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Pharmacological Evaluation and Investigation of Anticancer Properties of *Curcuma caesia* Roxb (Black Turmeric) in HeLa Cell Line

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ABSTRACT

Curcuma caesia Roxb. (black turmeric) is a perennial rhizomatous herb of the family Zingiberaceae, widely distributed in India and traditionally used by indigenous communities as a spice, food preservative, colouring agent, and therapeutic remedy for various ailments. Despite its rich ethnomedicinal background, scientific data pertaining to its pharmacological properties, drug-likeness, safety profile, and mechanistic attributes remain limited. The present study was therefore undertaken to comprehensively evaluate the antioxidant, anti-inflammatory, antimitotic, cytotoxic, and anticancer properties of an aqueous rhizome extract of *C. caesia*. Preliminary phytochemical screening confirmed the presence of a wide spectrum of secondary metabolites including alkaloids, flavonoids, tannins, saponins, glycosides, phenols, quinones, coumarins, proteins, and carbohydrates-suggesting a strong bioactive potential. Antioxidant activity assessed via the DPPH free radical scavenging assay demonstrated notable efficacy, with the extract exhibiting an IC_{50} value of 0.9142 mg, indicating the presence of potent radical neutralizing compounds. Anti-inflammatory activity, evaluated by protein denaturation inhibition, resulted in an IC_{50} of 0.605 mg, reflecting the extract's ability to stabilize proteins under stress conditions. The antimitotic potential of the extract was analyzed using *Allium cepa* root meristem assays, which revealed dose-dependent inhibition of cell division. At a concentration of 250 µg, the extract showed a maximum of 51.42% inhibition, accompanied by a significant reduction of the mitotic index from 52.87 in the control group to 25.68. Cytotoxicity evaluation using MTT assays revealed selective toxicity, with an IC_{50} of 112.5 µg in Vero (normal) cells and a markedly lower IC_{50} of 9.36 µg in HeLa cervical cancer cells, indicating strong anticancer potential with minimal effects on normal cells. Overall, the findings highlight *Curcuma caesia* Roxb. as a promising source of bioactive compounds with significant antioxidant and anticancer properties, warranting further investigation for therapeutic development.

1. Introduction

Cancer of the cervix has been the most important concern among women in the past two decades. In India the peak age for cervical cancer incidence is 55–59 years. Though population-based registries in India show a decline in cervical cancer, it continues to remain a major public health problem for women. Every year approximately 67,477 of the 122,844 women diagnosed with cervical cancer die from the disease in India alone [1]. Chemotherapy is one of the main modalities available for cancer treatment but they are reported to exhibit toxicity towards normal tissues and possess undesirable adverse effects, also leading to drug resistance. Use of medicinal plants was perhaps the oldest method of coping with sickness. They are easily metabolized in the body and hence provide a less toxic, safer, novel and effective mode of treatment. Modern medicine and alternative therapies have a special place for the use of traditional medicinal plants to treat cancer. More than 60% of the anticancer drugs used today come in some way from natural sources. This means that plant products are becoming more and more important in cancer treatment [2].

Curcuma is a Zingiberaceae genus. It includes 70 species of wild and cultivated rhizomatous herbs in Southeast Asia. *Curcuma caesia* is an Indian perennial with bluish-black rhizomes. *Curcuma caesia* (Black Turmeric) is also found in Andhra Pradesh's Papi Hills, East Godavari, West Godavari, and Khammam. *Curcuma caesia* rhizomes are valuable due to their medicinal properties. Rhizomes are used to treat haemorrhoids, leprosy, asthma, cancer, epilepsy, fever, wound, vomiting, menstrual disorder, anthelmintic, aphrodisiac, inflammation, gonorrheal discharges, etc., [3]. The part of the rhizome that is closest to the ground is bluish-black and smells sweet because it has essential oil [4].

In the past, the roots of the *Curcuma caesia* Roxb. have been used to treat leucoderma, tumours, asthma, piles, bronchitis, and many other conditions. The paste is used to treat bruises, cuts, and pain from rheumatism. Fresh rhizome decoction is used to stop diarrhoea and ease stomach pain. Fresh rhizome paste of *Curcuma caesia* is applied to wound caused by snake and scorpion bites [5, 6]. The aim of this study is to investigate and evaluate the antioxidant potential, anti-inflammatory activity, antimitotic properties, cytotoxicity and anticancer potential of aqueous rhizome extract of *Curcuma caesia* Roxb. (black turmeric).

