENREICHII* SURVIVAL DURING SPRAY-DRYING

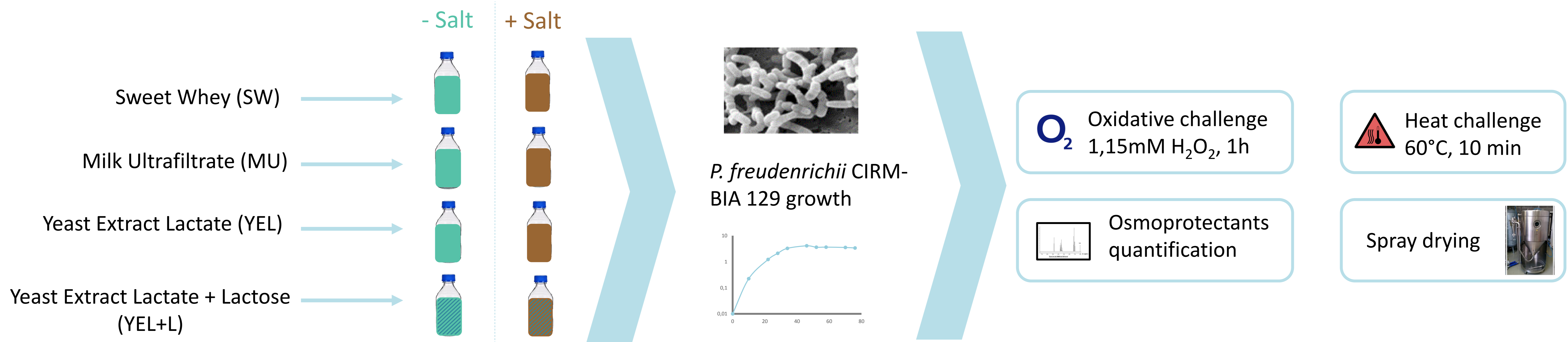
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## CONTEXT

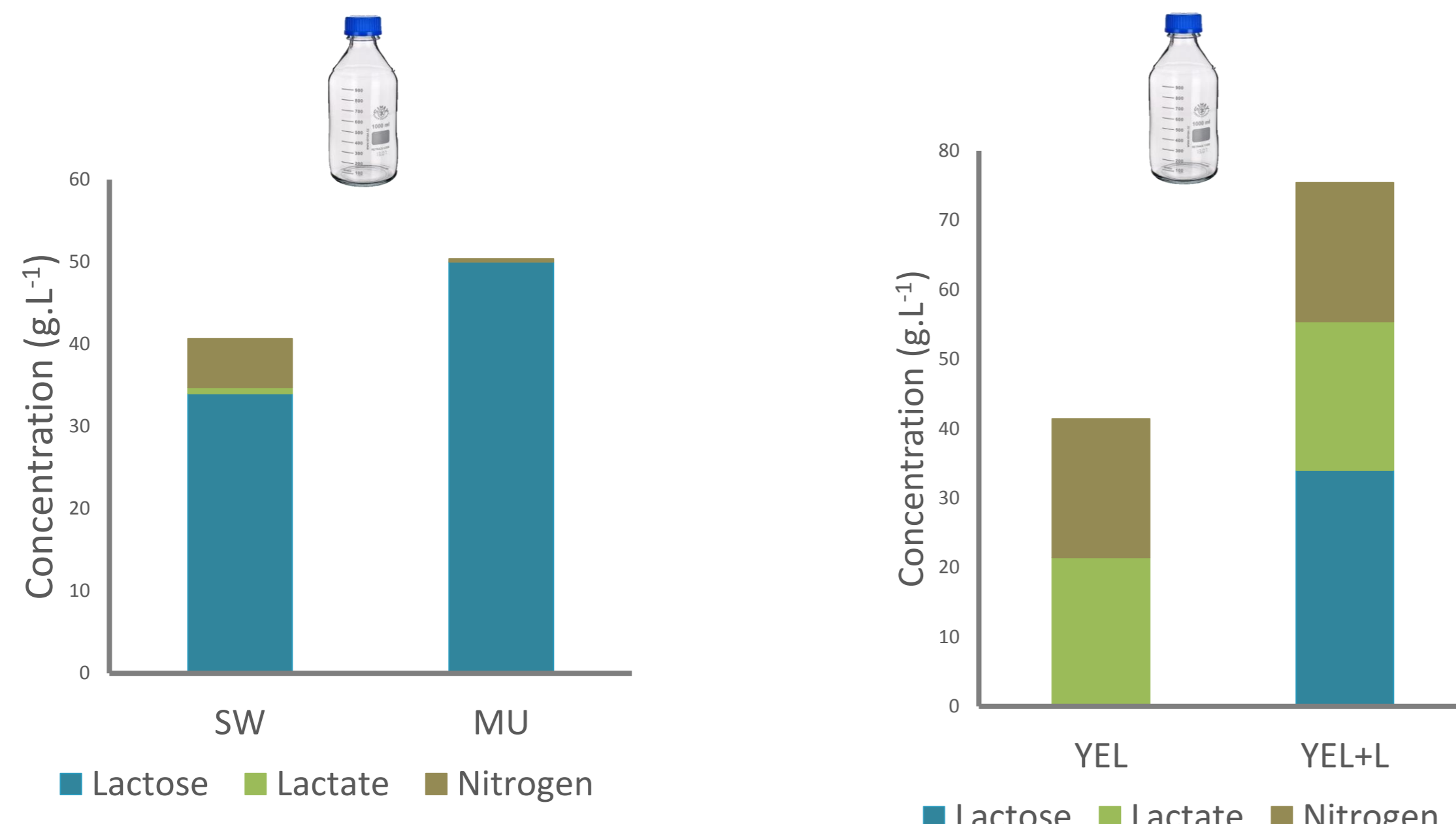
*P. freudenreichii* is used both as Swiss-type cheese starter and as probiotic. For these purposes, it should be converted into a powdered form to be stabilized, without significant loss of viability. Spray-drying is a stressful process, with simultaneous thermal, oxidative and osmotic stresses. To tolerate to these latter, bacteria should adapt. We investigate whether growth media could constitute a means to adapt bacteria in the aim to increase their survival during spray drying.

