Effect of carob flour addition on physical and chemical properties of cocoa drink mix powders

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INTRODUCTION

Instant cocoa powder beverages present a form of beverage and a form of commodity at the same time, offering "the cocoa comfort" on one side, as well as antioxidants and health benefits on the other. However, these beverages are mainly comprised of a basic recipe of 70 % sucrose and 30 % cocoa powder, resulting in a very high glycemic index beverage. In this research, by replacing a certain amount of cocoa powder with carob flour and sugar with stevia, new functional powder mixtures with lower glycemic index were produced.

MATERIALS AND METHODS

MIXTURES

- 8 mixtures (70 % sugar + 30 % carob flour)

Sample	Components, % (w/w)
B1	10 % carob + 20 % cocoa +70 % sucrose
B2	20 % carob + 10 % cocoa + 70 % sucrose
B3	30 % carob + 70 % sucrose
B4	10 % carob + 20 % cocoa + 69.7 % g sucrose + 0.3 % stevia
B5	20 % carob + 10 % cocoa + 69.7 % sucrose + 0.3 % stevia
B6	30 % carob + 69.7 % sucrose + 0.3 % stevia
K1	30 % cocoa + 70 % sucrose
K2	30 % cocoa + 69.7 % sucrose + 0.3 % stevia

PHYSICAL PROPERTIES

- Powder Flow Analyser (Stable Micro Systems, Godalming, UK)
- Bulk density

CHEMICAL PROPERTIES

- Total polyphenolic content (TPC)
- Antioxidant capacity (ABTS method)
- Dietary fibre

RECONSTITUTION

- Dispersibility
- Solubility

RESULTS AND DISCUSSION

Table 1. Physical properties of the cocoa/carob mixtures

Sample	d (0.5) [µm]	Bulk density [kg/m³]	Moisture [%]	Cohesion index [mm⁻¹]	Flow stability [/]	Mean cake strength [g]
B1	421.05±28.61	824.58±26.64	1.52±0.07	20.61±2.42	0.79±0.01	169.54±7.94
B2	466.42±6.00	926.18±6.02	1.72±0.09	12.34±0.85	0.94±0.02	82.29±1.66
B3	417.97±7.12	1028.18±11.08	1.97±0.08	8.50±0.04	0.84±0.06	58.88±7.07
B4	463.60±21.15	821.58±11.24	1.49±0.02	17.96±2.42	0.70±0.02	184.79±5.17
B5	292.74±5.83	915.53±13.99	1.74±0.03	11.91±0.45	0.94±0.01	120.57±6.91
B6	373.73±5.38	1000.74±23.57	2.01±0.10	8.17±0.16	0.76±0.09	43.47±5.86
K1	513.77±20.43	739.81±11.55	1.20±0.02	16.08±1.52	0.90±0.09	276.48±9.09
K2	501.69±34.96	749.85±32.35	1.22±0.09	19.52±1.80	0.94±0.09	239.15±3.62

