Investigation of Physicochemical, Bioactivity Properties and Health Benefit of Tablets of *Curcuma longa* Linn. (Na-nwin)

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Abstract

This research work deals with the Investigation of Physicochemical, Bioactivity properties and Health Benefit of Tablets of Na-nwin (*Curcuma longa* Linn.). The sample was collected from commercial medicinal shop, Amarapura Township, Mandalay Region. Preliminary phytochemical tests indicated the present of glycoside, alkaloid, α- amino acid, carbohydrate, flavonoid, phenolic compound, saponin, tannin, steroid and terpenoid. The elemental analysis of dried powered sample was also performed by WDXRF (Wavelength Dispersive X-ray Fluroscence) and AAS (Atomic Absorption Spectrophotometry) techniques.The determination of nutritional values from the dried powdered sample of Na-nwin was carried out by AOAC (Association of Official Analytical Chemists) method. On antimicrobial screening, Na-nwin sample with pet ether, EtOAc, $CHCl_3$, EtOH extract were examined with six microorganisms such as *Bacillus cereus, Staphylococcus aureus, Pseudomonas aeruginosa, Shigella boydii, Salmonella typhii and E.coli species*. The screening of antioxidant activity of ethanolic extract from tablets of Na-nwin was carried out by DPPH (1,1-diphenyl-2-picryl-hydrazyl) method using UV spectrophotometer .

***Keywords**: Curcuma longa* Linn., Antimicrobial Screening, WDXRF, AAS, Antioxidant activity

Introduction

Turmeric (*Curcuma longa* L.) is a rhizomatous herbaceous perennial plant of the ginger family, Zingiberaceae (Purseglove, 1972). It is native to tropical South Asia and needs temperatures between 20°C and 30°C and a considerable amount of annual rainfall to thrive. The continuing research indicates that turmeric and its active principle curcumin have unique antioxidant, antimutagenic, antitumorigenic, and anticarcinogenic, antiinflammatory, antiarthritic, antimicrobial, and hypocholesterolemic properties as reviewed elsewhere (Majeed *et al*., 1995; and Miquel *et al*., 2002).

When not used fresh, the rhizomes are boiled for several hours and then dried in hot ovens, after which they are ground into a deep orange-yellow powder commonly used as a spice in curries in India and other South Asian countries (Salvi *et al*., 2000; and Shirgurkar *et al*., 2001). In medieval Europe, turmeric known as Indian saffron, since it was widely used as an alternative to the far more expensive saffron spice.

Turmeric (*Curcuma longa*) is used extensively in foods for its flavor and colour, as well as having a long Tradition of use in Chinese and Ayurveda systems of medicine; India has a rich history of using plants for medicinal purpose. It extensively used as a spice, food preservative and colouring material in India. Turmeric is widely consumed in the countries of its origin for a variety of uses, including as a dietary spice, a dietary pigment, and an Indian folk medicine for the treatment of various illnesses. It is used in the textile and pharmaceutical industries of India have a rich history of using plants for medicinal purpose (Journal of Pharmacognosy and Phytochemistry 2017).

Current traditional Indian medicine uses it for biliary disorders, anorexia, cough, diabetic wounds, hepatic disorders, rheumatism, and sinusitis. Powder of

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turmeric mixed with slaked lime is a household remedy for the treatment of sprains and swelling caused by injury, applied locally over the affected area. Safety evaluation studies indicate that both turmeric and curcumin are well tolerated at very high dose without any toxic effects. Thus, both turmeric and curcumin have the potential for the development of modern medicine for the treatment of various diseases (Journal of Pharmacognosy and Phytochemistry 2017).

Scientific Classification

Family	:	Zingiberaceae
Genus	:	*Curcuma*
Species	:	*longa* Linn.
Scientific name	:	*Curcuma longa* Linn.
English name	:	Turmeric
Myanmar name	:	Na-Nwin
Part of used	:	Rhizomes

Figure 1.Rhizomes of *Cucuma longa* Linn. (Na-Nwin)

Sample Collection and Preparation of Na-nwin (*Curcuma longa* Linn.)

The tablets of Na-nwin (*Curcuma longa* Linn.) were collected from commercial medicinal shop, Amarapura Township, Mandalay Region. The collected samples were made into powder by using motor and pestle. These samples were separately stored in plastic bag.

