Iron-peptide complexes from spent yeast: evaluation of iron absorption using Caco-2 model

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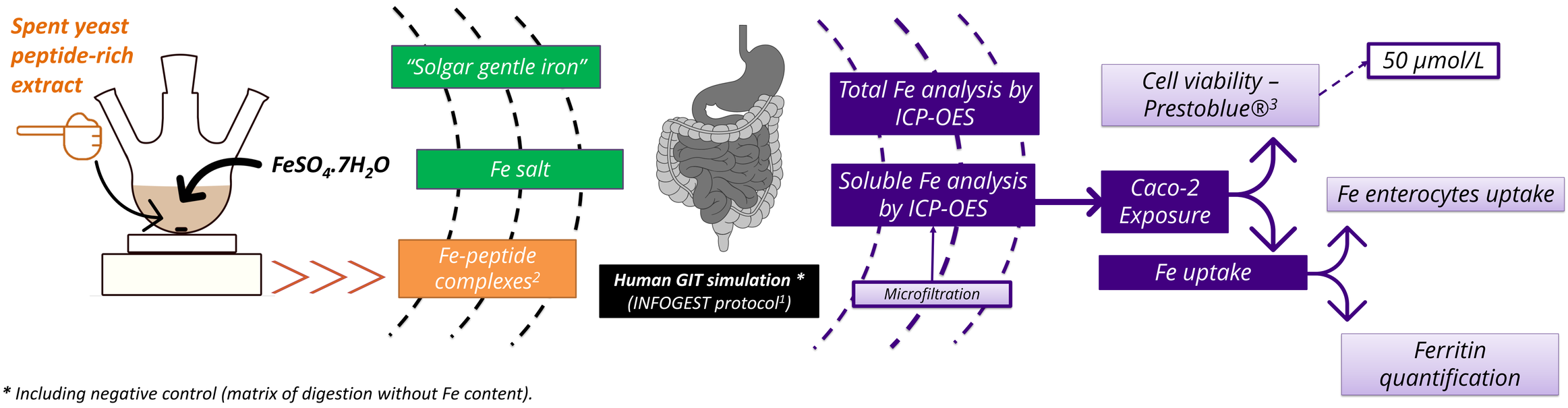
Introduction

Anaemia is one of the most prevalent nutritional diseases worldwide, with iron (Fe) deficiency being its major cause. In fact, the low bioavailability of Fe in diet and its interaction with food compounds is considered the main cause for low absorption in human body. Therefore, dietary Fe supplementation has been used worldwide and peptides have been applied in production of Fe-peptide complexes (CPX) as an alternative to conventional salt-based Fe supplements due to their adverse effects. Fe is mostly absorbed in the first portion of the intestine, namely duodenum and proximal jejunum, by differentiated enterocytes geared for vectorial transport of Fe and other nutrients. Since CPX can improve Fe solubility, they are able to improve its uptake and transport. Considering this, CPX absorption has been assessed *in vitro*, using a Caco-2 absorption model, where INFOGEST[1] digested samples uptake and capacity to stimulate ferritin synthesis were evaluated.

Methods



* Including negative control (matrix of digestion without Fe content).

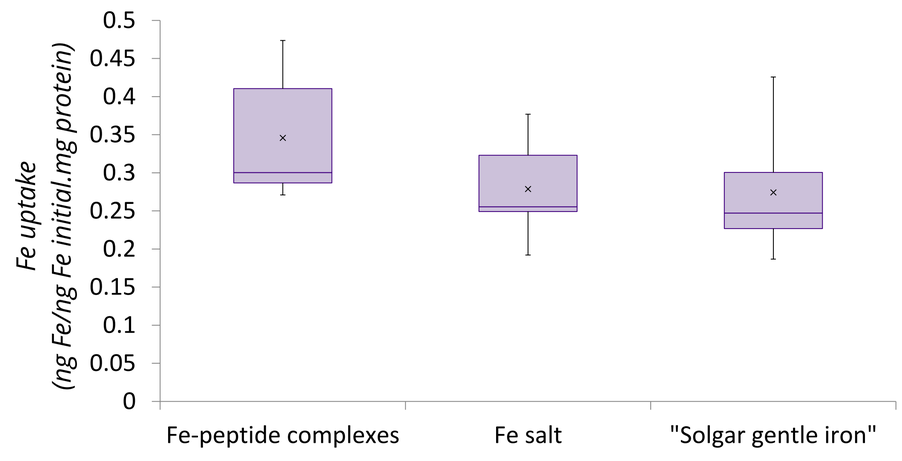
Results

Fe-peptide complexes

- Fe content: 20% (w/w)