2. Experimental Methods

2.1 Plant Material

The Rhizomes of *Curcuma caesia Roxb* (black turmeric) were procured from Sunshine Agro Industries in Indore, Madhyapradesh and authenticated at the Siddha Central Research Institute, Ministry of AYUSH, Govt. of India, Chennai.

2.2 Preparation of Aqueous Herbal Extract

Fresh rhizomes were thoroughly washed in running tap water and again washed in double distilled water, sliced and shade dried for 10 days. Dried rhizomes were then ground to a fine powder using blender and sieved to obtain the crude extract. 5 g of the crude extract was suspended in 50 mL of distilled water in conical flask. The flask was kept in orbital shaker for 2 hours. The contents were then transferred to a petri plate and heated at 60 °C on a hotplate. Dry powdered extract was recovered and stored in vials for further analysis [7].

2.3 Phytochemical Screening

About 2 g of powdered crude sample was suspended in 50 mL of distilled water. The test solution was subjected to qualitative screening to

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detect major phytochemicals, namely phenols, alkaloids, flavonoids, saponins, tannins, glycosides, steroids, resin, quinones, protein and carbohydrate [8]. 100 mg of aqueous herbal extract was made up to 100 mL of distilled water and used for further analysis.

2.4 Assessment of In-Vitro Antioxidant Activity

2.4.1 DPPH Radical Scavenging Activity

The DPPH radical scavenging activity of extract was determined by the method of (Brand-Williams W, 1995) with some modifications [9]. 0.1 mM solution of DPPH methanol was prepared. This solution (1 mL) was added to 3 mL of extract in methanol at different concentrations (250-1000) µg. The mixture was shaken vigorously and allowed to stand at room temperature for 30 minutes. The absorbance was measured at 570 nm by using colorimeter. Reference standard compound being used was ascorbic acid and experiment was done in triplicates.

2.4.2 2,2'-azino-bis(3-ethylbenzthiazoline-6-sulphonic Acid (ABTS) Scavenging Activity

ABTS radical scavenging activity of extract was determined according to the method of Re et al. [10]. Briefly, ABTS radical cation was produced by mixing ABTS stock solution (7 mM in methanol) with 2.45 mM potassium persulfate and allowing the mixture to stand in the dark at room temperature for 12–16 h before use. Then, ABTS radical solution was diluted with ethanol to an absorbance of 0.7 at 734 nm. To 3.0 mL of diluted ABTS radical solution, 30 µL of different concentration (1000 – 3000 mg) of extract in ethanol was added and after 1 min, the decrease in absorbance was measured at 734 nm calorimetrically.

2.5 Assessment of In-Vitro Anti Inflammatory Activity

Method of Mizushima and Kobayashi was followed with minor modifications. The reaction mixture consisted of test extract at different concentrations and 1% aqueous solution of bovine serum albumin fraction. pH of the reaction mixture was adjusted using small amount of 1N HCl. The samples were incubated at 37 °C for 20 minutes and then heated at 57 °C for 20 minutes. After cooling the samples, the turbidity was measured spectrophotometrically at 660nm. The experiment was performed in triplicates. Percent inhibition of protein denaturation was calculated as follows [11],

$$\text{Percentage inhibition} = \frac{\text{Abs (control)} - \text{Abs (sample)}}{\text{Abs (control)}} \text{ x } 100$$

2.6 Mitosis Study: Allium cepa Root Tip Assay

It was performed according to the method described by Grant and Fiskesjö [12, 13]. Locally available *Allium cepa* bulbs were washed, unscaled and grown over 50 mL of tap water filled in plastic cups for 48 hours. The water was changed daily. Selected bulbs with roots of approximately 2 to 3 cm were treated with 10 mg/mL concentration of aqueous extract of *Curcuma caesia* for next 48 hours. A "control" and "standard" were also maintained for the same duration where selected bulbs were grown in 50 mL plain water and 10 mg/mL concentration of cisplatin respectively. At the end of the treatment period, the length of the roots was measured and the number of roots was counted. The root tips from each group (control, standard and treated) were cut and fixed in ethanol : glacial acetic acid (3:1 v/v) for 15 min thereafter, they were hydrolyzed at 50 °C in 1 N HCL for 15 min after which they were washed with distilled water. The root tips were then squashed on a microscope slide and stained with acetocarmine for 30 min. Excess stain was removed and cover slips were carefully placed on the smear. In each slide, chromosome morphology and the number of mitotic and total meristematic cells were counted in 5-8 filed using high power (100x) light microscope and mitotic index (MI) was calculated.