Phytochemical Investigation of Dried Powdered Samples of Tablets of Na-nwin (*Curcuma longa* Linn.)

Preliminary detection of phytochemical compounds from Na-nwin (*Curcuma longa* Linn.) sample was carried out according to the general methods mentioned in phytochemical methods (Harborne, 1984). These qualitative tests were done to indicate the presence of organic compounds such as alkaloids, α-amino acid, carbohydrate, flavonoid, glycoside, phenolic compound, saponin, steroid, tannin and terpenoid.

Semi-Quantative Elemental Analysis of Dried Powdered Samples of Tablets of Na-nwin (*Curcuma longa* Linn.) by Wavelength Dipersive X-ray Fluorescence (WDXRF)

Relative Percent Abundance of Elements in tablets of Na-nwin (*Curcuma longa* Linn.) was measured by WDXRF method at Yadanabon University.

Elemental Analysis of Dried Powdered Samples of Tablets of Na-nwin (*Curcuma longa* Linn.) by Atomic Absorption Spectrophotometry (AAS)

Some heavy metals (Zn, Fe, Pb and Cu) in the dried powder sample of tablets of Na-nwin (*Curcuma longa* Linn.) by AAS method. It was measured at Taunggyi University.

Determination of Nutritional Values in Tablets of Na-nwin (Curcuma longa Linn.) Sample

The determination of nutritional valuesuc such as moisture, ash, fibre, fat, protein, carbohydrate and energy value in the dried powered sample of tablets of Na-nwin (*Curcuma longa* Linn.) was carried out by AOAC method (AOAC,2000).

In Vitro Screening of Antimicrobial Activities of Various Crude Extract from Tablets of Na-nwin (*Curcuma longa* Linn.) by Agar Well Diffusion Method

The screening of antimicrobial activity of various crude extract such as pet ether, EtOAc, $CHCl_3$ and EtOH of tablets of Na-nwin (*Curcuma longa* Linn.) were carried out by agar well diffusion method. The microorganisms used for detecting antibacterial activity were obtained the Department of Biotechnology, Mandalay Technology University, Myanmar.

Screening of Antioxidant Activity of Crude Extract from Tablets of Na-nwin (*Curcuma longa* Linn.) by Using DPPH Free Radical Scavenging Assay

DPPH (1,1-diphenly-2-picryl-hydrazyl) radical scavenging assay was chosen to assess the antioxidant activity of plants materials. The antioxidant activity was studied on EtOH extract from the sample. It was measured at Depertment of Chemistry,West University of Yangon.

Result and Disscussion

Phytochemical Constituents of Tablets of Na-nwin (*Curcuma longa* Linn.)

The phytochemical tests revealed that alkaloids, α-amino acids, carbohydrates, flavonoids, glycosides, phenolic compounds, saponins, steroids, tannins and terpenoids were presented in the sample. The results were shown in Table 1.

The observed phytochemical constituents are essential compounds for metabolism and nutritional of human body.

Table 1. Results of Phytochemical Investigation of Tablets of Na-nwin

No.	Types of compoud	Extrat	Test reagent	Observation	Remark
1	Alkaloid	1 % HCl	Mayer's reagent	White ppt	+
			Dragendroff's reagent	Brownish	
2	α-amino acids	H_2O	Ninhydrin	Purple color spot	+
3	Carbohydrates	H_2O	10 % α-naphthol, conc: H_2SO_4	Purple color solution	+
4	Flavonoids	EtOH	Mg turning, conc: HCl	Pink color solution	+
5	Glycosides	H_2O	10 % lead acetate solution	White ppt	+
6	Phenolic compounds	H_2O	10 % $FeCl_3$, $K_3Fe(CN)_6$	Greenish color solution	+
7	Saponins	H_2O	Distilled water	Forthing	+
8	Steriods	Pe	Acetic anhydride conc: H_2SO_4	Deep green color solution	+
9	Tannins	H_2O	10 % $FeCl_3$ solution	Yellowish brown ppt	+
10	Terpenoid	$CHCl_3$	Acetic anhydride, conc: H_2SO_4	Reddish color solution	+

(+) = presence (ppt) = precipitate

Elemental Composition in Tablets of Na Nwin Formulations by WDXRF

In this work, relative composition of elements in tablets of Na-nwin (*Curcuma longa* Linn.) was determined by WDXRF spectrometer applying fundamental parameter method. The results are shown in Table 2. In this result, K,Ca,Rh, Si and Fe were found as major constituents and P,Mg, Al, S, Cl, Mn, Rb and Mo were found as minor constituents.