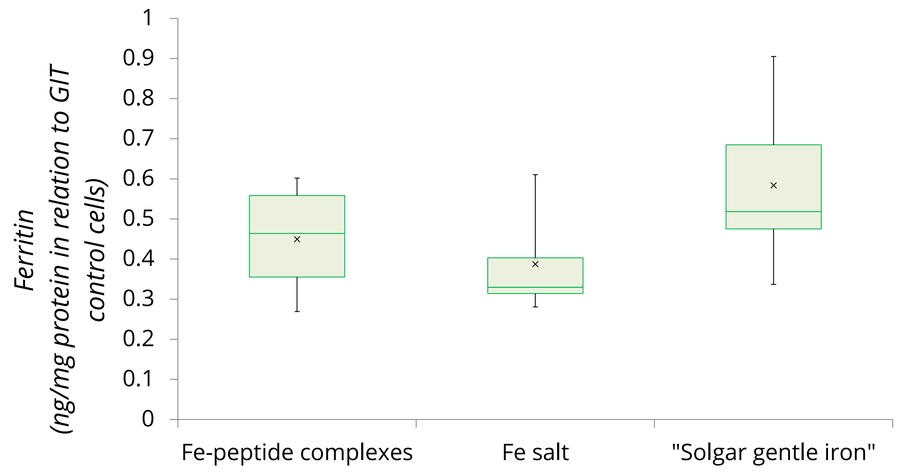
Table 1. *Total and soluble Fe concentrations (mg/L) found in Fe-peptide complexes, Fe salt and "Solgar gentle iron" benchmark subjected to human GIT simulation (n=2).*

	Negative control	**Fe-peptide complexes**	**Fe salt**	**"Solgar gentle iron"**
Total GIT Fe	4.0 ± 0.2	389 ± 10	479 ± 2	307 ± 3
Soluble GIT Fe	0.7 ± 0.1	4.7 ± 0.3	7.0 ± 0.3	98.7 ± 1.1



	Fe-peptide complexes	Fe salt	"Solgar gentle iron"
Average ± standard deviation	0.346 ± 0.090	0.279 ± 0.069	0.274 ± 0.086

Figure 1. *Fe uptake by Caco-2 cells exposed to GIT samples of Fe-peptide complexes, Fe salt and "Solgar gentle iron" benchmark (n=6). In order, minimum, first quartile, median, third quartile and maximum values are shown in the graph, plus mean value (x).*



	Fe-peptide complexes	Fe salt	"Solgar gentle iron"
Average ± standard deviation	0.450 ± 0.152	0.388 ± 0.150	0.584 ± 0.218

Figure 2. *Ferritin production increase by Caco-2 cells exposed to GIT samples of Fe-peptide complexes, Fe salt and "Solgar gentle iron" benchmark in relation to cells exposed to control GIT (no Fe exposure) (n=6). In order, minimum, first quartile, median, third quartile and maximum values are shown in the graph, plus mean value (x).*

Conclusions

In the uptake assay, CPX had a similar behaviour to Fe salt and benchmark. The same result was found considering ferritin synthesis since a increase of this intracellular protein was observed for CPX, Fe salt and benchmark in relation to control cells exposed to GIT matrix (without Fe content). This increase is an evidence of Fe entering in the enterocyte, suggesting its transportation by cell membrane and cell retention, which confirms Caco-2 Fe uptake results. Overall, CPX here described showed potential to be a promising alternative for Fe dietary supplementation since they had a similar performance to those of Fe salt and benchmark (no statistically significant alterations ($p > 0.05$)), without Fe salts disadvantage of Fe binding with food compounds during GIT.

References

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Acknowledgements

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