



ANALYTICAL STUDY OF CURCUMIN CONTENT IN DIFFERENT DOSAGE FORMS CONTAINING TURMERIC EXTRACT POWDER AND TURMERIC OLEORESIN

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ABSTRACT

Different dosage forms namely tablets, capsules, creams and syrups were analysed for curcumin content, by the well-known spectrophotometric method. Turmeric extract powder was used as a source of curcumin in capsule and tablet formulations. Turmeric oleoresin was used as a source of curcumin in cream formulation. Additionally, syrup formulations containing turmeric extract powder as well as turmeric oleoresin, separately, were also tested for their curcumin contents.

Analytical results for curcumin content were found to be satisfactory in tablets and capsules containing turmeric extract powder. Whereas, in case of syrup containing turmeric extract powder, analytical findings for curcumin content, did not meet the expected specifications. However, when turmeric powder was replaced by the same quantity of oleoresin having similar strength, in cream and syrup, the results met the expected values, at the initial stages. But analysis data over a period of 1 Year testing, showed declination in the initial findings due to unstability of turmeric oleoresin for long duration.

Keywords: Turmeric extract powder, turmeric oleoresin, curcumin content, analytical estimation, spectrophotometric method.

INTRODUCTION

Ayurveda, the ancient Indian medicine system, is now widely recognized as an effective, alternate and complementary medicine. Ayurveda literally means 'Science of Life.' Plant based medicine is one of the central pillars of Ayurveda¹. Plants and their products are being used in medicine, due to their better cultural acceptability, better compatibility with the human body and lesser side-effects².

Turmeric is one of the most commonly used ingredients in home remedies and Ayurvedic medicines, since times immemorial, due to its multiple uses as a health promoter as well as for treatment of numerous chronic diseases. It is a golden colored spice, and is used in cooking, in the Indian subcontinent. Due to its color and taste, it is named as "Indian Saffron." Turmeric is also used as a food preservative and as a dye in textile industry³.

Curcuma longa Linn. (Turmeric or Haldi), Family: Zingiberaceae, is a small perennial herb, native to India, bearing many rhizomes on its root system, which are the source of its culinary spice. The turmeric rhizomes are boiled, dried and made into a yellow colored powder, which is employed as a coloring agent and a condiment, entering largely into the Indian pickles and curry powders⁴. The rhizome is pungent, bitter, heating, laxative, anthelmintic, vulnerary, tonic, alexiteric and emollient. It improves the complexion, is useful in "kapha" and "vata", diseases of the blood, leucoderma, scabies, urinary discharges, inflammations, ozoena, bad taste in the mouth, biliousness, dyspepsia, elephantiasis, snake-bite, smallpox, swellings, sprains, cutaneous infections, colic and amenorrhoea. The juice of fresh rhizome is applied to wounds, bruises and leech bites⁵.

Turmeric contains a wide variety of phytochemicals including curcumin, bismethoxycurcumin, demethoxycurcumin, zingiberene, curcumenol, curcumol, eugenol, tetrahydrocurcumin, triethylcurcumin, turmerin, turmerones and turmeronols.

Curcumin falls into the the category of curcuminoids, It is the phytochemical that gives the yellow color to turmeric and is

now recognized as being responsible for most of its therapeutic effects. Curcumin exhibits antioxidant, anti-inflammatory, antiviral, antibacterial, antifungal and wound-healing properties. More recently, scientists have studied its anticancer activities as well as its benefits to chronic conditions such as diabetes, allergies, arthritis, Alzheimer's disease, multiple sclerosis, HIV replication, septic shock, multidrug resistance, cardiovascular diseases, cardiotoxicity, gall stones, lung fibrosis, inflammatory bowel diseases, nephrotoxicity and liver injury. Thus, curcumin holds a lot of promise in the treatment of a wide range of diseases and is used in various forms, in different medicaments and formulations¹.

Curcumin composes only 4% of the turmeric rhizome, therefore necessitating the need for enrichment. Thus, turmeric rhizome is extracted with various solvents and the final extracted form can be either in powder or oleoresin form.

Turmeric extract powder is prepared by extracting turmeric powder with ethanol, by soxhlation and then concentrating under reduced pressure and air drying. Turmeric oleoresin is a deep brownish-orange viscous oily fluid, also prepared by the extraction of turmeric powder using organic solvents⁶. Stability of turmeric oleoresin was studied by Zaubunnisa et al⁷ and suggested that the stability of turmeric oleoresin encapsulated with B-cyclodextrin (BCD) stored at 5°C in dark container can be extended to 154 days.

As curcumin is one of the major constituents of turmeric formulations and is responsible for most of the therapeutic actions, estimation of curcumin is considered as an important quality parameter as far as physico-chemical and stability studies are concerned. The curcumin content in different formulations, may not meet the expected values, as the various enriched forms of turmeric, like extract powder or oleoresin, differ with respect to their solubility. Hence, it is necessary to monitor the curcumin content in different formulations, against the theoretically expected value of Active Pharmaceutical Ingredient (API), used in the

respective formula. This is also important from the stability point of view.

