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**Research Article**

# Estimation of Capscaicin content in Commercial chilli powders by HPLC and study of its functional properties

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**Abstract**

Capsaicinoids are important in the food and pharmaceutical industries. The present study aimed to estimate the capscaicin content in three commercial brands of chilli powder by HPLC method. The functional properties of commercial chilli powder samples studied include determination of pungency of capsaicin in terms of schovelle heat value, gel formulation ability for topical application as pain reliever, litholytic properties and effect on oil stability for cooking purpose. The results revealed that the Capsaicin content of Brand 1 was found to be 0.13 g/100g when compared to Brand 2 (0.08 g/100gm) and Brand 3 (0.09 g/100gm). The pungency in terms of Scoville Heat Value (SHV) was found to be 20930 for Brand 1, 12880 for Brand 2 and 14490 for Brand 3 samples respectively. A good quality gel for topical application was formulated. The samples did not show liytholytic effect on renal stones and did not cause any stone dissolution. Thermal stability study has shown that the peroxide and acid values of cooking oil were found to be low when treated with commercial chilli powder extracts compared to control up on thermal degradation treatment for 72 hrs. Thus it can be concluded that commercial chilli powders have good amount of Capscaicin which also exhibits pungency properties, thermal degradation protection of cooking oils.

**Key words:** Capscaicin; Schovelle Heat value; Litholytic effect; Thermal stability

## INTRODUCTION

Red chili (Capsicum sp.) is one of the most widely cultivated spices globally valued for their sensory attributes of color, aroma and pungency. Red chilies also contain many other important nutrients and bioactive substances. The pungent flavor of red chili is due presence of closely related to the alkaloids called capsaicinoids which is found only in the genus capsicum[1, 2]. To date research has shown that capsaicinoids and capsaicin in particular have a wide variety of biological and physiological activities which provide them functions such as antioxidants[3], anti-carcinogens[4], promotion of energy metabolism and suppression of fat accumulation[5] and anti-inflammatories[6]. Indians especially South Indians consume chillies aswell as chilli powders on daily basis in variety of recipes including pickles. Thus, there is a serious lack of information about the capsaicin content of commercially available chilli powders. Therefore this study was taken up to determine the capsaicin content of commercial red chilli powders consumed in south India and study the properties of capsaicin present in the commercial samples.

## Materials and Methods.

**Procurement of Samples:** The standard Capscaicin was procured from Sigma and three Brands of commercial chilli powder samples were procured from local market

**Extraction of the samples:** The samples were extracted with methanol in soxhlet apparatus and concentrated using rotary evaporator and stored in

refrigerator for further analysis

**Estimation of capscaicin in the samples by HPLC:** The sample extracts and the standard were dissolved in methanol for estimation. The column used was C18, and chromatographic conditions used were wave length-280nm, Mobile phase – Acetonitrile: 1% acetic acid, run time- 25 min and flow rate -1.2 ml/min, Mode of elution - Isocractic flow

**Estimation of pungency of samples**: The pungency of selected samples was estimated interms of Schoville Heat value[78]

**Gel formulation:** An attempt was made to prepare gel with standard capscaicin and commercial sample extracts dissolved in methanol by adding Acrypol980, triethyleamine, PEG400, glycerol, 90% water and 18% NaOH.\

**Study of litholytic properties**: kidney stones of known weight were added to the extract of commercial chilli powders in a conical flask and stirred on rotary shaker continuously for 4 weeks. The dissolution of the stones reflecting the litholytic property was evaluated by measuring the weight of the stones on weekly basis

**Picture1. Kidney stones**

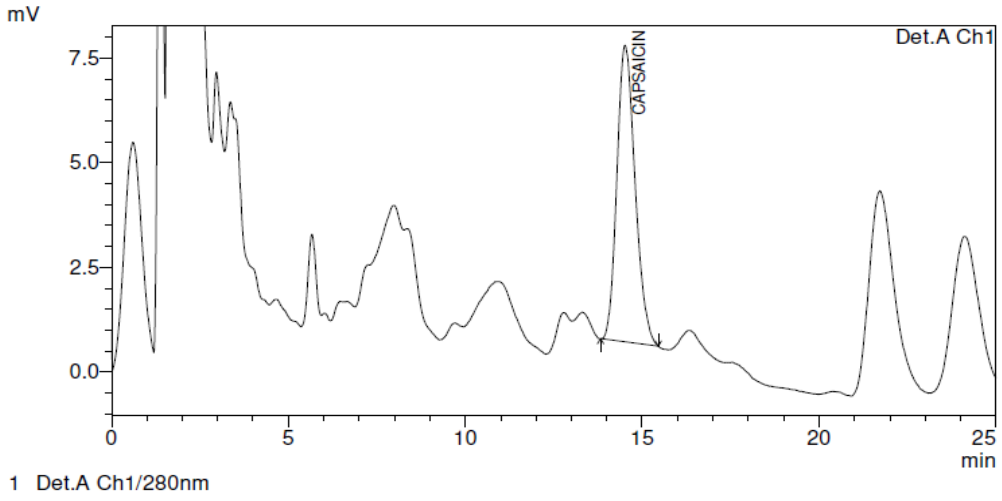
**Study of effect of capsaicin from commercial chilli powders on oil stability:**