Table 2.Relative Percent Abundance of Element in Tablets of Na-nwin (*Curcuma longa* Linn.) by WDXRF

No.	Element	Symbol	Relative abundance (%) Na-nwin
1	Potassium	K	56.8
2	Calcium	Ca	15.4
3	Rhodium	Rh	6.24
4	Silicon	Si	6.09
5	Iron	Fe	5.16
6	Phosphorus	P	2.87
7	Magnesium	Mg	2.54
8	Aluminum	Al	1.64
9	Sulphur	S	1.31
10	Chlorine	Cl	1.31
11	Manganese	Mn	0.36
12	Rubidium	Rb	0.103
13	Zirconium	Zr	0.0925
14	Molybdenum	Mo	0.0503

Determnation of Some Heavy Metals by Atomic Absorption Spectrophotometry (AAS)

In the present work, content of Zn, Fe, Pb and Cu in tablets of Na-nwin (*Curcuma longa* Linn.) was determined by AAS.The results are shown in Table 3.

Table 3.Results of some Heavy metal of Tablets of Na-nwin (*Curcuma longa* Linn.)

No	Element	Heavy metal content(ppm) of Na-nwin
1	Fe	0.784
2	Zn	1.285
3	Cu	0.119
4	Pb	0.418

Determination of Nutritional Values of Tablets of Na-nwin (*Curcuma longa* Linn.)

Moisture, ash, fat, protein, carbohydrate and energy value contents in sample were determined by using appropriate reagents. The observed data are listed in Table 4. From the determination of nutritional values of tablets of Na-Nwin , it was found that the amount of carbohydrate and energy value were highest in the sample.

Table 4. Nutritional values (%) in Tablet of Na-nwin (*Curcuma longa* Linn.)

No.	Test Parameter	Content (%)of Na-nwin
1	Moisture	6.17
2	Ash	6.4
3	Fiber	4.8
4	Fat	4.92
5	Protein	3.24
6	Carbohydrate	74.47
7	Energy Value (kcal/100g)	355.12

Investigation of Antimicrobial Activities of Tablets of Na-nwin (*Curcuma longa* Linn.)

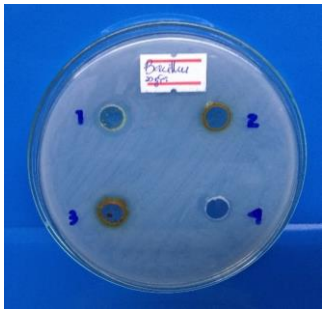
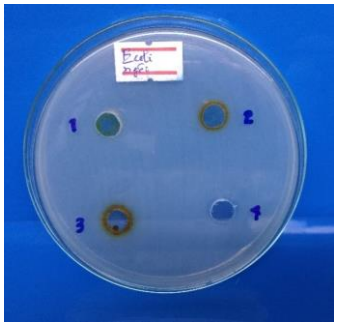
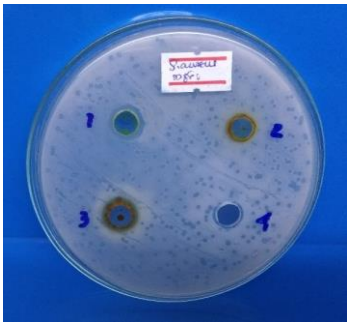
Antimicrobial activities of pet ether, $CHCl_3$, EtOAc and EtOH extracts were screened by agar well diffusion method. In this investigation,The samples were testedon six species of microorganisms, *Bacillus cereus, Staphylococcus aureus, Pseudomonas aeruginosa, Shigella bodii, Salmonella typhii and E. coli species* as described in table 5.The inhibition zone diameter for the sample as shown in Figure 2. EtOH extracts give activity on *Staphylococcus aureus, Pseudomonsa aeruginosa, Shigella boydii, Salmonella typhi, Bacillus cereus* and no activity on *Escherichia coli*.

