

Detection of Adulterants in Turmeric Powder from Deulgaon Raja Village Weekly Market

Dr. Deekshaputra R. Birhade* and Mr. Pavan M. Kadam

Department of Chemistry, Shri Vyankatesh Arts, Commerce and Science College,
Deulgaon Raja, Dist. Buldana-443204

Corresponding Author: Dr. Deekshaputra R. Birhade

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ABSTRACT: Turmeric powder or Curcumin has been used for the treatment and prevention of different chronic diseases as like cancer, neurological diseases, arthritis, obesity, autoimmune diseases, diabetes, Cardiovascular diseases, infectious diseases, hemoglobinopathies, metabolic syndrome, hypertension, Inflammation, and skin diseases. Turmeric powder/Haldi has been an inseparable part of Indian cuisine, commonly used as a colouring and flavouring agent. Such an important and valuable turmeric powder was observed to be adulterated by other cheap substances such as chalk powder, starch of maize, wheat and rice, metanil yellow, Lead chromate/ lead salt, and aniline dye etc. to get more profit. Adulteration is also done because of consumer's behaviour as they want to buy stuffs at lowest possible price. Adulteration is not only degenerating the quality of food but also affecting on human health and causes many serious diseases. Thus it is essential to know that whether the turmeric that we are using is good, safe to use or it is adulterated with some harmful substance. This can be done by simple physical and chemical tests. In this study, we performed several chemical tests to detect adulteration present in turmeric powder. This is an attempt to bring an awareness in the public on the important subject of food adulteration.

KEYWORDS: Turmeric powder, Curcumin, food adulteration, adulterants.

I. INTRODUCTION

Turmeric (*Curcuma longa*) belongs to the family Zingiberaceae and is one of the most potent spices which has been used over centuries for its medicinal and healing properties. Turmeric commonly known as Haldi has been an inseparable part of Indian cuisine, commonly used as a colouring and flavouring agent. Turmeric contains a yellow pigment called curcumin or diferuloylmethane, which is the principal ingredient responsible for its properties. Turmeric is distributed throughout subtropical and tropical regions of the world. It is extensively cultivated in Asian

countries, especially in India and China. It grows up to a height of one meter and has a short stem. Picture 1 shows turmeric farm, raw turmeric, whole turmeric sticks and turmeric powder.

There are number of components present in turmeric as like turmerone, curcuminoids, arturmerone, zingiberene, etc with diverse biological activities. Curcuminoids contain curcumin dimethoxy- curcumin, dihydrocurcumin, and 5'- methoxycurcumin, which are natural antioxidants. Turmerone, arturmerone, and zingiberene are the components responsible for the aroma of turmeric. Curcumin shows huge pharmacological properties for the prevention and treatment of several chronic diseases such as arthritis, autoimmune disease, cancer, cardiovascular disease, diabetes, hemoglobinopathies, hypertension, infectious disease, inflammation, metabolic syndrome, neurological diseases, obesity and skin diseases.¹



Picture 1: Turmeric Farm and raw turmeric, whole turmeric sticks and turmeric powder

Literature review indicate curcumin's potency as an anti-inflammatory and anti-cancer agent. Curcumin exhibits anti-neoplastic attributes via regulating a wide array of biological cascades involved in mutagenesis, proliferation, apoptosis, oncogene expression, tumorigenesis, and metastasis. Curcumin has shown a wide range of pleiotropic anti-proliferative effect in multiple cancers and is a

known inhibitor of varied oncogenic elements, including nuclear factor kappa B (NF- κ B), c-myc, cyclin D1, Bcl-2, VEGF, COX-2, NOS, tumour necrosis factor alpha (TNF- α), interleukins, and MMP-9. Further, curcumin targets different growth factor receptors and cell adhesion molecules involved in tumour growth and progression, making it a most promising nutraceutical for cancer therapy.²

It is also observed that curcumin has been shown to regulate various signaling pathways, including JAK/STAT, PI3K/Akt/mTOR, and Wnt/ β -catenin, vascular endothelial growth factor (VEGF) / vascular endothelial growth factor receptor (VEGFR). It modulates genes such as cyclin D1, TP53, BAX, BCL-2, human telomerase reverse transcriptase (hTERT) and matrix metalloproteinases (MMPs), thereby affecting tumour cell proliferation, migration, invasion, cell cycle, and apoptosis. Curcumin can also enhance the anticancer immune response, reshape the tumor immune suppressive microenvironment, impact lymphocyte infiltration, and improve the immune status of the TME.³

Given the prospective anti-cancer benefits of targeting the Hippo signaling pathway, the identification of natural compounds that target YAP-TEAD activity is crucial for the development of cancer therapeutics based on natural compounds. It is reported that curcumin promoted proteasomal degradation of KLF5 via downregulating YAP/TAZ activity in both in vitro and in vivo studies. Curcumin was found to inhibit cell growth through modulation of autophagy. It was demonstrated that curcumin increased the LC3-II levels with downregulation of p62 and YAP expression. Moreover, silencing of YAP led to increased curcumin's sensitivity towards HCT116 and SW620 cells. Curcumin derivative WZ35 has shown to reduce proliferation, and other hallmarks of cancer through modulating the Hippo signaling nexus in GC. Curcumin was also found to modulate the Hippo pathway in A549 and NCI-H1299 NSCLC cells. Curcumin treatment only decreased the TAZ expression and no other critical effectors of Hippo pathway (YAP, LATS1, MST1). Curcumin is a well-known compound with wide pleotropic and medicinal properties against wide variety of diseases including pancreatic cancer. Zhou and group elucidated the mechanism of curcumin targeting Hippo signaling cascade in pancreatic cancer. Curcumin substantially decreased the proliferation, migration, invasion and induced apoptosis and cell cycle arrest. Moreover, treatment with curcumin resulted in downregulation of YAP, TAZ and

