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Influence of processing on physicochemical and antioxidant activity in tea and extracts of *Hibiscus sabdariffa* and *Rosa* spp. powder vs. petals/calyces

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Introduction

Rose (*Rosa* spp.) and roselle (*Hibiscus sabdariffa*) petals and calyces are rich in antioxidants and phenolic compounds.

This study investigated the impact of physical form and processing time on the physicochemical characteristics and antioxidant properties of tea infusions and ethanolic extracts prepared from rose and roselle respectively.

Materials and Methods


A


B


C

Parameter	Details
Samples	Rose (A) and roselle Sudan (B) and roselle Nigeria (C) (petal/ calyx and powder)
Preparation	Tea infusion (3,5, 10 mins at 100°C). Ethanolic extract (60% ethanol at 20°C for 24, 48, and 72 hours)
Analysed for	Antioxidant activity, phenolic compounds, pH, and sugar
Equipment	HPLC-TOF, spectrophotometer, and HPLC.

Results

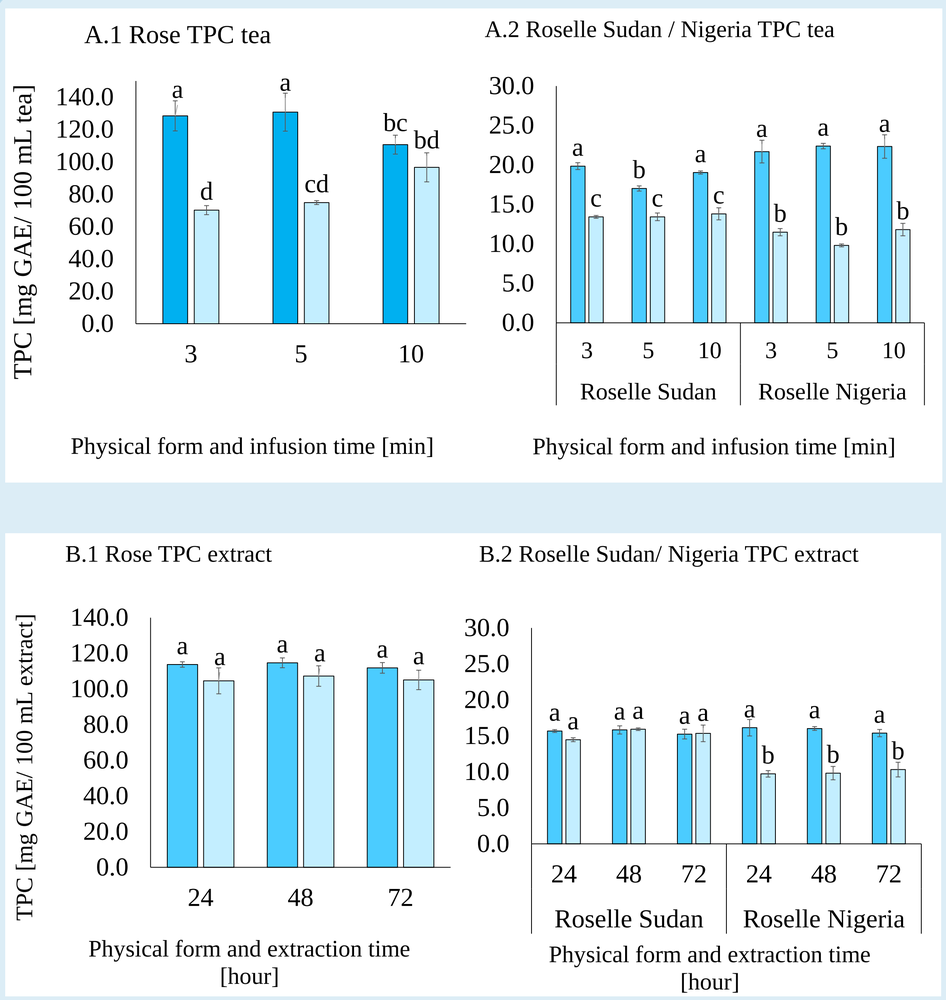

Figure 1. Effect of physical form (powder and petal/calyx) and infusion time (3, 5, and 10 minutes) for tea, and extraction time (24, 48, and 72 hours) for extracts on the antioxidant activity as total phenolic content (TPC) of rose (A.1 and B.1), roselle Sudan, and roselle Nigeria (A.2 and B.2). Dark blue bars denote (powder) and light blue bars (petal/calyx). Bars represent mean ± standard deviation (n = 3) Significant differences ($p \leq 0.05$ by Tukey's HSD test) are marked with letters.

Table 1. Tentatively identified main phenolic compounds found in rose petals and roselle calyces measured with LC-MS/MS in negative ion mode.