## EXPERIEMENTS DESIGN

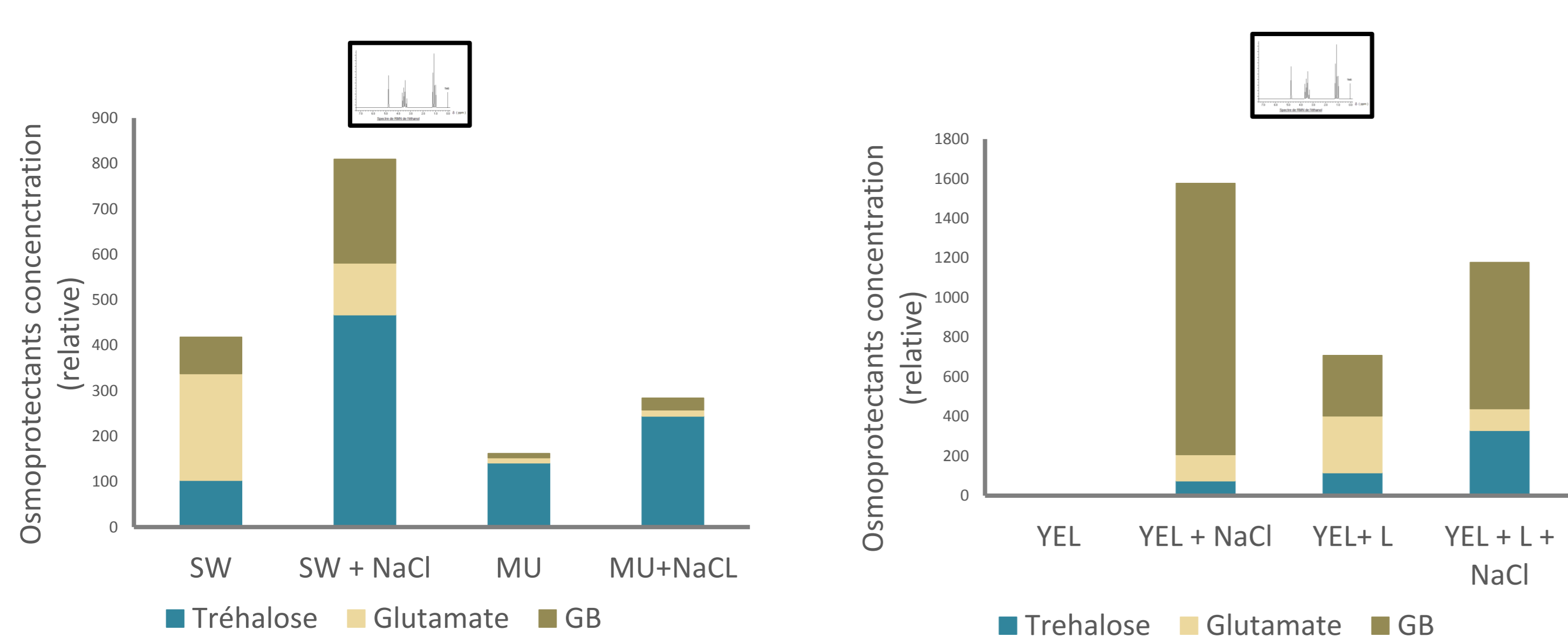


## RESULTS

### 1 Carbon/nitrogen composition of the culture medium

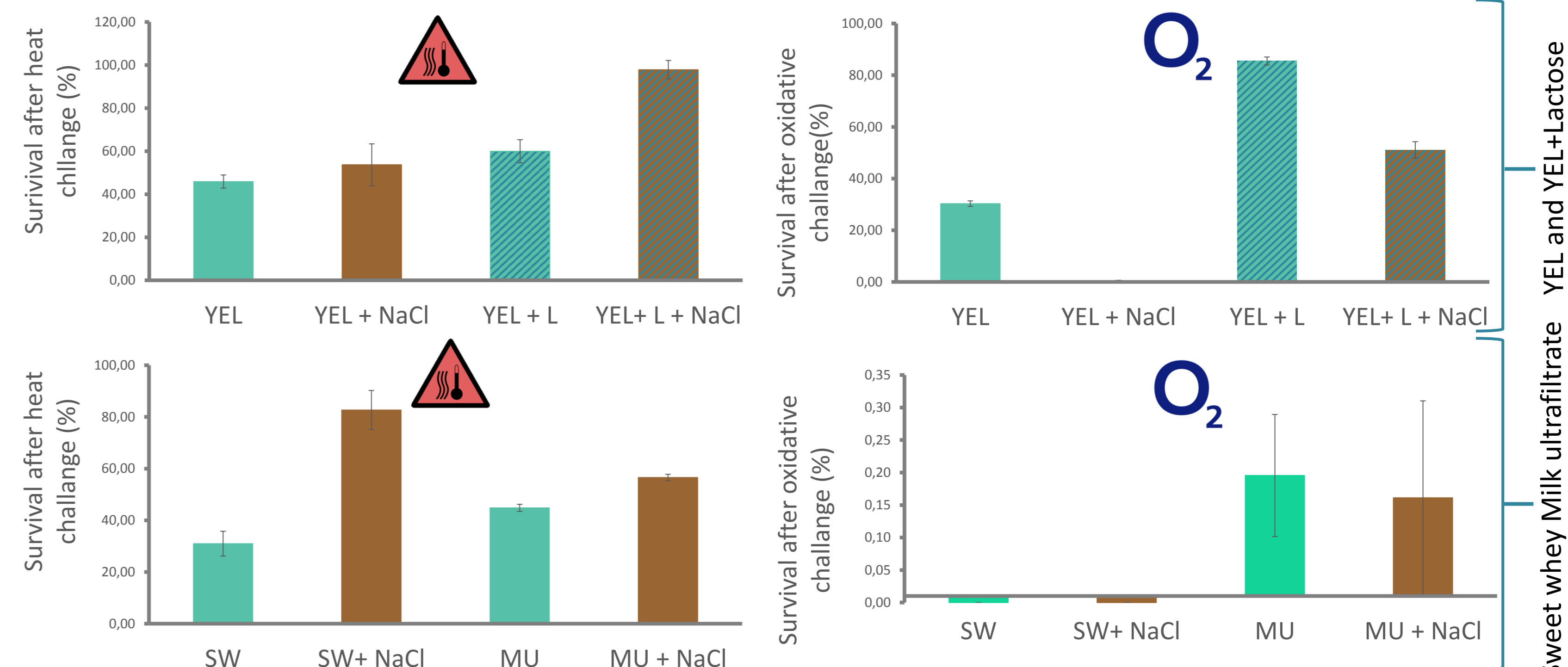


### 2 Osmoprotectants accumulations is determined by the medium composition