Table 5. Result of Antimicrobial Screening of Extract from Tablets of Na-nwin (*Curcuma longa* Linn.) Formulation

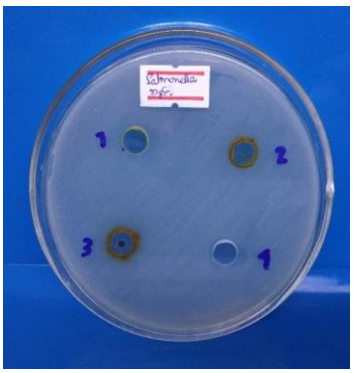
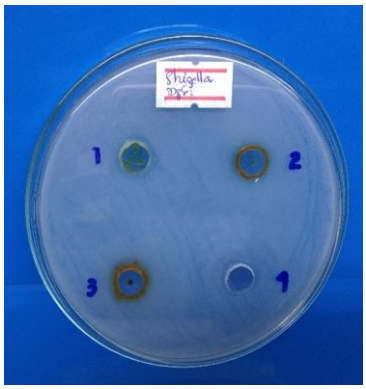
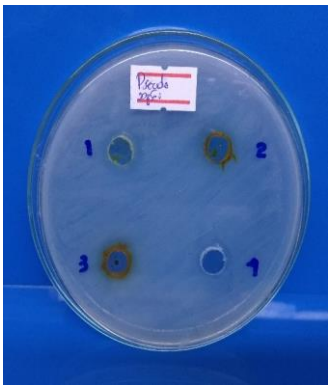
Sample	Sovent	Inhibition zone					
		I	II	III	IV	V	VI
Na Nwin Formulation	EtoH	-	13mm (+)	15mm (+)	15mm (+)	17mm (++)	16mm (++)
	EtOAc	11mm (+)	13mm (+)	12mm (+)	13mm (+)	12mm (+)	14mm (+)
	pet ether	-	12mm (+)	11mm (+)	11mm (+)	12mm (+)	13mm (+)
	$CHCl_3$	-	10mm (+)	-	11mm (+)	-	12mm (+)

Agar well
10mm ~15mm (+)
16mm ~19mm (++)
20mm above (+++)

Test Organisms
I = *Escherichia coli*
II = *Bacillus cereus*
III = *Salmonella typhi*
IV = *Shigellaboydii*
V = *Staphylococcus aureus*
VI = *Pseudomonas aeruginosa*

(a) *Bacillus cereu* (b) *Escherichia coli* (c) *Staphylococcus aureus*

(d) Salmonella typhii (e)*Shigellaboydii* (f) *seudomonus aeruginosa*

1=Pet ether(30 mg/ml), 2= Chloroform(30 mg/ml),3= Ethyl acetate(30 mg/ml), 4= Ethanol (30 mg/ml),well= 8 mm

Figure 2. Inhibition well diameter of Tablets of Na-nwin (*Curcuma longa* Linn.)

Screening of Antioxidant Activity of Crude Extracts of Tablets of Na-nwin (*Curcuma longa* Linn.) by DPPH method

Determination of radical scavenging activity by DPPH method bases on the crude extract solution in various concentrations. In the study six kinds of concentration (50µg/ml, 25µg/ml,12.5µg/ml, 6.25µg/ml and 3.125µg/ml) of extract were prepared by dilution with ethanol solvent. Sample solution was prepared by mixing sample with DPPH solution. Determination of absorbance was carried out at wavelength 517nm using spectrophotometer. . IC_{50} values of ethanolic extract Na-nwin and ascorbic acid were 4.12 µg/ml and 0.65 µg/ml respectively. According to the comparisons between IC_{50} values of standard ascorbic acid and the extract samples, ethanolic extracts of tablet of Na-nwin sample was also possesses the rich antioxidant property.. The resultant data are recorded in Table 6. The bar graph of IC_{50} values of ethanol crude extract and standard ascorbic acid were illustrated in Figure 3 and 4.

Table 6. IC_{50} Values of Standard Ascorbic Acid and Na-nwin (*Curcuma longa* Linn.)