$$\text{Mitotic Index} = \frac{\text{Number of dividing cells (P,M,A,T)}}{\text{Total number of cells}} \times 100$$

$$\text{Mitotic Inhibition (\%)} = \frac{\text{Mitotic index of control} - \text{Mitotic index of Extract}}{\text{Mitotic index of control}} \text{ x } 100$$

2.7 Anti-Proliferative Activity: In Vitro Anticancer Activity (HeLa cell line) and Cytotoxicity Studies (Vero cell line): HeLa Cell line

HeLa cell lines were obtained from National Centre for cell sciences, Pune (NCCS). The cells were maintained in minimal essential media supplemented with 10% FBS, Pencillin (100 U/mL) and streptomycin (100 µg/mL) in a humidified atmosphere of 50 µg/mL $C0_2$ at 37 °C.

9.5 grams of MEM was dissolved in 950 mL of pre-sterilized double distilled water and mixed well. 2.2 g of sodium hydrogen carbonate was dissolved in 50 mL of pre-sterilized double distilled water and mixed well. Both bottles were sterilized at 15 lbs, 121 °C, for 15 min. Cooled down to room temperature. 0.3 g of L-glutamine was weighed and dissolved in 10 mL of pre-sterilized double distilled water and poured. 1 mg of each antibiotic, namely, streptomycin, penicillin G and amphotericin B, was dissolved separately in 1 mL of pre-sterilized double distilled water. pH was checked and adjusted to 7.2 - 7.4 with diluted HCl. All the contents were syringe filtered and stored at 4 °C.

2.7.1 MTT ASSAY

The cancer activity of samples on HeLa and VERO cells were determined by the MTT assay [14]. Cells (1×10^5/well) were plated in 0.2 mL of medium/well in 96-well plates and incubated in 5 % CO_2 incubator for 72 hours. Then, added various concentrations of the samples in 0.1% DMSO for 48, 24 hrs at 5% CO_2 incubator. The images were viewed under inverted microscope 40x and the images were captured. After removal of the sample solution, 20 µL/well MTT reagent was added and incubated at 37 °C for 4-6 h. Then 1 mL of DMSO was added. Viable cells were determined by the absorbance at 540 nm. 50% inhibition of cell viability (IC-50) value was determined graphically. The effect of the samples on the proliferation of HeLa and VERO cells was expressed as the % cell viability, using the following formula [14],

% cell viability = (A540 of treated cells / A540 of control cells) × 100%

3. Results and Discussion

The rhizomes of *Curcuma caesia* provided 27.6% of dry powder from the freshly weighed (851 g) rhizomes. Phytochemical analysis is of paramount importance in identifying new sources of therapeutically and industrially valuable components in traditional medicinal plants. In the present investigation, the primary and secondary metabolites were qualitatively and quantitatively analyzed in the crude black turmeric rhizome extract [15].

Table 1 Phytochemical screening of the crude extract

S. No.	Phytochemicals	Name of test	Inference
1	Alkaloids	Hagerr's test	+
2	Flavonoids	Alkaline reagent	+
3	Glycosides	Legal's test	+
		Borntrager's test	+
4	Saponins	Foam test	+
5	Tannins	$FeCl_3$	+
7	Steroids	acetic anhydride	-
8	Phenol	ferric chloride	+
9	Resin	copper sulphate	-
10	Coumarin	Alc. potassium hydroxide	-
11	Quinones	Alc. potassium hydroxide	+
12	Anthocyanin	HCl and ammonia	-
13	Diterpenes	copper acetate	-
14	Protein	Ninhydrin test	+
15	Carbohydrate	Benedict's test	+
		Molisch's test	+
		Ninhydrin test	+

The results presented (Table 1) reveal the presence of maximum number of plant constituents such as alkaloids, flavonoids, tannins, saponins, glycosides, phenols, quinones, proteins and carbohydrates. The amount of total phenolics, flavonoid and flavonol content and the total antioxidant capacity is presented in Table 1.

The author Siriwantanmetanon [15] has demonstrated the cytotoxicity of polyphenols on a range of cancer cells. Their antioxidant properties were also assessed. Anticancer activities of polyphenols are probably due to their apoptosis inducing properties. The polyphenols are thought to mobilize copper ions which are bound to chromatin inducing DNA fragmentation, thereby initiating apoptosis. The author Cao [16] identified and looked at the anticancer effects of flavonoids on human lung cancer cells (A456 cell line) from the fern species *Dryopteris erythrosora*. They found flavonoids to demonstrate cytotoxicity on cancer cells and to have high free radical scavenging activity. Purified flavonoids have also shown anticancer activities against other human cancers including; hepatoma (Hep-G2), cervical carcinoma (Hela) and breast cancer (MCF-7) [17].