Peak	ret. time [min]	wavelength [nm]	MS [M-H]$^-$ *[m/z]*	MS/MS *[m/z]*	compound
rose					
1	10.52	520	627	285/267/355/193/465/303	cyanidin-3-(6''-feruloylglucoside)
2	14.44	520	641	479/317/300/193	peonidin-3-(6''-feruloylglucoside)
3	21.06	320	785	301/483/633	pedunculagin
4	24.28	320	291	247/191/145/219	brevifolinic carboxylic acid
5	27.79	320	953	301/425/785	rugosin B
6	32.27	320	469	300/172	ellagic acid glucoside
7	45.80	370	300	300	ellaic acid
8	49.76	370	463	300	isoquercetin
roselle					
1	12.51	520	595	301	delphinidin 3-sambubioside
2	14.85	320	353	191	neochlorogenic acid
3	16.54	520	579	284	cyanidin 3-sambubioside
4	20.48	320	353	191	chlorogenic acid
5	21.25	320	707	353/191	chlorogenic acid dimer
6	22.17	320	707	353/191	cryptochlorogenic acid dimer
7	32.23	370	611	316	isorhamnetin-3-sambubioside
8	40.61	370	595	300/179/271	quercetin-3-sambubioside

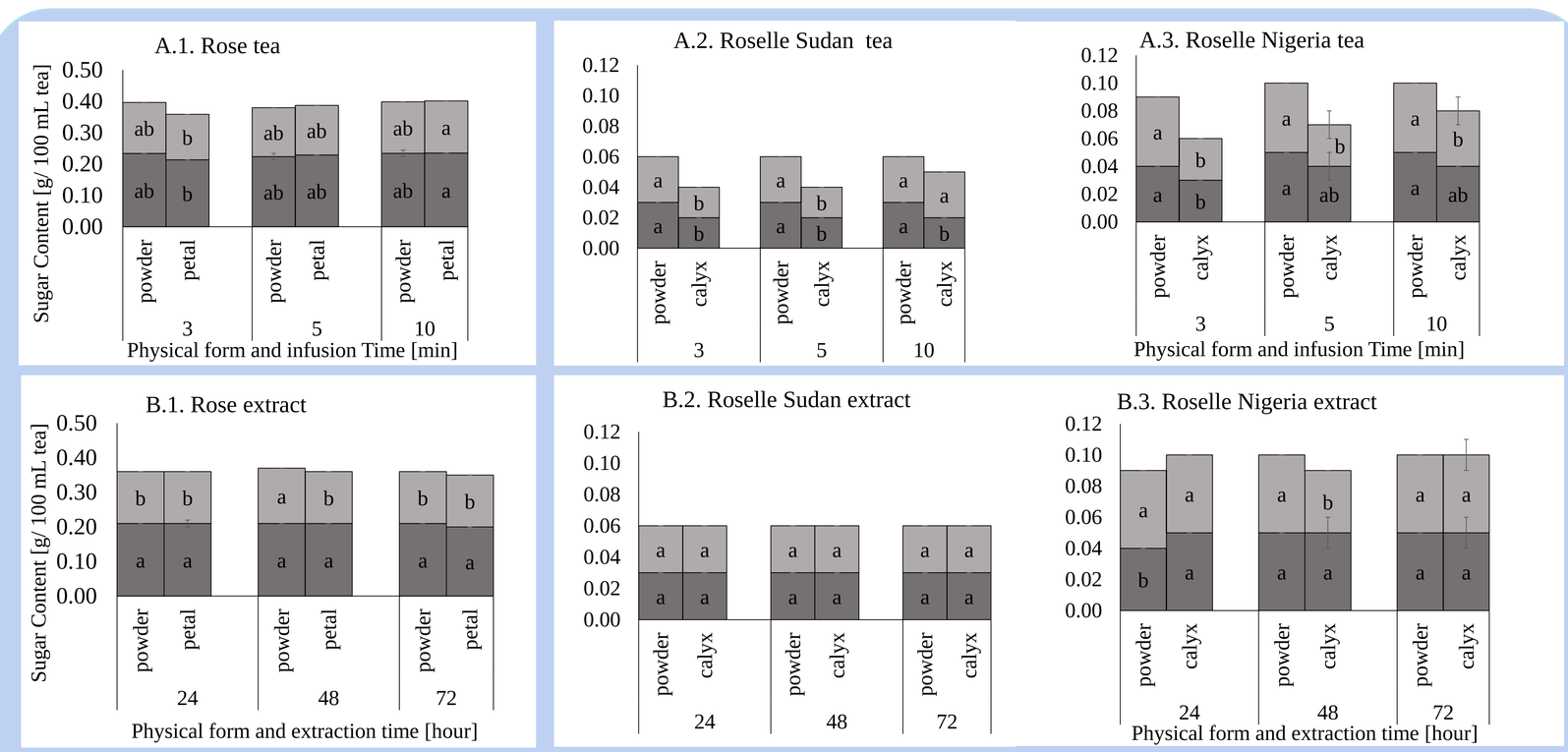

Figure 2. Effect of physical form (powder and petal/calyx) and infusion time (3, 5, and 10 minutes) for tea on sugar content of rose (A.1), roselle-Sudan (A.2), and roselle-Nigeria (A.3) tea and extraction time (24, 48, and 72 hours) for extracts on sugar content of rose (B.1), roselle-Sudan (B.2), and roselle Nigeria (B.3) extract. Black bars denote (powder and grey bars (petal/calyx). Bars represent mean ± standard deviation (n = 3) Significant differences ($p \leq 0.05$ by Tukey's HSD test) are marked with letters.

Conclusions

- Overall, powdered forms consistently yielded higher concentrations of phenolic compounds than intact petals and calyces, particularly with longer extraction or infusion durations. Surface area and cellular disruption facilitate better compound release.
- Identification of phenolic compounds in rose and roselle supports the view that both plant materials offer health-promoting properties, though with distinct biochemical signatures.
- Sugar content was more in rose tea and lower in its extract. In roselle, it was more in roselle Nigeria tea and extract compared to roselle Sudan tea and extract.
- These findings support the inclusion of rose and roselle in functional foods, such as fortified biscuits, teas, or beverages, to enhance both nutritional and antioxidant value.

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