MATERIALS AND METHODS

Four different dosage forms namely tablet, capsule, syrup and cream are selected for the evaluation of Curcumin content. Presence of piperine is seen in each formulation along with curcumin. Curcumin with piperine increases the absorption of and pharmacological effects of curcumin in the body. Experiments carried out on mice by Rinwa et al⁸ clearly suggest that piperine enhances the bioavailability of curcumin and potentiate its protective effects against CUS induced cognitive impairment and associated oxidative damage. Various standardised classical and instrumental methods are available for estimating curcumin content. The UV/visible spectrophotometric method⁹ is one of the most reliable and popular methods, and hence, this method was used for the estimation of curcumin, in the various formulations. Before recording the absorbance reading at 425nm on UV-Visible spectrophotometer, it is calibrated using standard method¹⁰. The quantity of sample taken, the dilutions and the calculations, in case of all the different turmeric formulations are as mentioned below:

Turmeric (Haldi) (*Curcuma longa*) extract powder:

0.1g → 100ml → 0.5ml → 50ml

Content of Curcumin (%w/w) =

$[(A / 168) \times (100 / W) \times 10]$

Where, A = Absorbance Reading of the sample ;

W = weight of the sample in g = 0.1

Turmeric (Haldi) oleoresin:

0.1g → 100ml → 0.2ml → 25ml

Content of Curcumin (%w/w) =

$[(A / 168) \times (100 / W) \times 12.5]$

Where, A = Absorbance Reading of the sample ;

W = weight of the sample in g = 0.1

Tablet with Turmeric (Haldi) extract powder:

0.2 g → 100ml → 5.0ml → 50ml → 5.0ml → 50ml

Content of Curcumin (mg/ tablet) =

$[(A / 168) \times (100 / W) \times 10 \times \text{Average weight of 20 tablets in g} \times (1000/100)]$

Where, A = Absorbance Reading of the sample ;

W = weight of the sample in g = 0.2

Capsule with Turmeric (Haldi) extract powder:

0.2g → 100ml → 2.0ml → 50ml

Content of Curcumin (mg/capsule) =

$[(A / 168) \times (100 / W) \times 2.5 \times (\text{filled average weight of 20 capsules in g}) \times (1000 / 100)]$

Where, A = Absorbance Reading of the sample ;

W = weight of the sample in g = 0.2

Cough syrup 1 with Turmeric (Haldi) extract powder:

5ml → 100ml → 5.0ml → 10ml

Content of Curcumin (mg/100ml) =

$[(A / 168) \times (100 / V) \times 0.2 \times 1000]$

Where, A = Absorbance Reading of the sample ;

V = Volume of the sample in ml = 5

Cough syrup 2 with Turmeric (Haldi) oleoresin:

1ml → 100ml → 5.0ml → 50ml

Content of Curcumin (mg/100ml) =

$[(A / 168) \times (100 / V) \times 1 \times 1000]$

Where, A = Absorbance Reading of the sample ;

V = Volume of the sample in ml = 1

Cream with Turmeric (Haldi) oleoresin:

4.0g → 100ml → 5.0ml → 50ml

Content of Curcumin (mg/10g) =

$[(A / 168) \times (100 / W) \times 1 \times 100]$

Where, A = Absorbance Reading of the sample ;

W = Weight of the sample in g = 4

Table 1: Formulation details: tablet, capsule, syrup with "*Curcuma longa*" turmeric (haldi) extract powder as a source of "Curcumin"

Tablet	Capsule	Syrup - 1
Turmeric extract powder (Haldi extract) standardized for 20% w/w curcumin	Turmeric extract powder (Haldi extract) standardized for 20% w/w curcumin	Turmeric extract powder (Haldi extract) standardized for 20% w/w curcumin
Each tablet of 1100mg	Filled weight of each capsule 480mg	Each 10ml syrup
Composition : Each uncoated tablet contains : Turmeric extract powder (<i>Curcuma longa</i>) ... 200mg Kali mirch extract ... 10mg Excipients ... q.s.	Composition : Each Hard gelatine capsule contains, Turmeric extract powder (<i>Curcuma longa</i>) 40mg Marich extract 10mg Manjishtha extract 120mg Neem leaf extract 100mg Anantmoool extract 80mg Khadir extract 60mg Lodhra extract 20mg Excipients q.s.	Composition : Each 10 ml syrup contains: Turmeric extract powder (<i>Curcuma longa</i>)... 125mg Pippli extract..... 10mg Tulsi extract125mg Mulethi extract125mg Excipients ... q.s.

Table 2: Formulation details: syrup and cream with Turmeric (haldi) oleoresin as a source of "Curcumin"

Syrup 2	Cream
Turmeric (Haldi) Oleoresin standardized for 20% w/w curcumin	Turmeric (Haldi) Oleoresin standardized for 20% w/w curcumin
Composition : Each 10ml syrup contains: Turmeric (Haldi) oleoresin..... 125 mg Pippli extract..... 10 mg Tulsi extract125 mg Mulethi extract 125 mg Excipients ... q.s.	Composition : Each 10 g cream contains : Turmeric (Haldi) oleoresin 10 mg Marich extract 25 mg Bakuchi oil 500 mg Coconut oil 700 mg Sathi extract 25 mg Neem leaf extract 50 mg Triphala extract 100 mg Ferrous Sulphate 50 mg Excipients q.s.

