

A Comparison of the Polyphenolic and Antioxidant Properties of Cold versus Hot Brew Black Tea (*Camellia Sinensis*, *Theaceae*)

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Introduction

Tea

- Originated in China
- Four main types (black, green, oolong and white tea) due to different processing methods
- All varieties comes from *Camellia Sinensis* (L.) plant
- Antioxidant capacity: Significantly affected by steeping time and temperature of tea
- New trend in coffee and tea market: Cold brewing
- New innovations of cold brew tea products



Figure 1. Black tea (hot brew)



Figure 2. Black tea (cold brew)

Justification

- Oxidative stress: Main cause of cancer, cardiovascular diseases, diabetes and inflammatory diseases
- Antioxidants: Protects body by neutralizing activity of free radicals
- Black tea: Has flavonoids and polyphenolic compounds that are shown to reduce symptoms of chronic diseases
- Cold brew: Received attention of millennials and provides good taste of tea with more antioxidants without giving bitterness or caffeine (Dobos, 2017)
- Cold brew and hot brew black tea may have different polyphenolics and antioxidant levels which may affect their bioactive properties

Specific Objectives

- Quantify in vitro polyphenols (flavonoids and phenolics) in cold and hot brew black tea
- Determine effects of different brewing methods on in-vitro antioxidant capacity of black tea using 1, 1-Diphenyl-2-picryl-hydrazyl (DPPH) radical assay

Method

Tea Brewing: 2g of each cold brew and hot brew tea brewed in 230 mL of cold (4 °C) and hot (100°C) water for 5 minutes respectively

Antioxidant Tests:

- Phenolics Content Test:** Used Follin-Ciocalteu's reagent, Gallic acid standards and absorbance at 750 nm (Marinova, Ribarova, & Atanassova, 2005)
- Flavonoids Content Test:** Used Catechin standard and absorbance at 510 nm (Marinova et al., 2005)
- DPPH Radical Test:** Used DPPH radical solutions and absorbance at 517 nm (Priyanka, Kadam, Kadam, Ghule, & Aparadh, 2013)
- Data Analysis:** Used Mann-Whitney test and $p < 0.05$

