Influence of raspberry and its dietary fractions on the *in vitro* activity of the colonic microbiota from normal and overweight subjects

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INTRODUCTION

Phenolic compounds become attached to cell walls and act together with the dietary fibre in the large intestine, being metabolized by the gut microbiota. When dietary fibre undergoes the colon fermentation process, this produces short-chain fatty acids (SCFAs), which exert different beneficial effects for human health. Moreover, when the raspberry-phenolic compounds, specifically ellagitannins and ellagic acid, reach the large intestine, they are metabolised by the intestinal microbiota, producing different urolithins. Since gut microbiota plays an important role on catabolite production, acting on food matrix fractions and transforming them into more beneficial compounds, the state of the gut microbiota is very important. In this sense, diseases like obesity are related to dysbiosis of the microbiota, which lead to altered catabolite production. The aim of this study was to investigate whether the whole raspberry and its fractions (phenolic extract, total and insoluble dietary fibre) affect the microbial activity influenced by the faecal inoculum (normal-weight and overweight women).

MATERIAL AND METHODS

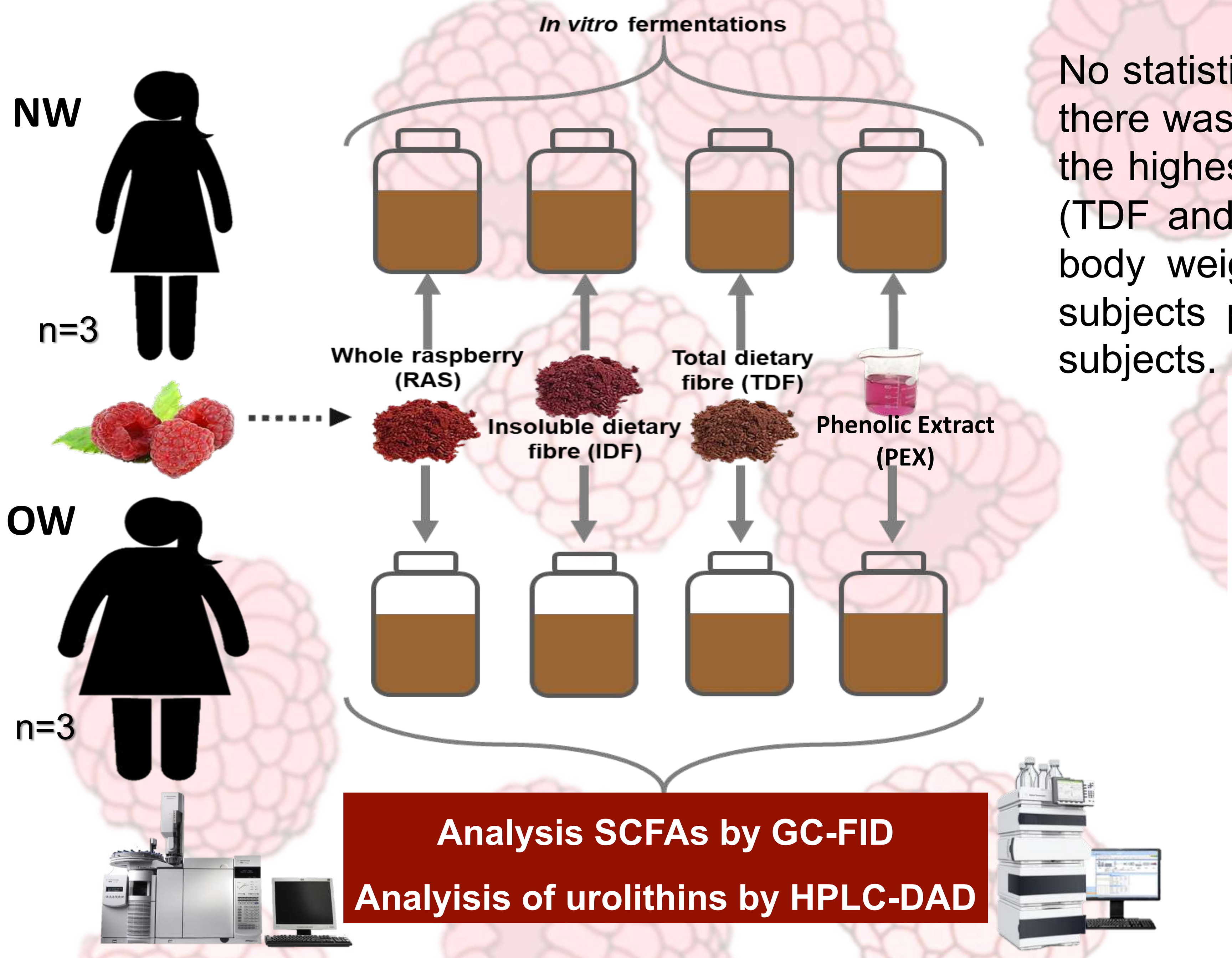