Table 3: Content of "Curcumin" in different dosage forms

Extracts / Dosage form	Initial		After a period of 1 year	
	Curcumin Content *	Curcumin Content **	Curcumin Content *	Curcumin Content **
Extracts				
Turmeric (Haldi) (Curcuma longa) extract powder	Standardised for 20.00 %w/w curcumin (NLT20%w/w)	22.10%w/w	Standardised for 20.00%w/w curcumin (NLT20%w/w)	21.00%w/w
Turmeric (Haldi) oleoresin	Standardised for 20.00%w/w curcumin (NLT20%w/w)	21.09%w/w	Standardised for 20.00%w/w curcumin (NLT20%w/w)	14.97%w/w
Dosage Forms				
Tablet	Not less than 40.00 mg/tablet	44.40 mg/tablet	Not less than 40.00 mg/tablet	43.00 mg /tablet
Capsule	Not less than 8.00 mg/capsule	9.09 mg/capsule	Not less than 8.00 mg/capsule	9.00 mg /capsule
Syrup - 1	Not less than 250.00 mg/100ml	12.26 mg/100ml	Not less than 250.00 mg/100ml	7.73 mg /100ml
Syrup - 2	Not less than 250.00 mg/100ml	240.00 mg/100ml	Not less than 250.00 mg/100ml	161.90 mg /100ml
Cream	Not less than 2.00 mg /10g	2.03mg/10g	Not less than 2.00 mg/10g	1.57 mg /10g

* :- Theoretical value with respect to the product formula, ** :- Practical value (Analytical findings).

g:- gram, mg :- milligram, ml :- milliliter

RESULTS

Table 1 and 2 summarize the actual active ingredients in the individual sample under study.

Table 3 focuses on the "Curcumin content" in different dosage forms including Active Pharmaceutical Ingredient (API) namely, Turmeric (Haldi) extract powder and turmeric (Haldi) oleoresin.

Initial analysis data and the data of analysis of the same sample after 1 year are recorded in the table 3. Content of curcumin is found to be around 20.00 %w/w in turmeric extract powder, which remains stable even after 1 year. However, turmeric oleoresin gives good results at the initial level, but after 1 year it decreases from 21 %w/w to around 14.97 %w/w. It comes out to be 75 % of the labelled claim value.

Curcuma longa (Turmeric) (Haldi) extract powder is used as a source of curcumin in tablet formulation, as the blend of the tablet is in powder form. Results of curcumin content are observed to be satisfactory and stable even after 1 year at room temperature.

Similarly for capsule formulation, extract powder of turmeric is chosen as a source of curcumin, as the blend of the capsule is in powder form. Results are meeting with the specification at initial level as well as after 1 year study.

In case of syrup formulation, since syrup is in liquid form, powder form of extract creates problem with respect to solubility. During manufacturing process, at the filtration stage most of the turmeric extract powder remains unfiltered, as a result, syrup 1 mentioned in table 3 gives 12.26 mg curcumin / 100ml syrup instead of 250 mg/100 ml calculated value with respect to the manufacturing formula. Also because of non-uniform distribution of insoluble particles of turmeric extract powder in the sample, the result comes down up to 7.73 mg/100ml after a period of 1 year.

To avoid the major problem of solubility in syrup formulation, turmeric extract powder is replaced by turmeric oleoresin of same strength and this syrup 2 sample is subjected to analysis for content of curcumin. Initially the content is found to be 240 mg/100 ml, which is equivalent to 96% of the theoretically expected value. However, after a period of 1 year the results are found to be decreased to 161.90 mg/100 ml, which is equivalent to 64.76% of the theoretically expected value. This is because the Active Pharmaceutical Ingredient (API), turmeric oleoresin, used here, itself is not stable with respect to its curcumin content.

Cream formulation is made only with oleoresin, as the semisolid base of the cream does not allow the uniform distribution and homogeneity with respect to the solubility of extract powder. Turmeric oleoresin itself is in thick viscous liquid form and can be properly mixed with the cream sample. Hence the cream sample with turmeric oleoresin is analyzed for curcumin content. Results are found to be satisfactory at the initial level. Since the oleoresin is not stable for a long period, curcumin content in cream sample after a period of 1 year, is found to be 1.57mg/10g equivalent to 78.50% of the theoretical value.

DISCUSSION

Curcuma longa that is Turmeric (Haldi) extract powder can be used as a source of curcumin in certain dosage forms like tablets and capsules, where respective blends are in powdered form. However, quantitative estimation of curcumin is not possible in case of syrup formulation, due to solubility criteria of turmeric powder and its uneven distribution in the syrup. The alternative option of using turmeric oleoresin of the same strength and in the same quantity does not meet with the specification after few months, due to short shelf life of oleoresin. In cream also it shows slight deterioration after a few months. Hence turmeric oleoresin can be used as Active Pharmaceutical Ingredient (API) only for short term purpose, provided that, the oleoresin as well as its corresponding formulations, are stored at controlled conditions.

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