



“Nutritional and Antinutritional composition of three varieties of *Chenopodium quinoa* flour”

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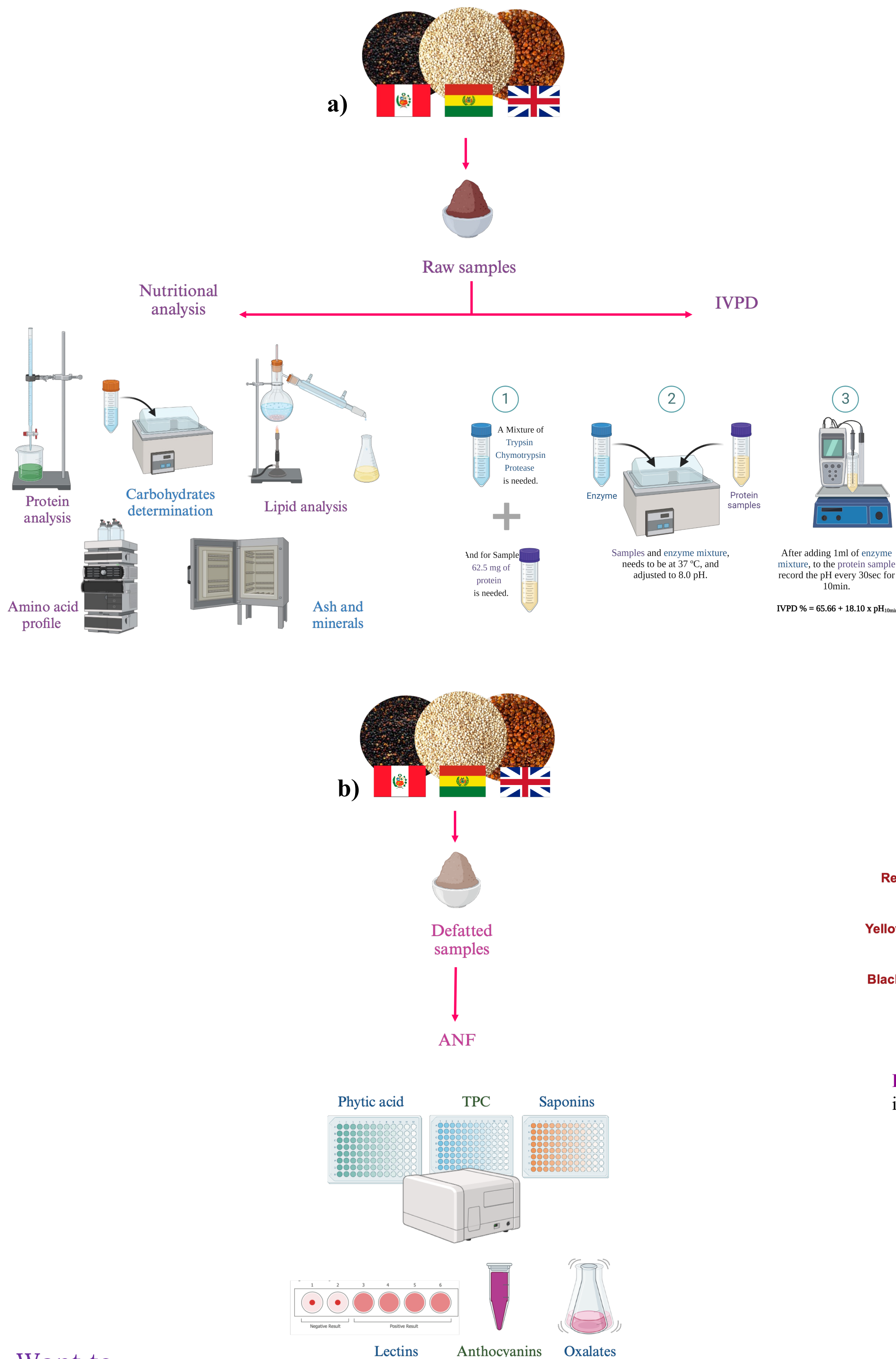
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Introduction

Quinoa (*Chenopodium quinoa*) is a pseudocereal widely consumed due to its high protein content and complete amino acid profile. However, plant sources have the presence of antinutritional factors (ANF), and thus reducing nutrients absorption and digestibility. There is a lack of information regarding some ANF in different quinoa varieties.

For this reason, the **aim** of this study was to assess the nutritional and antinutritional composition of three commercial quinoa varieties (**Black**, **Yellow**, and **Red**) as well as their *in vitro* protein digestibility (IVPD), and protein quality.

Methodology



Results

Table 1. Nutritional composition of **black**, **yellow** and **red** quinoa raw flours.