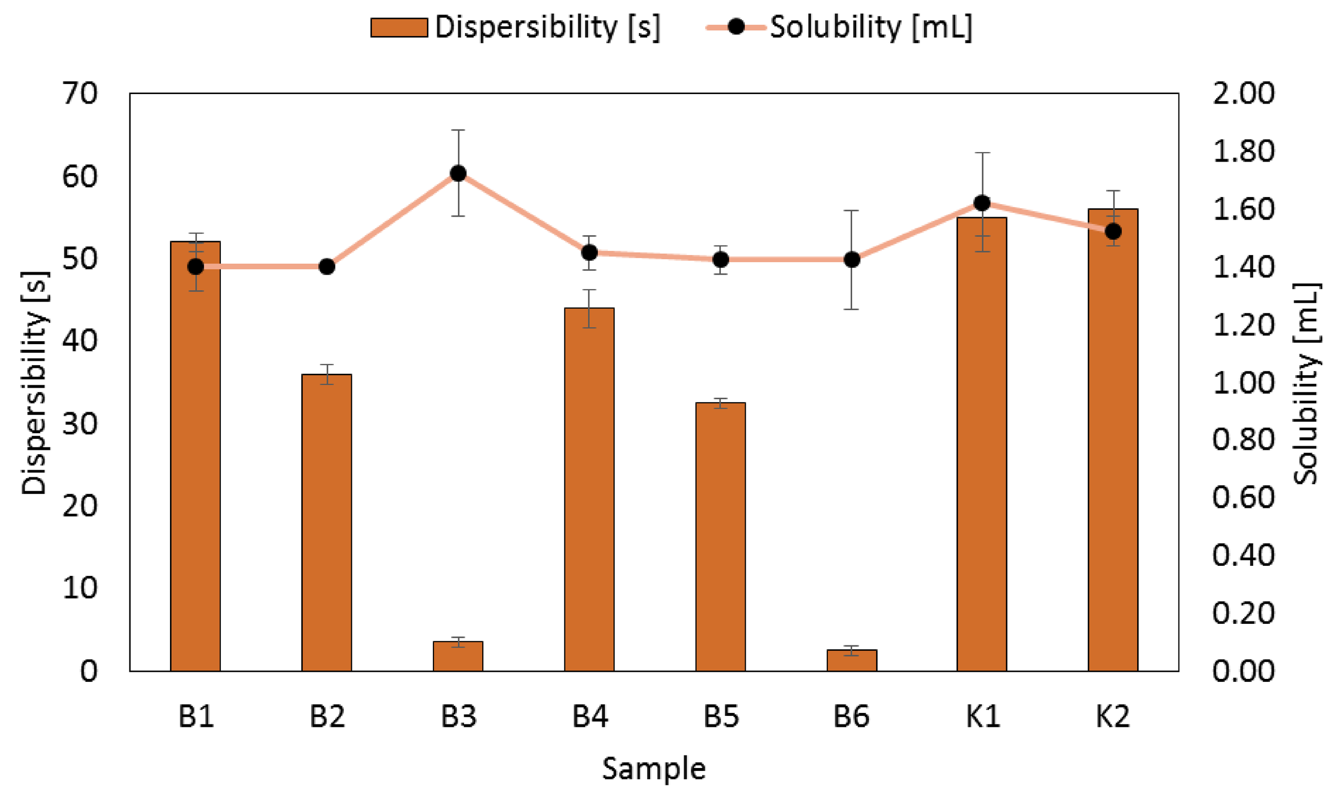

Figure 1. Reconstitution properties of the cocoa/carob mixtures

Based on data shown in Table 1, the median diameter was higher for mixtures which did not contain stevia, since stevia comprised of very small particles which caused a shift of the d (0.5) towards smaller particle sizes. Bulk density was higher for samples with higher amounts of carob flour, as well as the moisture content, in comparison to the K1 and K2 samples which only contained cocoa and sugar. All flow property values (cohesion index, flow stability and mean cake strength) were lower for samples containing more carob flour. As visible in Fig.1., samples with more carob flour had lower dispersibility times, but, when compared to solubility, it can be seen that, although large carob flour particles sink more rapidly below the water surface, they do not dissolve that well.