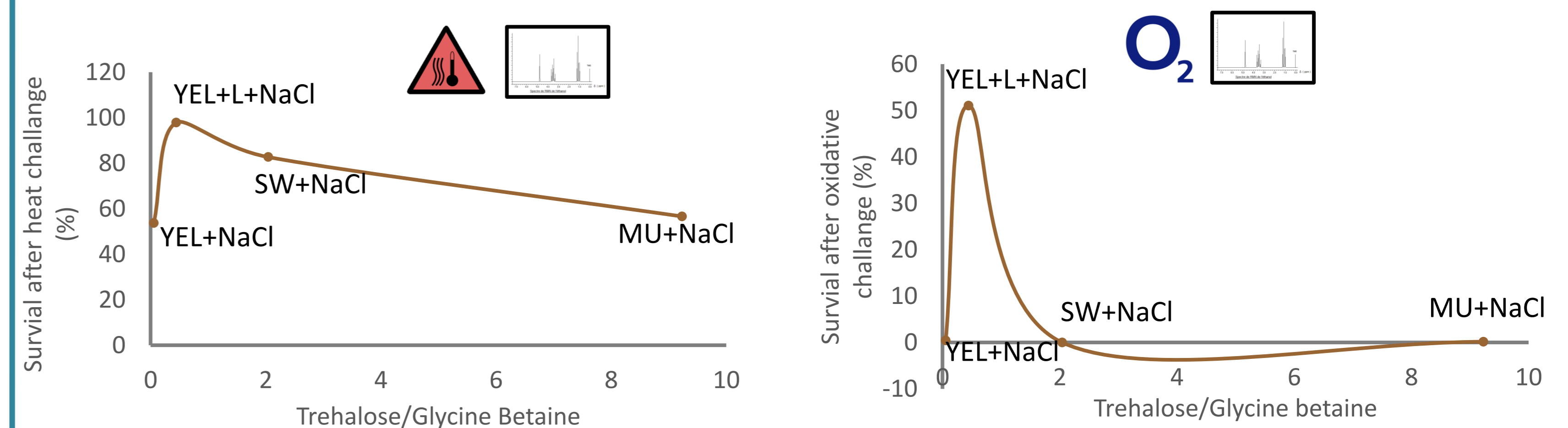
*P. freundeichii* was cultivated in the different growth media and collected during exponential phase. Cytoplasmic molecules were extracted and the osmoprotectants were identified and quantified by C and H NMR