Table 1: Increase (Δ) in short-chain fatty acids (SCFAs) (mmol L^{-1}) produced by human faecal microbiota after 48 h of *in vitro* fermentation with different substrates: RAS (whole raspberry), PEX (polyphenol extract), TDF (total dietary fibre) and IDF (insoluble dietary fibre). Values are expressed as the means ± SD (n =3). Different letters (a–c) indicate significant differences (p<0.05) among the fractions at the same time.*indicates significant differences (p<0.05) between normal-weight and overweight volunteers.

SCFAs	RAS	PEX	TDF	IDF
	Normo-Weight			
Acetate	14.5±5.5 ^{a}	13.3±2.4^{ab}	9.3±4.4^{ab}	6.8±0.9*^{b}
Propionate	3.6±0.5 ^{a}	2.7±0.6 ^{ab}	1.9±1.1 ^{b}	1.6±0.7^{b}
Butyrate	2.6±1.0	2.8±0.2	2.1±0.6	1.9±0.6
Total	20.6±6.7 ^{a}	18.8±1.9^{ab}	13.2±5.6^{ab}	10.4±1.8^{b}
	Over-Weight			
Acetate	22.1±9.1	20.4±10.6	9.3±1.4	9.0±0.1*
Propionate	3.9±2.2	3.6±2.4	1.6±0.4	1.6±0.6
Butyrate	2.5±0.8	2.9±0.6	1.9±0.4	1.9±0.5
Total	28.5±12.0	26.9±13.5	12.8±1.6	12.4±0.3

RESULTS

No statistically significant differences were found in urolithins production (Figure 1), but there was a clear tendency. The faecal incubations with RAS and PEX fraction showed the highest urolithins production than for the incubations with the dietary fibre fractions (TDF and IDF). It could be due to the bioaccessibility of their precursors. As for the body weight condition, it is important to highlight that the faeces of normal-weight subjects produced more urolithins from the fibre fractions than those of overweight subjects.