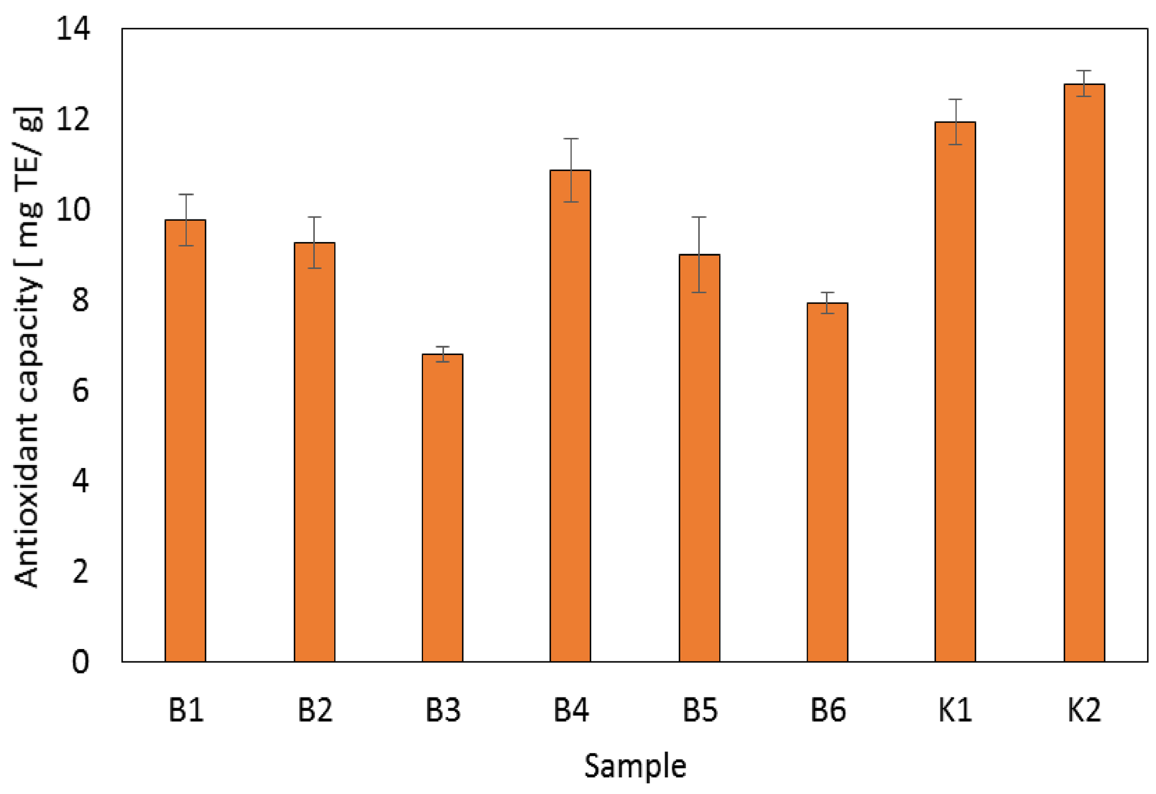

Figure 2. Antioxidant capacity of the cocoa/carob mixtures

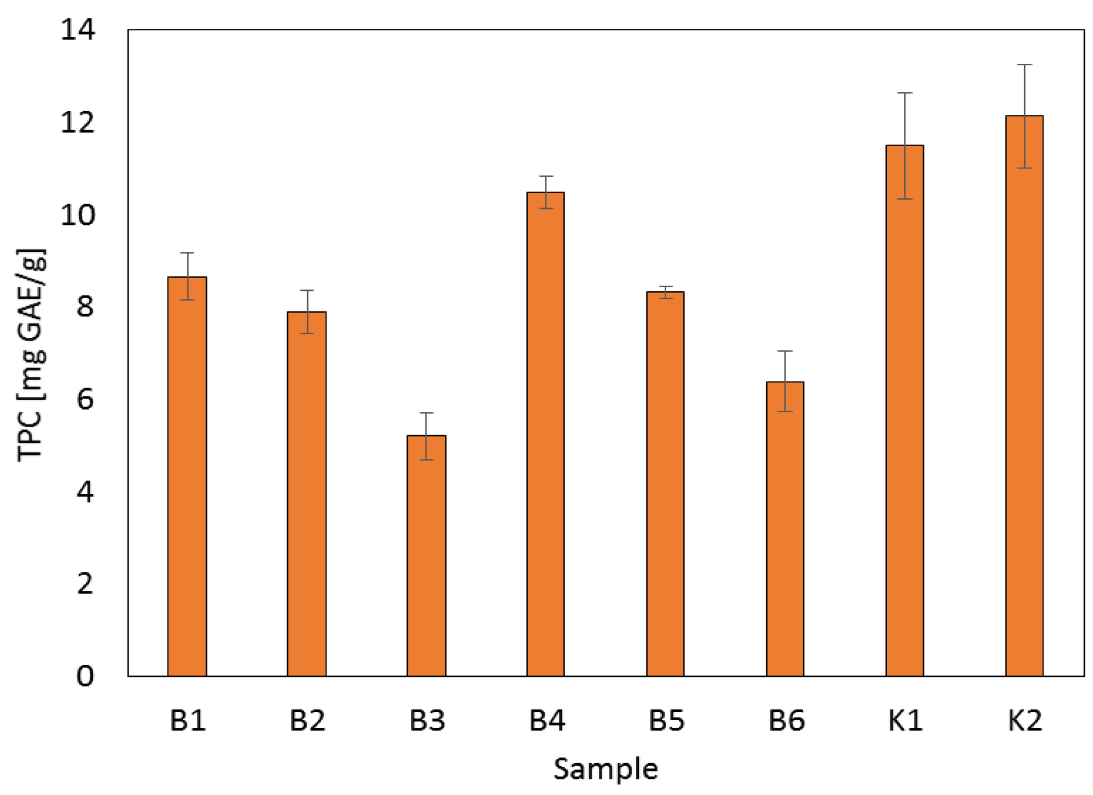

Figure 3. Total polyphenolic content of the cocoa/carob mixtures

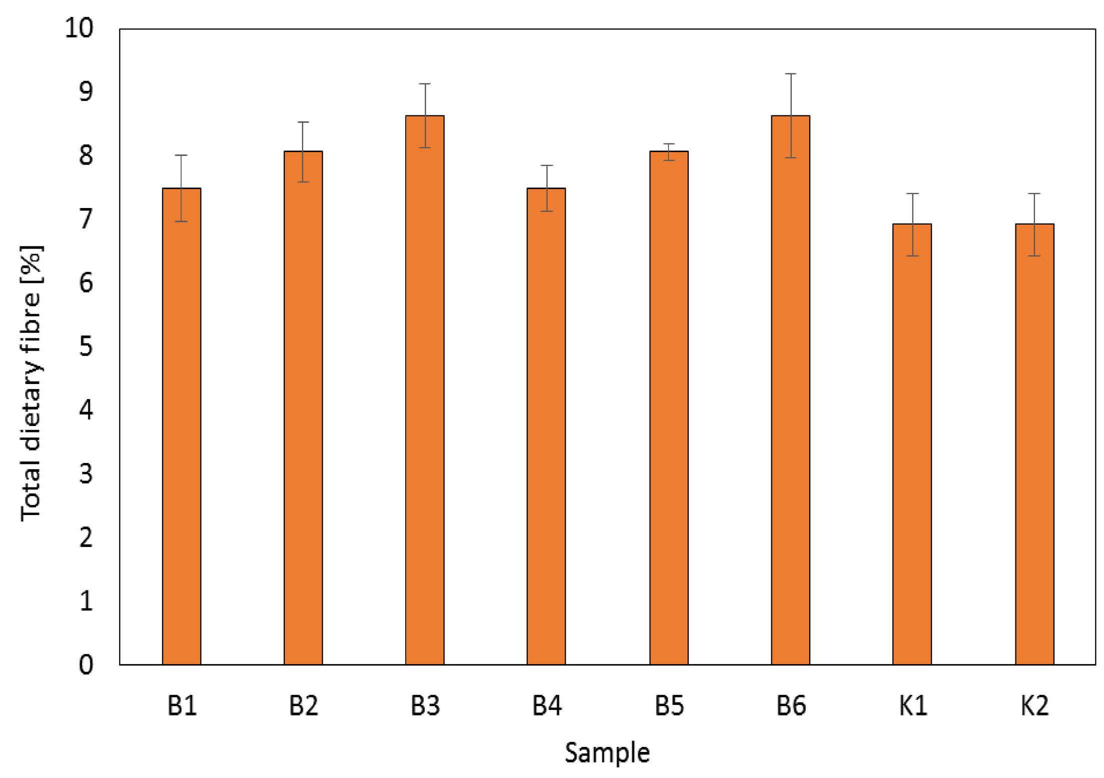

Figure 4. Total dietary fibre of the cocoa/carob mixtures

Replacement of cocoa with carob flour results in reduction of antioxidant capacity (Fig.2.) and total polyphenolic content (Fig.3) in comparison to samples K1 and K2, where cocoa was not replaced by carob flour. An opposite trend was observed with total dietary fiber content (Fig 4.): increase of the amount of carob flour added to the mixtures contributes to a rise in dietary fiber content.

CONCLUSIONS

- Mixtures with a larger percentage of carob flour had lower cohesion index values and mean cake strength
- Carob flour improves dispersibility, but reduces solubility of the mixtures
- Antioxidant capacity and total polyphenolic content dropped with higher amounts of carob flour in the mixtures, while the fiber content was higher for mixtures which contained more carob flour

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