Test Samples	IC_{50} Values (µg/ml)
Ascorbic Acid	0.65
Na Nwin	4.12

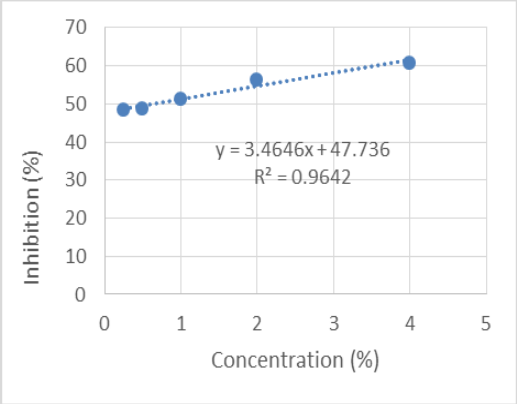


Figure 3. Plot of (%) Inhibition Vs Concentration of Standard Ascorbic Acid

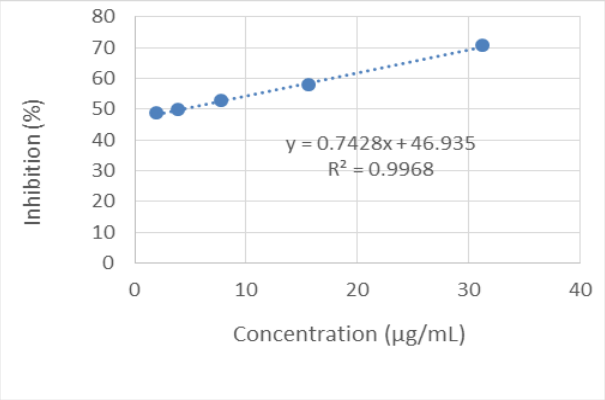


Figure 4. Plot of (%) Inhibition Vs Concentration of Ethanolic Extract from Na-nwin Formulation

Conclusion

From the research work the investigation of the phytochemical constituents and bioactivity properties of the dried powder sample of tablets of Na-nwin (*Curcuma longa* Linn.).

Phytochemical constituents such as alkaloid, α-amino acid, carbohydrate, flavonoid, glycoside, phenolic compound, saponin, steroid, tannin and terpenoids were represented in the sample. The observed phytochemical constituents are essential compounds for the metabolism and nutrition of human body.

From the determination of nutritional values of tablets of Na-nwin (*Curcuma longa* Linn.), it was found that the amount of carbohydrate and energy value were highest in the sample. Na-nwin was found to be (6.17 %) moisture, (3.24 %) of protein, (6.4%) of ash, (4.92 %) of fat, (4.8 %) of fibre, (74.47%) of carbohydrate and (355.12%) of energy.

On antimicrobial screening of tablets of Na-nwin sample, the pet ether, $CHCl_3$, EtOAc and EtOH extracts were examined with six microorganisms such as *Bacillus cereus, Pseudomonas aeruginosa. Shigella boydii, Salmonella typhii, Staphylococcus aureus and Escherichia coli* species. EtOH extracts give activity on *Staphylococcus aureus, Pseudomonsa aeruginosa, Shigella boydii, Salmonella typhi, Bacillus cereus* and no activity on *Escherichia coli*.

The Na-nwin sample contains many elements 1.2848 ppm of Zn, 0.7839 ppm of Fe, 0.4177 ppm of Pb, 0.1185 ppm of Cu respectively by using AAS method. Zinc is vital to immune resistance, wound healing, digestion, reproduction, physical growth, diabetes control, taste and smell and maintaining normal vitamin A levels and usage. Iron builds up the quality of blood and increases resistance to stress and disease. Iron is also part of hemoglobin, which is found only in muscle tissue and helps muscles store oxygen.

From WDXRF study, it can be found that Na-nwin contains fourteen principal elements as K, Ca, Rh, Si, Fe, P, Mg, Al, S, Cl, Mn, Rb, Zr and Mo. Among of them, the highest content of potassium was 56.8 % in Na-nwin. Potassium is one of the most important electrolytes in the human body. It can be concluded that Na-nwin should be taken daily to get nutritional values and pharmacological activities which are beneficial for human health.

The screening of antioxidant activity from Tablets of Na-nwin (*Curcuma longa* Linn.) was carried out by DPPH method. In this screening, ascorbic acid was used as the standard antioxidant. The antioxidant activity of ethanolic extract was also screened. IC_{50} values of ethanolic extract Na-nwin and ascorbic acid were 4.12 µg/ml and 0.65 µg/ml respectively. According to the comparisons between IC_{50} values of standard ascorbic acid and the extract samples, ethanolic extracts of tablet of Na-nwin sample was also possesses the rich antioxidant property.

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