3.1 In Vitro Antioxidant Activity

In ethanopharmacological and nutraceutical investigations, free radical scavenging assays are used to understand the role of plants in minimizing the oxidative stress linked pathophysiology of diseases [18].

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Table 2 shows the effect the rhizome extract has on the percentage inhibition of DPPH and ABTS radicals present in the reaction mixtures, respectively. The aqueous is an effective free radical scavenger. The extent of scavenging DPPH and ABTS radicals is found to be dose dependent. In DPPH assay, the IC-50 value was found to be 914.2 µg/mL.

There is a steady increase in the percentage of inhibition even at low concentrations as shown above. It is observed that the aqueous rhizome extract possesses significant free radical scavenging potential which might be due to the presence of high content of polyphenolic compounds.

Table 2 Dpph Assay and Abts Assay

DPPH Assay		ABTH Assay	
Concentration (µg)	% Inhibition	Concentration (µg)	% Inhibition
0.25	15.49	50	20
0.5	30.5	60	24
0.75	44.79	70	28
1	53.63	80	33
1.25	65.28	90	67
		100	77

3.2 In Vitro Anti-Inflammatory Activity

Numerous biological activities (Table 3) have been attributed to Ginger. Besides being used as a spice and flavoring agent worldwide, the plants of the family Zingiberaceae are an essential and frequently available source of anti-inflammatory constituents, which can be used to prevent the occurrence of cancer as well as to combat various forms of these diseases [19-21].

Table 3 Inhibition of albumin denaturation

Concentration (µg)	% Inhibition
0.5	11.292
1	25.91
1.5	63.85
2	86

3.3 In Vitro Anti Mitotic Activity

Plants of the family Zingiberaceae or the ginger family have been known as the remedy for medicinal ailments in the traditional system of medicine since time immemorial. In cancer treatment, herbals with cytotoxic and anti-mitotic activity will be of immense clinical benefits. Fig 1 shows the antimitotic activity of Curcuma caesia was growing the *Allium cepa* bulbs in varying concentrators of the aqueous rhizome extract.

Table 4 Average root length and number in control and treated root tips after 48 h

Concentration (µG)	Root Length (Standard)	Root No. (Standard)	Root Length (Extract)	Root Number (Extract)
75	2.81	51	3.2	56
100	2.7	42	3.0	40
150	2.69	39	2.8	39
200	2.58	37	2.4	36
250	2.8	33	1.9	34

Table 4 shows the average root length and root numbers in the beakers having various concentrations of the standard and the extract. It can be seen that both the root number and the length reduce with increase in concentration of extract and standard. However, there is a significant reduction in the root length treated by the extract when compared to the standard cisplatin.

Table 5 Mitotic inhibition in onion roots

Concentration (µg)	Mitotic Index	Inhibition(%)
Control	52.87	1.5
Standard (75)	1.44	100
75	47.88	9.438
100	44.64	15.56
150	39.62	25.06
200	35.38	33.08
250	25.68	51.42

Table 5 shows the mitotic index in control, standard and various concentrations of the herbal aqueous rhizome extract after a period of 48 hours. It is evident from the results that the mitotic index reduces with increase in the concentration of the extract while there is notable inhibition of cell division in the meristematic cells and seems to be concentration dependent. These findings suggest interference with cell cycle progression and mitotic spindle activity, supporting its potential role in suppressing abnormal cell proliferation.



Fig. 1 Allium cepa bulbs showing the effect of extract (*Curcuma caesia*) on various concentration of root length after incubation

Table 6 Measurement of cell viability using MTT assay on vero and Hela cell lines

S. No.	Concentration of the extract µg/mL	% cell Viability (Vero cell lines)	% cell Viability (HeLa Cell lines)
1	500	12.5	1.4
2	250	24.4	2.9
3	125	47.2	6.6
4	62.5	68.5	15.5
5	31.2	77.1	29.6
6	15.6	87.4	42.2
7	7.8	98.4	54.0
8	DMSO	98.4	97.7
9	Control Cells	100	100