NOTCH1 expression in Panc-1 and Patu8988 cells. Hence, targeting TAZ/YAP axis using natural compounds might be a novel approach in the battle against pancreatic cancer.⁴

Because of the food and pharmacological values, Turmeric is considered as a major economic crop worldwide. According to Government of India notifies establishment of National Turmeric Board (Ministry of Commerce and Industry), India is the largest producer, consumer and exporter of turmeric in the world. In the year 2022-23, an area of 3.24 lakh ha was under turmeric cultivation in India with a production of 11.61 lakh tones (over 75% of global turmeric production). More than 30 varieties of Turmeric are grown in India and it is grown in over 20 states in the country. The largest producing states of Turmeric are Maharashtra, Telangana, Karnataka and Tamil Nadu. India has more than 62 % share of world trade in turmeric. During 2022-23, 1.534 lakh tones of turmeric products valued at 207.45 million USD was exported by more than 380 exporters.

When a crop is becoming a highly valuable industrial commodity, the natural tendency is to find fraudulent practices to increase the profit margin. Adulteration of food commonly defined as "the addition or subtraction of any substance to or from food, so that the natural composition and quality of food substance is affected". There are evidences that, Turmeric is adulterated with cheap biological adulterants, which is often mixed with artificial colors, dyes, Metanil yellow, Lead Chromate to give that perfect bright color and smooth texture. In some cases, chalk powder, raw rhizomes or even wild turmeric is used to make edible Haldi powder, which is unfit for consumption and shows adverse effects. Following table no. 1 shows the adulterant and type of disease/disorder caused by that adulterant.

Table 1: List of Adulterants present in Turmeric and disorder caused by them.⁵⁻¹¹

Sr. No.	Adulterant	Disease/disorder
01	Aniline dye	Carcinogenic
02	Yellow lead salts/ lead chromate	Cancer, Anemia, Neurotoxicity, Reduce male fertility, etc.
03	Metanil Yellow	Cancer, toxicity, stomach disorder
04	Tapioca starch	Stomach disorder
05	Chalk	Indigestion

Thus it is essential to know that whether the turmeric that we are using is good, safe to use or it is adulterated with some harmful substance. This can be done by simple chemical tests.

II. METHODOLOGY

This experimental study was carried out for the turmeric powder samples collected from Saturday weekly market of Deulgaon Raja village, Dist. Buldana (MH). This study is done for determination for various adulterants present in turmeric powder by using physical and chemical methods. Ten random samples were collected from the village, Deulgaon raja Saturday weekly market and following methods are used to check the adulteration.

1. Lead Chromate Test

To test the presence of chemicals in Turmeric powder, mix a teaspoon of Haldi powder with water. If it settles down at the bottom and turns pale yellow, then it is real. On the other hand, adulterated Haldi powder will turn dark yellow after putting it in water.

2. Metanil Test

a) To check whether your Turmeric is polished with the bright metanil yellow. Add a pinch of turmeric powder to a test tube, add a few drops of

strong Hydrochloric acid. Shake it well. If the solution turns pink it indicates that there's a strong presence of metanil, which may cause food poisoning, stomach cramps, nausea and indigestion.

b) A sample of turmeric powder is taken. To it 13N sulphuric acid is added. Disappearance of red color on adding distilled water indicates the presence of metanil yellow.

3. Chalk Powder Test

Turmeric powder is taken in a test tube along with a few drops of water and Hydrochloric acid. If there are bubbles in the solution, then you must throw away the turmeric as it indicates the presence of chalk powder in your Turmeric powder.

4. Aniline dyes test

To a sample of turmeric powder few drops of water is added. To it 5 ml of spirit is added. Immediate disappearance of yellow color indicates the presence of aniline dye.

5. Test for starch of maize, wheat and rice.

It is observed by using microscope. Under microscopic view pure turmeric appears to be yellow in color and bigger in size.

III. RESULT AND DISCUSSION

Each sample was analysed carefully to obtain accurate results. The observation drawn from analysing the samples I to X is given Table 2.

Sr. No.	Adulterant type	Results for Adulteration tests for different Samples									
		I	II	III	IV	V	VI	VII	VIII	IX	X
01	Chalk	A	A	P	P	P	A	P	P	P	P
02	Starch of Maize, wheat and rice	P	P	P	P	P	P	P	P	P	P
03	Metanil yellow	P	P	P	A	A	P	P	P	P	P
04	Yellow lead salt/lead chromate	P	P	P	P	P	P	P	P	P	P
05	Aniline Dye	A	A	A	P	P	A	A	A	P	P

Table 2: Observations made during analysis of Turmeric Powder (Note: P = Present and A = Absent)

IV. CONCLUSION

From the experimental observations it is clear that all the turmeric powder samples contain adulterants as like chalk powder, starch, metanil yellow, lead salts, and aniline dye. Among all adulterants, metanil yellow and lead salts are most harmful adulterants which causes cancer.

From the obtained results it is clear that turmeric powder samples collected from Deulgaon Raja weekly market were adulterated and harmful to

use. One should buy packed turmeric powder from the trusted sources containing either by ISI mark or an Agmark. Adulterated food causes both physical and mental disorders along with malnutrition. Hence we must avoid eating such food. Also the government needs to take necessary actions against the companies and individuals who for the sake of their own profit are manufacturing and selling adulterated products to consumers.

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