ANTIOXIDANT CONTENT AND ANTIOXIDANT ACTIVITY OF COLD AND HOT AQUEOUS EXTRACT OF *Curcuma longa*

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Abstract

This study was designed to determine the effect of cold and hot extraction on the antioxidant content and antioxidant activity of Curcuma longa. 10 g of coarsely powdered C. longa was macerated for 48hrs and concentrated at 45c, 10 g of coarsely powdered C. longa was also heated at 100c in water for 20 min to obtain the hot extract. Total phenolic content, total flavonoid content, DPPH activity and ABTS activity was assessed for the different extracts. The result showed that, the Hot extract of C. longa had a higher total phenolic content, total flavonoid content and ABTS activity at 45.00%, 30.65% and 44.93% respectively compared to the cold extract which had 22.43%, 20.61% and 31.14% respectively. However, the DPPH activity for the C. longa extract was higher in the cold extract at 36.23% compared to the hot extract (21.31%). Results from this study reveals that temperature rise affects the antioxidant qualities of C. longa, increasing the extraction temperature had a significant impact on C. longa activity, as evidenced by an increase in antioxidant content and activity.

Keywords: Phenols, Temperature, Antioxidants

Introduction

Spices have always been sought for and highly prized. Spices have various applications, including seasoning bland dishes, adding flavor to an otherwise repetitive diet, and acting as preservatives. (Gottardi et al., 2016). They were utilized in drinks as well as in medicine. Studies have shown that culinary spices and herbs can improve heart health, cognition, and weight management, as well as improve diet quality by making healthier meals more appealing to consumers. *C. longa* has long been utilized in the Orient for illness prevention and treatment.(Prasad & Aggarwal, 2011).

Turmeric has been shown in vitro studies to be a powerful antioxidant, anti-inflammatory, antimutagenic, antibacterial, and anticancer agent. Turmeric extracts can scavenge free radicals, boost antioxidant enzymes, and reduce lipid peroxidation as an antioxidant. (Cohly et al., 1998). Curcumin, a phenolic compound, is the main bioactive ingredient in the turmeric extract and is widely consumed as part of the curry mix and dietary supplements, which exhibit anti-inflammatory effects on health (Schneider et al., 2015).

Food processing has a significant impact on quality, safety, storage, and final ingredient properties. In this regard, heat-related chemical processes in home cooking may weaken or change these bioactive molecules' antioxidant and antibacterial properties. Curcuminoids, for example, are sensitive to high temperatures, extended drying times, extraction, processing, and storage. (Suresh et al., 2007).

Addressing this problem will have practical health benefits to the consumers of turmeric and contribute to the understanding of its' behavior during processing. There is a need to investigate the effect of cold and hot extraction of *C. longa* on its antioxidant properties *a*nd established the optimum temperature at which its antioxidant capacity and activity is active the most.

2.0 Methodology

Collection and preparation of plant material

The rhizomes of *C. longa* were collected at Agege market, Agege, Lagos state. The fresh rhizomes were washed with running tap water and air-dried for 3 weeks to avoid deterioration of phytochemical constituents. The dried rhizomes were milled into a coarse powder using a grinder and was kept in a polythene bag.

Maceration

10g of coarsely powdered *C. longa* was placed in a stoppered glass (Containing Distilled water) to submerge solid matrix and allowed to stand at room temperature for a period of 48 hours with frequent agitation until the soluble matter has dissolved. The mixture was trained, and filtered by using a sieve, a mesh of 200mm (the damp solid material) was pressed with a muslin cloth and the combined liquid are clarified by filtration after standing (Handa et al., 2008).The concentration of the extract was done using a rotary evaporator at 45℃, and evaporated to dryness at 45c.

Decoction

10g of coarsely powdered *C. longa* was placed in a clean container. Water was poured on the rhizome and stirred, to which heat was applied at 100℃ for about 20 minutes.

Qualitative analysis

Determination of Total flavonoid Content (TFC)

The TFC of each extract was investigated using the aluminum chloride colorimetry. In brief, the extract sample was diluted with methanol until 100 mg/Ml. The calibration curve was prepared by diluting quercetin (QR) in methanol (100 mg/mL). The diluted extract or quercetin (2.0 mL) was mixed with 0.1 mL of 10% (w/v) aluminum chloride solution and 0.1 mL of 0.1 mM potassium acetate solution. The mixture was kept at room temperature for 30 minutes. Then the maximum absorbance of the mixture was measured at 415 nm using a UV/VIS spectrophotometer (Yoo et al., 2008)

Determination of Total Phenolic Content (TPC)

The TPC in the bark extracts were estimated using Folin–Ciocalteu reagent (Gao et al., 2000) In the reaction mixture containing 50 µl of plant extract, 250 µl of freshly prepared Folin–Ciocalteu reagent, 0.75 ml of 20% sodium carbonate, and 3 ml of pure water. The mixture was left to stand at ambient temperature for 2hrs, the absorbance at 765 nm was measured and used to calculate the phenolic contents using gallic acid as a standard.