	Black	Yellow	Red
Moisture (g/ 100g)	11.53 ± 0.07 ^{ab}	12.04 ± 0.12 ^a	10.90 ± 0.13 ^b
Ash (g/ 100g)	2.57 ± 0.10 ^a	2.32 ± 0.11 ^a	2.58 ± 0.74 ^a
Lipid (g/ 100g)	4.62 ± 0.14 ^a	3.48 ± 0.28 ^a	4.39 ± 0.68 ^a
Protein (g/ 100g)	18.74 ± 0.17 ^a	17.27 ± 0.52 ^b	18.26 ± 0.20 ^a
IDF (% w/w)	22.65 ^a	16.83 ^b	14.57 ^c
SDF (% w/w)	0.32 ^c	2.40 ^a	1.58 ^b
TDF (% w/w)	22.97 ^a	19.43 ^b	16.15 ^c
D-glucose (g / 100 g)	50.28 ± 2.45 ^b	57.45 ± 2.63 ^a	59.89 ± 2.63 ^a
D-fructose (g / 100 g)	3.63 ± 0.71 ^a	2.28 ± 0.63 ^{ab}	1.54 ± 0.30 ^c
Total available carbohydrates (g / 100 g)	54.9 ^c	61.6 ^a	59.5 ^b
RS (g / 100 g)	9.05 ^b	8.90 ^b	10.29 ^a
NRS (g / 100 g)	44.36 ^b	45.90 ^a	44.28 ^b
TS (g / 100 g)	53.41 ^b	54.8 ^a	54.57 ^a

Different superscript letter in the same row indicate statistical difference, by One-way ANOVA, and Tukey's multiple range test. Data expressed as mean ± SD, n = 5 (p < 0.05).