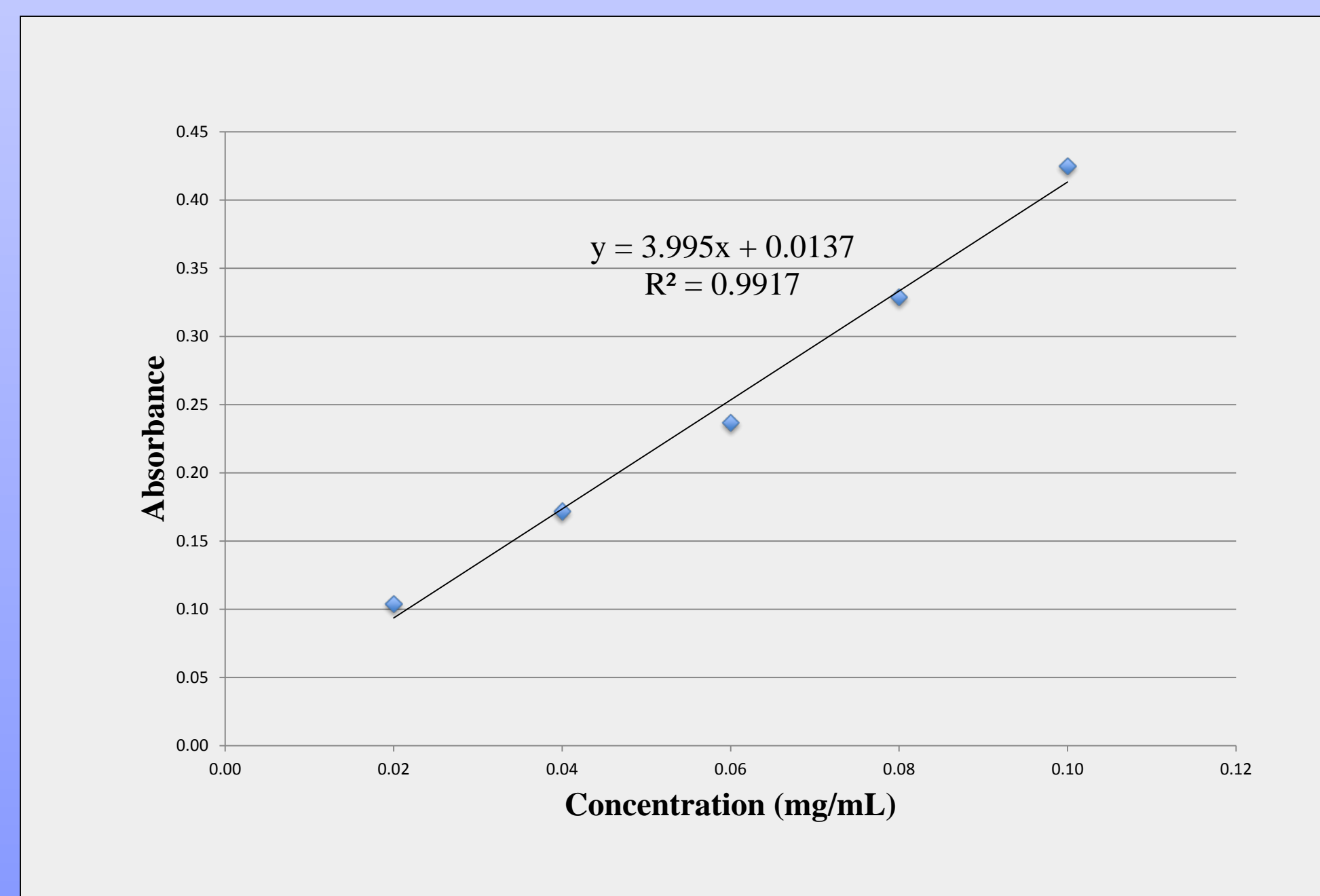


Figure 3. Standard curve for total phenolics content

Tea brew type	Total phenolics content (mg/mL gallic acid equivalents (GAE)/100 g or mg/230 mL GAE/100 g)	Total flavonoids content (mg/mL catechin (CE) equivalents/100 g of extract or mg/230 mL CE/100 g)	DPPH: Free radical scavenging activity (%)
Cold Brew Tea	0.19 OR 43.7	0.40 OR 92.0	86.3
Hot Brew Tea	0.43 OR 98.9	1.01 OR 232	88.1

Figure 5. Polyphenolics content results of cold brew and hot brew black tea

Results and Discussion

Phenolics Content:

Cold brew had lower amount of total phenolics than hot brew black tea

Had significant difference in total phenolics content between cold brew and hot brew black tea

Flavonoids Content:

Cold brew had lower amount of total flavonoids than hot brew black tea

Had significant difference in total flavonoids content between cold brew and hot brew black tea

DPPH Radical Scavenging Activity:

Both cold and hot brew black teas scavenged DPPH radical in almost same capacity

Had significant difference in DPPH activity between cold brew and hot brew black tea