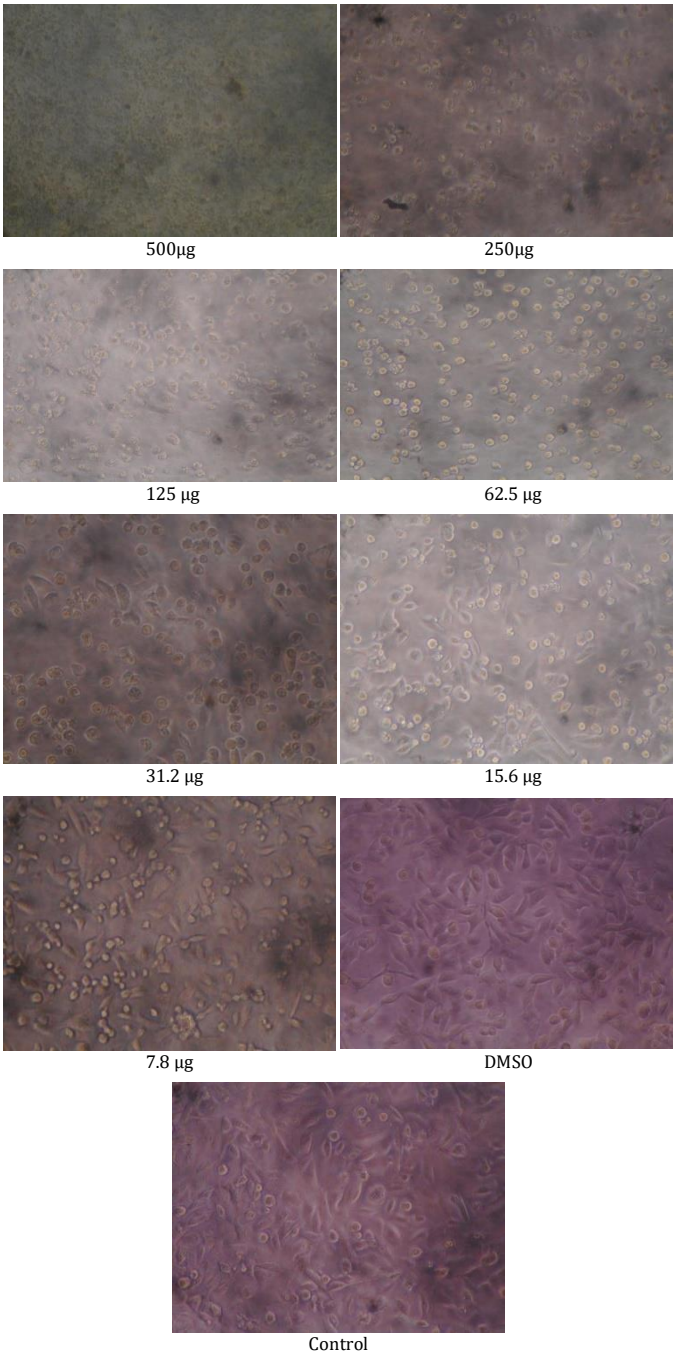


Fig. 2 Cell viability in Hela cancer cell line

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3.4 Determination of MTT Assay

MTT assay is a colorimetric assay used to measure cellular metabolic activity as an indicator of cell viability, proliferation and cytotoxicity (Table 6 and Fig. 2). It is based on the ability of NADPH dependent enzymes to reduce MTT to form a purple colour. Cell viability is a measure of healthy cells that can grow and divide. Proliferation is a vital mechanism in understanding the cell survival mechanism. Measuring the cell viability and cytotoxicity is essential for the development of new drugs in the treatment of cancer. MTT assay was performed on two cell lines. Vero cell lines were used the check the cytotoxicity of the drug towards normal cells while HeLa cell lines, the first ever isolated immortal human cells, were used to study the effect of the extract on cervical cancer cells [22].

4. Conclusion

The cell viability values, the images and the IC-50 values clearly show that the extracts have potent anti-cancer activity. In conclusion, the present study shows that rhizome extract of *Curcuma caesia* Roxb. shows promising anticancer activity. Further studies are needed to isolate the active principles present in it to improve the efficacy of the herbal drug.

References

[1] A. Sreedevi, R. Javed, A. Dinesh, Epidemiology of cervical cancer with special focus on India, Int. J. Womens Health 7 (2015) 405–414.

[2] M.S. Butler, A. Avril, B. Robertson, M.A. Cooper, Natural product and natural product-derived drugs in clinical trials, Nat. Prod. Rep. 31 (2014) 1612–1661.

