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# Therapeutic Properties of *Curculigo Orchioides* (Kali-Musli)

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**Abstract:** ***Kali musli scientifically called as Curculigoorchioidesbelongs to the family Hypoxidaceae. The rhizome of this plant is used as a traditional medicine to cure different ailments. The tuber is Diuretic, aphrodisiac, depurative, appetizer, carminative, viriligenic, antipyretic cures skin diseases, asthma, bronchitis, jaundice, diarrhea, cuts, wounds etc. The potent secondary metabolites of this plant are extracted using different extraction process and different solvent systems. The present review summarizes some important pharmacological properties of Curculigoorchioides products and active principles showing variable medicinal properties which can be further investigated to achieve novel herbal drugs. The present review provides comprehensive information regarding the medicinal uses of rhizome /tuber of Curculigoorchioides.***

**Keywords:** Tuber; Traditional medicine; Pharmacological properties; Herbal Drugs

## 1. Introduction

Modern medicine is known to have its roots in natural plant products. The secondary metabolite is more important to serve the plant as a biochemical interface between the plant and its surrounding environment. In the 19$^{th}$ century, it was realized that the healing properties of the plants were due to the presence of some active ingredients. With the development of organic chemistry at the beginning of this century, extraction and fractionation technique improved significantly. It became possible to identify and isolate many of the active constituents from the plants. Investigation of the plants as source of antibiotics was reported by George *et al.* (1947). Skinner (1955) summarized the historical land marks in the development of antibiotics. In 1887, Martini first used thymol, a simple phenol present in the essential oils of many plants, as an antiseptic and a preservative. Some plant extracts and exudates like those of neem were observed to have some antifungal and antibacterial properties.

The plant-derived medicines are generally considered to be safer, gentler and better for human health than synthetic drugs. Plant products have been part of phytomedicines since time immemorial which can be derived from any part of the plant like bark, leaves, flowers, roots, fruits, seeds, etc. i. e., any part of the plant may contain active components (Cragg and Newman2001).

**Taxonomical description**

A herbaceous plant with a tuberous rhizome or corm. Leaves are simple, sessile, crowded on the short stem with sheathing leaf base, tapering into short petiole almost radical. Inflorescence spike, flowers most often pedicillate, unisexual, actinomorphic, tepals 3+3, and yellow in colour. Perianth is gamopetalous with six equal lobes. Outer lobe is hairy on the back and while the inner ones are sparsely hairy along nerves. Stamens 3, dithecous, basifixed and dehiscence via longitudinal slits. Ovary tricarpellary, syncarpous, trilocular and inferior ovary and ovules arranged on axile placentation; style slender, stigma capitate. Fruit a capsule, seeds with endosperm (Gamble1936).

**Phytochemical screening**

The crude extracts of rhizome was screened for the presence of secondary metabolites. Petroleum ether, chloroform, ethylacetate and methanolic extracts of *Curculigoorchioides* reported the presence of carbohydrates, glycosides and saponins in higher concentrations and phenolic compounds in lower concentration. (Agraharie*t al.2010*)) dichloromethane, methanol and water extracts of the dried rhizome of *Curculigoorchioides* revealed the presence of glycosides, tannins, carbohydrates and steroids (Soni *et al*.2011). *Curculigoorchioides* rhizome also showed the presence of tannins, musilage, saponins and essential oils. HPLC analysis of methanolic extract was also performed to detect the presence of β-sitosterol as a marker compound (Patil *et al*.2011). Jagtap *et al.* (2010) indicated the presence of secondary metabolites like carbohydrates, and glycosides in water, methanol, chloroform and acetone extracts. Alkaloids and flavonoides were present only in methanolic extract, saponins were present in water and methanol whereas phenols were present in methanol, chloroform and acetone extracts.

The hexane, chloroform, methanol and water extracts of both leaf and rhizome revealed the presence of medicinally important secondary metabolites. GC-MS analysis of methanolic extract of leaf and rhizome showed the presence of several compounds like 2-Myristynoyl pantetheine c 4-Acetyloxyimino-6, 6-dimethyl-3-methylsulfanyl-4, 5, 6, 7-tetrahydro benzo [c] thiophene-1 carboxylic acid methyl ester 2, 7-Diphenyl 1, 6 dioxopyridazino [4, 5: 2', 3'] pyrrolo [4', 5'-d] pyridazine was also found to possess biological role in treatment of alzheimer's disease, neurodegenerative disease, cognition disorder, antiepileptic for treating renal disease and heart failure. Brintha *et al.* (2017)

**Antioxidant assay**

Methanolic extract *Curculigoorchioides* (Rathod *et al*.2010) found to have substantial activity in DPPH radical scavenging, nitric oxide scavenging, lipid peroxidation and protection against superoxide induced damage to erythrocytes. Ethanolic root extract of *Curculigoorchioides* was screened for its antioxidant potential by three different established *in vitro* methods viz., DPPH, Reducing Power and Phosphomolybdenum assays. Gallic acid was used as the reference standard. The results obtained showed ethanolic root extract possessed significant free radical reducing power, antioxidant activities in a concentration dependant manner Ratnam *et al.* (2013). Curculigoside, a phenolic glycoside, derived from *Curculigoorchioides* both in the *in vitro* and *in vivo* models exhibited significant DPPH, superoxide, hydroxyl radical scavenging activities. *In vivo* antioxidant was checked by Phorbol-12-myristate-13-acetate induced superoxide radical formation by mouse peritoneal macrophages.