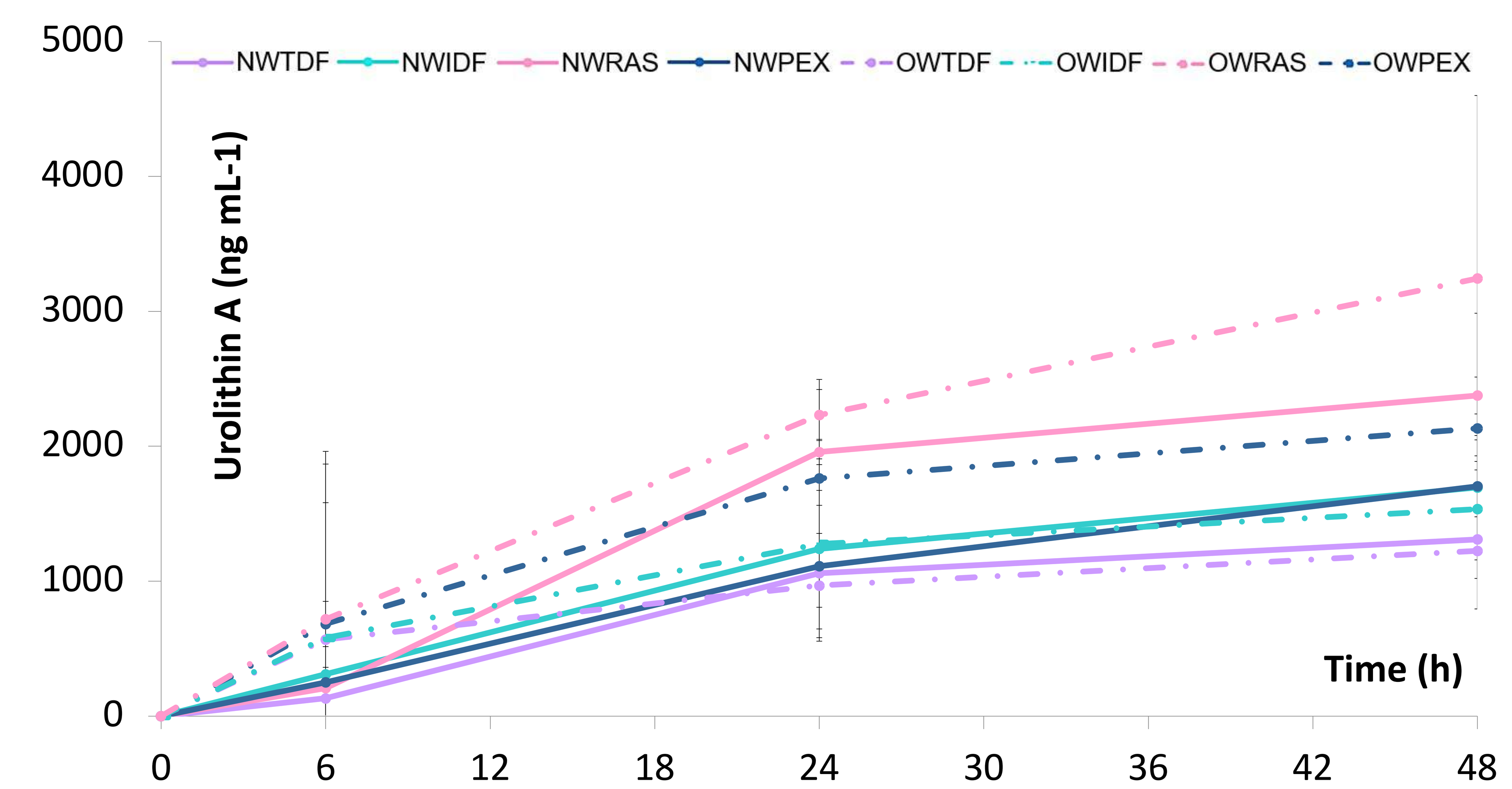

Figure 1: Increase (Δ) in urolithin production (μg mL^{-1}) produced by the faecal microbiota during *in vitro* fermentation with different substrates: TDF (total dietary fibre), IDF (insoluble dietary fibre), RAS (whole raspberry), PEX (polyphenol extract), NW (normo-weight subjects), OW (over-weight subjects). Values are expressed as the means ± SD (n =3).

Table 1 shows that RAS produced the highest amounts of acetate, propionate and total SCFAs, followed by the PEX fraction. These results reveal that the prebiotic effect previously attributed to the fibre content may also be due to the content of phenolic compounds when in vitro fermentation where conducted with faeces from NW subjects. There were no differences between the two study groups regarding the production of SCFAs; with the exception of acetate from IDF fraction.

CONCLUSIONS

The whole raspberry and the phenolic extract produced greater quantities of urolithins and total SCFAs when compared with fibre fractions. The body weight condition was an important factor, since faeces from NW subjects gave rise to greater production of urolithins from fibre fractions. In summary, the whole raspberry has been shown to have a prebiotic effect, mainly due to its phenolic compounds content rather than its fibre content.

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