### 3 Osmoprotection protects *P. freudenreichii* during lethal challenges



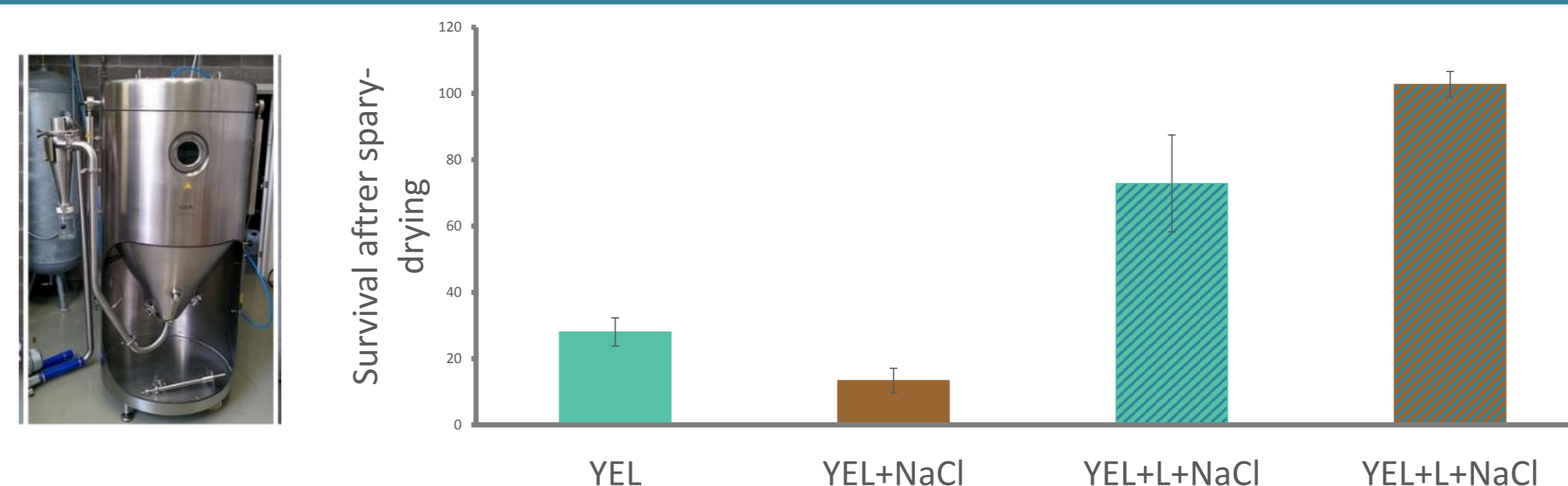
*P. freundeichii* was cultivated in the different growth medium. Both lethal challenges were applied at the beginning of the stationary phase. *P. freudenreichii* quantification was made by CFU numeration before and after challenges

### 4 The trehalose/glycine betaine ratio is linked to *P. freudenreichii* survival during lethal challenges



The relation between the trehalose/glycine betaine ratio and *P. freudenreichii* survival with the experiments 2 and 3

### 5 The nitrogen/carbon ratio of the growth medium influence *P. freudenreichii* viability during spray drying



*P. freundeichii* was cultivated in the different growth media, and spray-dried at the beginning of the stationary phase. *P. freudenreichii* quantification was made by numeration before and after spray-drying

## CONCLUSION

We demonstrate here that driving the nitrogen/carbon ratio of the culture medium modulates the trehalose/glycine betaine ratio which, in turn, determines *P. freudenreichii* survival during spray-drying. Spray-drying needs less energy than freeze-drying. This work thus opens new perspectives for sustainable drying of beneficial bacteria