Multi mineral analysis of the rhizome was evaluated using Inductively Coupled Plasma (ICP) spectroscopy. The methanolic extract exhibited highest DPPH radical scavenging activity (77.7%) than the other solvents chloroform (19.6%), acetone (52.16%) and water (71.39%) Jagtap (2016). Ethanolic extract of *Curculigo* exhibited less reducing power in scavenging DPPH radicals when compared with the standard ascorbic acid but showed significant $H_2O_2$ scavenging activity. Sharma and Singh (2017). All the crude extracts of different solvents exhibited significant anti oxidant activity.

**Antimicrobial activity**

*Curculigoorchioides* was screened for its antibacterial and antifungal activities through agar well plate method and disc diffusion method. Methanolic extract showed highest activity against *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Staphylococcus aureus*. Acetonitrile, chloroform and hexane extracts showed low activity against these tested organisms (Singh and Gupta 2008). Rhizome extracts of this species was evaluated for antibacterial activity against pathogenic strains of Gram-positive (*Staphylococcus aureus* and *Staphylococcus epidermidis*) and Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa* and *Salmonella typhimurium*) bacteria. The results were compared to those obtained with the standard antibiotics gentamycin, ampicillin, doxycycline and erythromycin. Only the clinical isolate of *S. aureus* showed more sensitivity towards water extracts than the standard strain. Also, the steam distilled fraction was more effective against Gram-positive strains than Gram-negative strains. Therefore, it was suggested that the steam distilled extract from *C. orchioides*has a potential application as an antiseptic for the prevention and treatment of antibacterial infections thus supporting its traditional local usage (Nagesh and Shanthamma2009).

Antimicrobial activity of aqueous and ethanolic extracts of *Curculigoorchioides* was investigated using the disk diffusion method. The microorganisms tested were *Erwinia amylovora, Klebsiella pneumonia, Escherichia coli, Proteus mirabilis, Pseudomonas aeruginosa* and *Enterobacter cloacae*. The aqueous extract of *Curculigoorchioides* showed maximum antimicrobial activity against *Klebsiella pneumonia*e (18.49 mm) than other organisms. *Proteus mirabilis* showed minimum (6.34 mm) inhibition against aqueous extract while *Enterobacter cloacae* showed no inhibition. Likewise, ethanolic extracts of *Curculigoorchioides* rhizome exhibited maximum inhibitory activity against all the microorganisms tested but showed differences in the zone of inhibition; *Klebsiella pneumonia* showing maximum inhibition (27.3 mm) than other organisms. Among the two extracts, ethanolic extract has maximum antimicrobial activity against the six microorganisms (Susindran and Ramesh 2014).

Rajanikanth *et al.* (2016) reported good antimicrobial activity of the callus extract of *C. orchioides* against *E. coli, Proteus vulgaris, Salmonella typhimurium, Pseudomonas aeruginosa, Staphylococcus aureus* and *Candida albicans.*

**Hepatoprotective activity**

Hepatoprotective activity of *Curculigoorchioides* on carbon tetrachloride ($CCl_4$) induced hepatotoxocity. was evaluated by Venukumar and Latha (2002). According to them hepatic damage was evidenced by elevated levels of serum biochemical parameters and liver showed a tendency to attain near normalcy in animals co-administered with the methanolic extract of the plant. The similar result was obtained by Thapliyal *et al.* (2014). The dose of 100, 200, 400 mg/kg were administered orally and elevated biochemical parameters like SGOT, SGPT, ALP, Bilirubin due to toxicity were found to be normalized significantly by the methanolic extract in a dose dependent manner. Ali *et al.* (2014) evaluated the hepatoprotective activity of 'habbeassand', a unani formulation with the total constituents of120 kg which had 8.25 kg of *Curculigo*and this formulation exhibited significant hepato protection on paracetmol induced hepatotoxicity.

**Hypoglycemic/ Antihyperglycemic activity**

Susindran and Ramesh (2014) screened the antidiabetic and antioxidant activity of *Curculigoorchiodes* in alloxan induced diabetic rats. Hyperglycemia was induced in rats by alloxan (150 mg/kg i. p). Two weeks after alloxan induction, diabetic rats received aqueous and ethanolic extracts of *Curculigoorchiodes* (CO) orally 100, 200 and 300 mg/kg body weight respectively for 90 days. In this study, protective effects of CO rhizome on glucose tolerance test and an alloxan induced diabetes were evaluated. Serum biochemical parameters glucose, urea, total cholesterol and total protein were measured. The observation confirmed that aqueous and alcoholic extract of *Curculigoorchoides* rhizome has remarkable antidiabetic activity and the hepatoprotective activity.