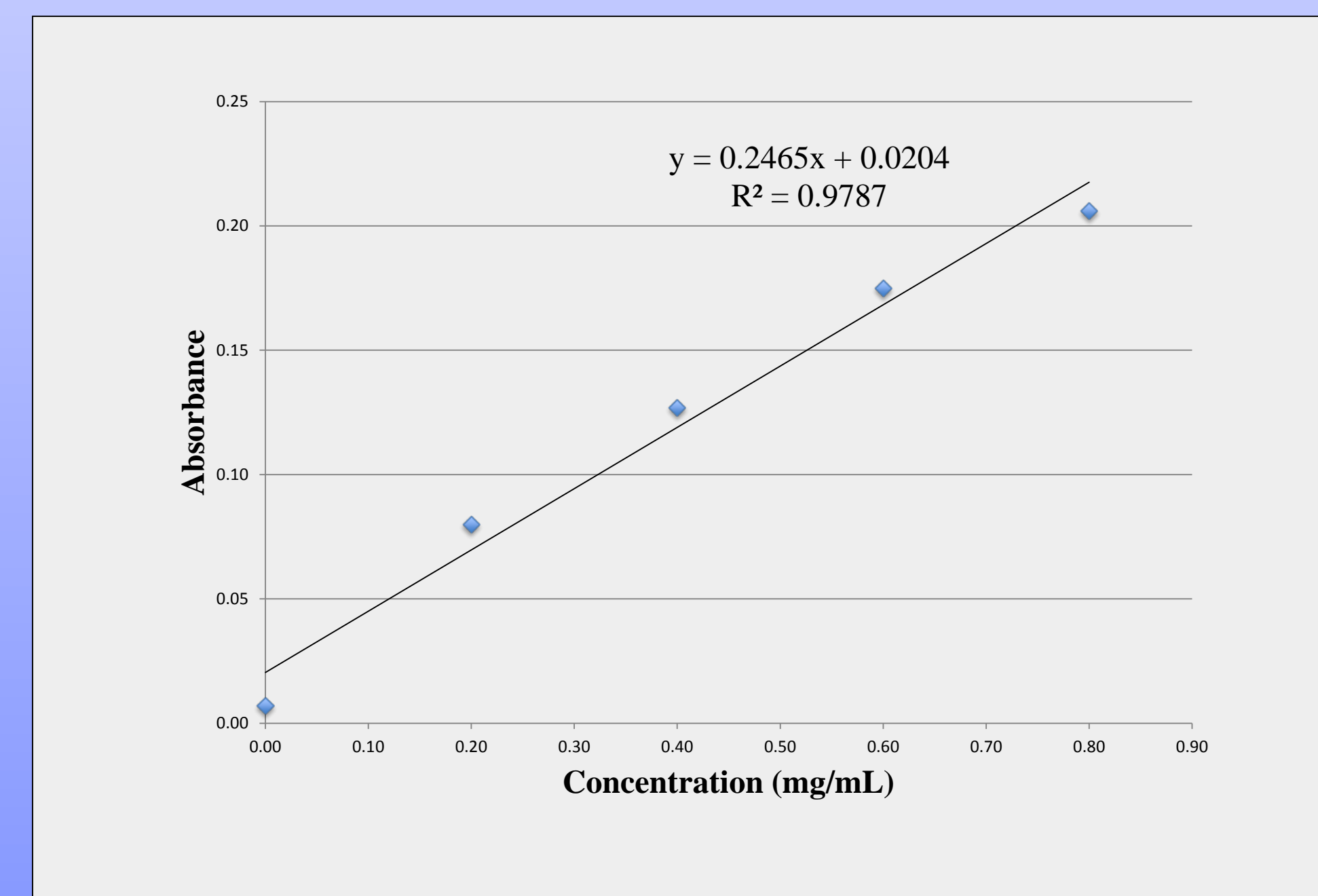


Figure 4. Standard curve for total flavonoids content

Antioxidant test	Cold brew mean \pm SD	Hot brew mean \pm SD	P- value
Phenolics Test	0.78 \pm 0.04	1.74 \pm 0.10	0.004
Flavonoids Test	0.12 \pm 0.01	0.27 \pm 0.02	0.004
DPPH Radical	0.61 \pm 0.06	0.53 \pm 0.01	0.016

Figure 6. Mann-Whitney test comparing polyphenolics properties of cold brew and hot brew black tea

Conclusion

- Cold brew had lower levels of phenolics and flavonoids compared to hot brew black tea.
- Both scavenged DPPH radical in nearly same capacity
- Had significant differences in total phenolics, flavonoids and DPPH activity between cold brew and hot brew black tea.

Implications & Practical Applications

- Cold brew as a new alternative to traditional hot brew tea
- Useful for consumers to know about amount and quality of tea antioxidants to acquire desired health benefits.

Selected References

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