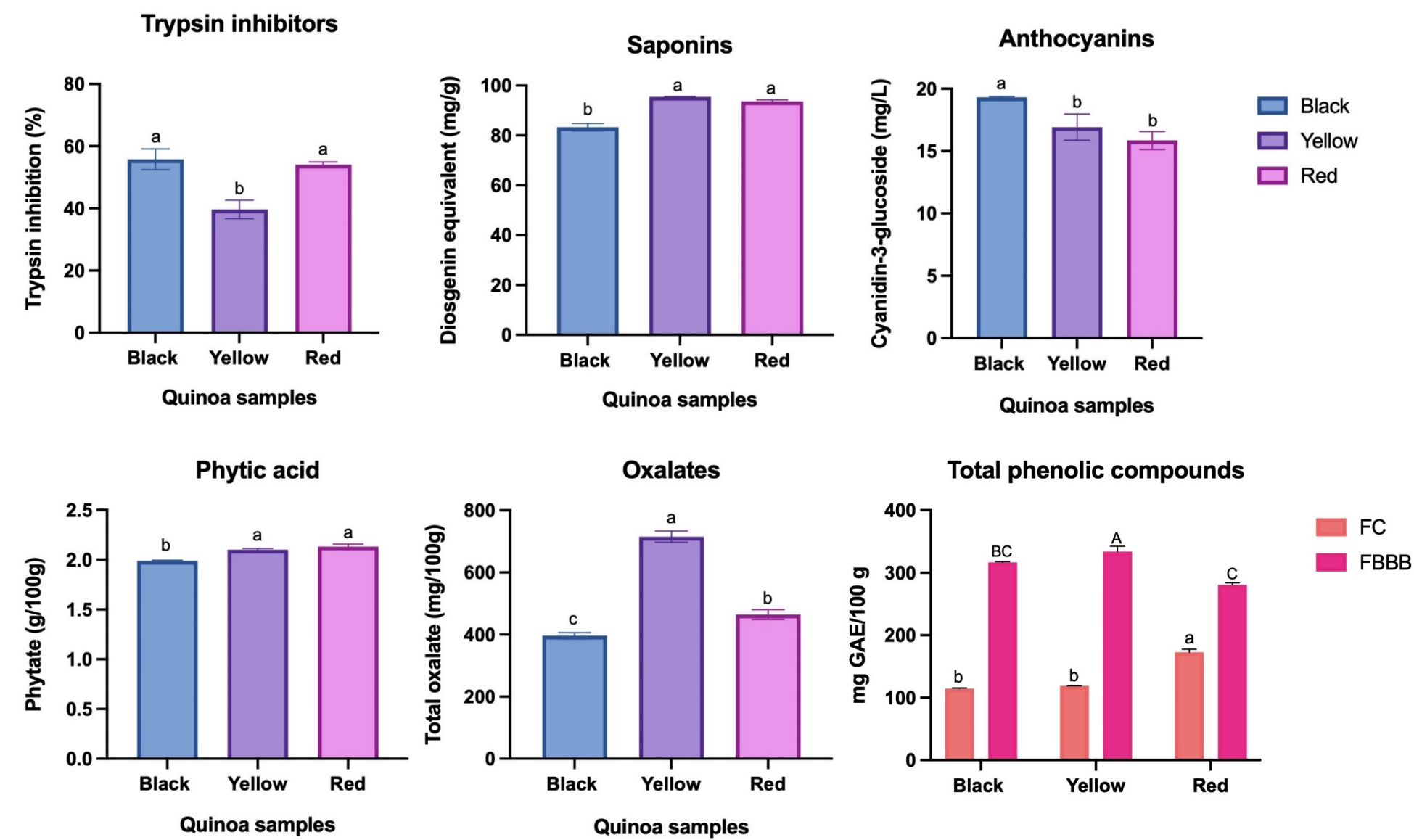


Figure 1. Antinutritional assessment of **black**, **yellow** and **red** quinoa in defatted flours. Different superscript letter between bars indicate statistical difference, by One-way ANOVA, and Tukey's multiple range test. Data expressed as mean ± SD, n = 5 (p < 0.05).

Table 2. Protein quality assessment of **black**, **yellow** and **red** quinoa raw flours.

Quinoa	IVPD (%)	AAS (%)	EAAI (%)	BV	PER ₁	PER ₂	PER ₃	PER ₄	PER ₅	IVPDCAAS
Black	77.69 ^a	156.70	240.87	250.8	2.90	3.00	3.18	2.75	3.14	1.36
Yellow	77.61 ^a	154.91	91.80	88.3	2.77	2.86	2.53	2.67	3.14	1.53
Red	76.90 ^b	155.60	57.35	50.7	2.87	2.95	2.75	2.69	3.12	1.00

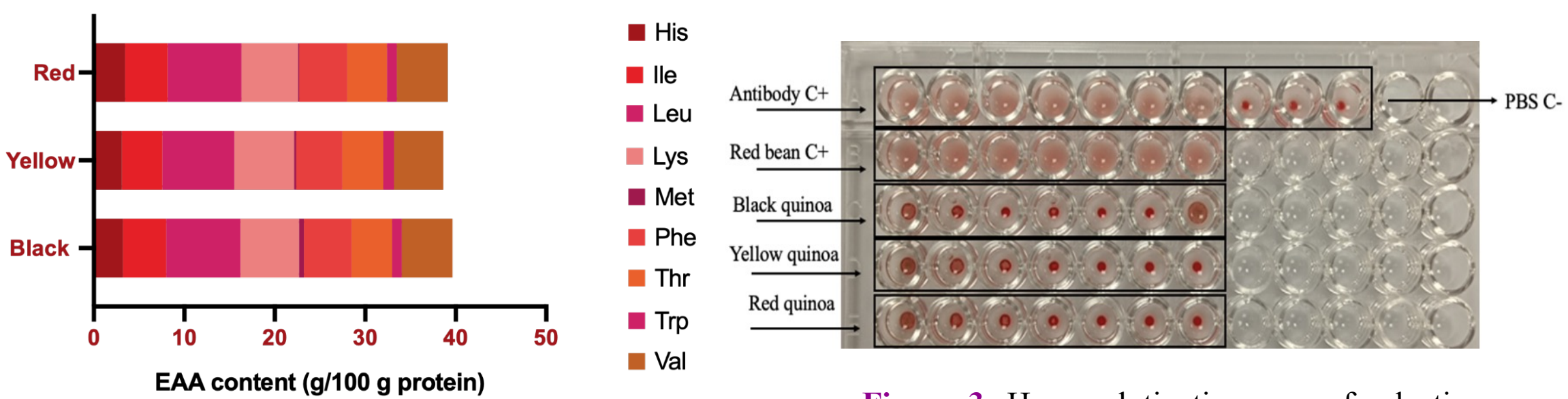


Figure 2. Comparison of essential amino acids in three varieties of quinoa.

Figure 3. Hemagglutination assay for lectin detection in quinoa.

Conclusion

In general, the results showed that **black**, **yellow**, and **red** quinoa flours are high in TDF and digestible starch. Dietary fiber has beneficial effects in digestibility, and lowering glucose in the bloodstream. Overall, the amino acid profile of the three quinoa varieties fulfils the FAO/WHO requirements (2011). In conclusion, although quinoa presents high content of trypsin inhibitors, oxalates and saponins, that can reduce protein digestibility these are rich protein plant sources and moderate protein digestibility values.

References



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