Antioxidant Assay

DPPH radical scavenging activity

Radical scavenging activity of the plant extract was determined by method described by Loizzo et al., (2010). 1.5ml of 0.1 mM methanol solution of DPPH was added to tubes containing 1.5 ml of cold and hot extract of *C. longa* and shaken vigorously. The tubes were allowed to stand at 27°C for 30 min. The control was prepared as the same without any extract. The changes in the absorbance of the prepared samples were measured at 517 nm. Radical scavenging activity was estimated as the inhibition percentage using the following formula, (Loizzo et al., 2010). Radical scavenging activity %

$$= \frac{\text{ABS of blank} - \text{ABS of sample}}{\text{ABS of blank}} \times 100 \qquad (1)$$

ABTS radical scavenging assay

ABTS Radical Scavenging Activity Assay In this assay, the 2,2-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS) solution was mixed with potassium persulfate and left in the dark for 12 h before use (Loizzo et al., 2010). Samples 10 µL were added to the ABTS methanol solution (1 mL), and the absorbance at

734nm was measured after 6 min. Ascorbic acid was the positive control. The ABTS radical scavenging ability was calculated with equation (1) above.

3.0 Result

Antioxidant Content

Total Phenolic Content

Table 3 .1: Showing the Total Phenolic Content in Cold and Hot Extract of Turmeric

Conc	CTE (%)	HTE (%)
0.5 mg/ml	10.5	31.00
1.0 mg/ml	22.43	45.38

CTE – Cold Turmeric Extract at 45° C

HTE - Hot Turmeric Extract at 100° C

Total Flavonoid Content

Table 3.2: Showing the Total Flavonoid Content in Cold and Hot Extract of Turmeric

Conc	CTE (%)	HTE (%)
0.5 mg/ml	20.61	30.65
1.0 mg/ml	51.13	41.59

Antioxidant Activity

DPPH scavenging activity

Table 3.3 Shows the percentage DPPH scavenging activity of the cold and hot extract.

Conc	CTE (%)	HTE (%)
0.5 mg/ml	36.23	21.31
1.0 mg/ml	29.47	15.21

ABTS scavenging activity

Table 3.4: Shows the percentage ABTS scavenging activity of the cold and hot extract.

Conc	CTE (%)	HTE (%)
0.5 mg/ml	21.19	36.17
1.0 mg/ml	31.14	44.93

4.0 Discussion

Plant phenolic components are believed to play a role in cancer, chronic disease, and coronary heart disease prevention. They are frequently utilized as antioxidants and can operate as free radical scavengers and metal ion chelators. Some of them are more potent antioxidants than the typical antioxidants, vitamins C and E. (Rice-Evans et al., 1997). Table 3.1 displays the total phenolic content of *C. longa* extract extracted at various temperatures. The phenols from turmeric treated with an increase in temperature had a substantial rise compared to the extract treated with a low temperature (Khatun et al., 2006), reported an increase in the radical scavenging activity of turmeric after heating, this may due to glycosides that get hydrolyzed to form aglycone, and Some aglycones are known to have a more active potential for antioxidant activity than their glycosides (Shahidi et al., 1992).

Flavonoids are plant pigments that are responsible for plant color and have health-promoting properties due to their strong pharmacological potential as radical scavengers(Cook, 1996). Table 2 displays the total flavonoid content of turmeric extract after thermal treatment. The findings demonstrate that the flavonoid content increased with increasing temperature. According to (Temitope et al., 2010) heat treatment of turmeric at 100°C for 1 hour increases total phenolic content, total flavonoids, and antioxidant activity.

The DPPH assay was used to determine the radical scavenging activity of turmeric extract when it is cold and also when heat is applied. Result showed that there was increase scavenging activity in the cold extract (36.23%) when compared to the hot extract (21.31%) for the hot turmeric. The result shows that there is a decrease in the radical scavenging activity of the hot extract compared to the extract without heat.

The ABTS assay evaluates the ability of antioxidants to scavenge ABTS in aqueous phase to that of a Trolox standard. As demonstrated in Table 3.4 the extract's radical scavenging activity increased with increasing temperature. These findings demonstrate that the heated extract of *C. longa* retained its antioxidant content and activity. The radical-scavenging activities of spices remained after boiling, suggesting that the active components are relatively stable during thermal cooking at about 100℃

5.0 Conclusion

It is often difficult to determine if the antioxidant activity of spices is kept or eliminated when temperature rises. This study reveals how temperature rise affects the antioxidant qualities of *C. longa* and at what temperature it is best employed. In conclusion, increasing the extraction temperature has a significant impact on *C. longa* activity, as evidenced by an increase in antioxidant content and activity.

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