[3] B. Sasikumar, Genetic resource of Curcuma: Diversity, characterization and utilization, Plant Genet. Resour. 12 (2007) 230–251.

[4] A.K. Pandey, A.R. Chaudhary, Volatile constituents of rhizome oil of *Curcuma caesia*, Flavour Fragr. J. 18(5) (2003) 463–465.

[5] R. Kagyung, P.R. Gajural, P. Rethy, B. Singh, Ethnomedicinal plants used for gastrointestinal diseases by Adi tribe of Dihang-Dibang biosphere reserve in Arunachal Pradesh, J. Tradit. Knowl. 9(3) (2010) 496–501.

[6] H. Tag, A.K. Das, H. Loyi, Anti-inflammatory plants used by Khanti tribes of Lohit district in Arunachal Pradesh, Nat. Prod. Radiance 6(4) (2007) 334–340.

[7] P. Sinh, B. Deeb, Antimutagenic/antigenotoxic activity of bioactive compounds of *Curcuma caesia* Roxb. against cyclophosphamide-induced hepatotoxicity and nephrotoxicity in mice, Int. J. Sci. Res. 7(12) (2018) 640–646.

[8] T.S. Roopashree, D. Raman, S. Rani, Antibacterial activity of anti-psoriatic herbs: Cassia tora, *Momordica charantia* and *Calendula officinalis*, Int. J. Appl. Res. Nat. Prod. 1(3) (2008) 20–28.

[9] W. Brand-Williams, M.E. Cuvelier, C. Berset, Use of a free radical method to evaluate antioxidant activity, LWT–Food Sci. Technol. 28 (1995) 25–30.

[10] R. Re, N. Pellegrini, A. Proteggente, A. Pannala, M. Yang, et al., Antioxidant activity applying an improved ABTS radical cation decolorization assay, Free Radic. Biol. Med. 26(9–10) (1999) 1231–1237.

[11] Y. Mizushima, M. Kobayashi, Interaction of anti-inflammatory drugs with serum proteins, J. Pharm. Pharmacol. 20(3) (1968) 169–173.

[12] W.F. Grant, Chromosome aberration assays in Allium: A report of the U.S. Environmental Protection Agency Gene-Tox Program, Mutat. Res. 99(3) (1982) 273–291.

[13] G. Fiskesjö, The Allium test as a standard in environmental monitoring, Hereditas 102(1) (1985) 99–112.

[14] T. Mosmann, Rapid colorimetric assay for cellular growth and survival: Application to proliferation and cytotoxicity assays, J. Immunol. Methods 65(1–2) (1983) 55–63.

[15] N.F.B. Siriwantanmetanon, Traditionally used Thai medicinal plants: In vitro anti-inflammatory, anticancer and antioxidant activities, J. Ethnopharmacol. 130 (2010) 197–207.

[16] J. Cao, X.X. Cao, Characterization of flavonoids from *Dryopteris erythrosora* and evaluation of their antioxidant, anticancer and acetylcholinesterase inhibition activities, Food Chem. Toxicol. 51 (2013) 242–250.

[17] A.L. Huntley, The health benefits of berry flavonoids for menopausal women: Cardiovascular disease, cancer and cognition, Maturitas 63 (2009) 297–301.

[18] M. Antolovich, P.D. Prenzler, E. Patsalides, S. McDonald, K. Robards, Methods for testing antioxidant activity, Analyst 127(1) (2002) 183–198.

[19] R.M. Rajurkar, R.G. Jain, P.A. Bedmutha, S.S. Khadbadi, Antioxidant activity of phenolic extract from ginger (*Zingiber officinale* Roscoe) rhizome, Asian J. Res. Chem. 2(3) (2009) 260–261.

[20] B.G. Devangamath, S.A. Raddi, A randomized controlled trial to assess the efficacy of dry ginger powder on management of nausea and vomiting among antenatal mothers, Asian J. Nurs. Educ. Res. 6(1) (2016) 17–26.

[21] S.M. Ashraf, J. Sebastian, K. Rathinasamy, Zerumbone, a cyclic sesquiterpene, exerts antimitotic activity in HeLa cells through tubulin binding and exhibits synergistic activity with vinblastine and paclitaxel, Cell Prolif. 52(2) (2019) e12558.

[22] K.P. Nair, Turmeric (*Curcuma longa* L.) and Ginger (*Zingiber officinale* Rosc.): World's invaluable medicinal spices, Springer Nature, Switzerland, 2019.

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