**Anticancer activity**

*Curculigoorchioides* rhizome was screened using the methanolic extract for its cytotoxic and anticancer activities on cultured cell line. The methanolic extract of *C. orchioides* on Hep2 cell line indicated non-toxicity up to 800 µg/ml. From the results it became evident that *C. orchioides* neither is an anticancer agent nor a cytotoxic agent up to this concentration. Raaman *et al.* (2009).

Chanda and Nagani (2013) reviewed the *in vitro* and *in vivo* methods of screening anticancer activity and evaluated some Indian medicinal plants exhibits this activity. He reported anticancer property of *Curculigoorchioides* on breast cancer cell line by MTT assay as was also previously reported by Singh and Gupta (2008).

*Gmelina arborea* Roxb. ex Sm., *Guazumaulmifolia* Lam. and *Curculigoorchioides* Gaertn., the three plants frequently used in South Sulawesi for their activity on cervical epithelial carcinoma. These ethanol extracts were assessed using HeLa cells (Human cervix cancer) with doxorubicin as the positive control. Cytotoxic activity was measured using MTT colorimetric assay. Dose-dependent studies revealed $IC_{50}$ of 113.61 ± 0.12 µg/ml, 174.90 ± 1.22 µg/mL and 126.05 ± 2.43 µg/ml for eGA, eGU and eCO on HeLa cell cancer, respectively and correlated with the treatment of cancer Lukman *et al.* (2014).

The anti-tumor effects of polysaccharides from *Curculigoorchioides* (PDC) on cervical cancer and the possible mechanisms involved were evaluated. The anti-tumor effect of PDC on cervical cancer was investigated *in vivo* in mice injected with Hela cells. The parameters measured were tumor volume and weight. *in vitro* anti-tumor effects of PDC were assessed by measuring expressions of caspase-3, caspase-9 and P53 proteins in Hela cells via ELISA assay. Thymus and spleen indices were calculated for assessment of PDC effect on immune function. It significantly increased thymus and spleen indices in mice; and significantly up-regulated expressions of caspase-3, caspase-9 and P53 proteins in HeLa cells. It was suggested that PDC has significant anti-tumor effect on cervical cancer both *in vivo* and *in vitro*, most probably through mechanisms involving enhancement of immune function and induction of apoptosis Xia *et al.* (2016).

**Other medicinal properties**

Murali, and Kuttan (2015) analyze the ameliorative effect of the methanolic extract of *Curculigoorchioides*on the urotoxicity and nephrotoxicity induced by Cyclophosphamide (CPA). CPA was administered to male Swiss albino mice at a single dose of 1.5 mmol/kg body weight to induce urotoxicity after 5 days of prophylactic treatment with *Curculigoorchioides* extract (20 mg/kg bodyweight). Mesna (2-mercaptoethanesulfonate) was used. The plant extract was found to be effective in ameliorating the urotoxic and nephrotoxic side effects of CPA. Up regulation of serum interferon-γ and interleukin-2 levels were observed with *Curculigoorchioides* treatment, which was decreased by CPA administration. Besides these, serum tumor necrosis factor-α level was also down regulated by *Curculigoorchioides* treatment. *Curculigoorchioides* was found to be effective against the CPA-induced bladder and renal toxicities by its antioxidant capability and also by regulating the pro-inflammatory cytokine levels.

## 2. Conclusions

The most prevalent health issues as of today are cancer, diabetes, heart diseases, kidney diseases, liver diseases, Alzheimer, AIDS and influenza. Among these, cancer, liver related diseases and diabetes are on the top list. *Curculigo* has a very potent secondary metabolites which has a significant anti-cancer, anti-diabetic, anti-microbial, hepatoprotecive, neuro protective etc. this review has given a comprehensive literature of the rhizome of *Curculigoorchioides.* Putting together the outcome of all these studies further *in-vitro* and *in-vivo* investigation of the pure compounds are required. Hence there is a hope for the development of new, novel and more powerful commercial drug from *Curculigo* rhizome to treat human diseases.

**Abbreviations:**

GC-MS-Gascromatography-Mass spectrometry
DPPH-2, 2-diphenyl-1-picrylhydrazyl
ICP-Inductively coupled plasma
$H_2O_2$-Hydrogen peroxide
mm-Millimeter
$Ccl_4$-Carbon tetracloride
SGOT-Serum glutamic oxaloacetic transaminase
SGPT-Serum glutamic pyruvic transaminase
ALP-Alkaline phosphatase
Kg-Kilogram
mg-milligram
i. p.-Intra peritonial
µg-microgram
ml-milliliter
HepG2-Human Liver hepatocellular carcinoma cell line
MTT-3-(4, 5-dimethylthiazol-2-yl)-2, 5-diphenyl tetrazolium bromide
HeLa-Henrietta Lacks (Human cervical cancer cell line)
ELISA-Enzyme linked immuno assay
CPA-Cyclo phosphamide
AIDS-Acquired immune deficiency syndrome.

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