Thermal oxidative stability of Sunflower oil was evaluated by adding commercial chillie powder extracts. Oils were subjected to high temp frying up to 140°C for 3 hours in a day for a period of 3 days to cause thermal degradation[9]. All the three days they were exposed to sun light during day and photo oxidation during night. Lipid oxidation of sunflower oil with different levels of capsaicin was evaluated by monitoring acid value and peroxide value at 0, 24, 48 and 72 hrs respectively. The Peroxide value and acid value were determined by the method of AOCS 1998 [10].

**Results and Discussion**

The chromatograms shown in figures 1, 2, 3&4 of samples correspond to standard and commercial samples respectively and reveal that capsaicin is eluted at 14.15 min, respectively. Here, the retention time of the sample is less than the standard retention time. The concentration of capsaicin in commercial sample Brand1 is more when compared to Brand 2 and Brand 3 samples. Similar results were obtained for pungency evaluation showing Brand1 sample had more pungency than the others. (Table1). This clearly shows the popularity Brand1 chilli powder in the usage of pickles by the south Indians. A clear, water-soluble, non-greasy capsaicin gel was obtained by dissolving the capsaicin in the methanol and addition of Acrypol 980, triethyleamine, PEG400 and glycerol along with 90% of the water. This gel when applied topically had the ease of spread ability (Picture 1, 2). The pain reducing properties need to be yet investigated. However, extracts of commercial samples did not produce good quality gel. When the litholytic effect was studied against renal stones, samples did not show litholytic effect and stone dissolution effect on kidney stones.

Lipid oxidation of sunflower oil with different levels of capsaicin in commercial chillie samples were evaluated by monitoring acid value and peroxide value at 0, 24, 48 and 72 hrs after subjecting it to thermal degradation and photo oxidation. Rancidity in edible oils is one of the primary factors associated with oil quality and health problems. Increased consumption of edible oils worldwide is limited by a number of factors including trans-fatty acids content and rancidity. However, edible oils are very susceptible to lipid oxidation and off-flavour development during deep frying depending upon their fatty acid composition, storage period and processing temperature. The results of the present study had shown that addition of commercial chilli powder extracts to sunflower oil has reduced the peroxide and acid values when compared to controls (Table 2 & 3). This shows the anti oxidative effect of capscaicin. Several researchers have reported the antioxidant activities of capsaicin in edible oils[9].

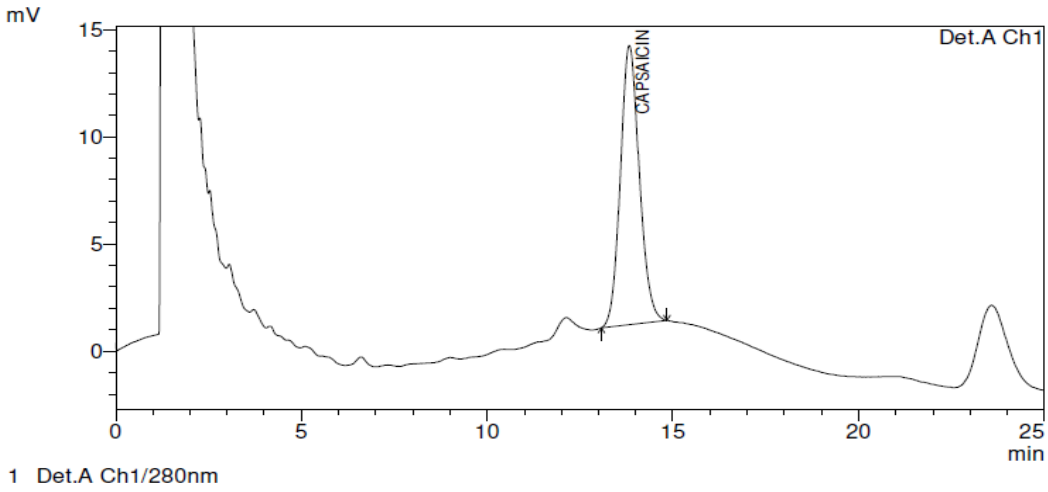



PeakTable

Detector A Ch1 280nm

| Name | Ret. Time | Area | Theoretical Plate# | Tailing Factor | Resolution |
|---|---|---|---|---|---|
| CAPSAICIN | 14.51 | 253678 | 9531 | 1.17 | 0.00 |

**Fig.1. Chromatogram of Capsaicin Standard**

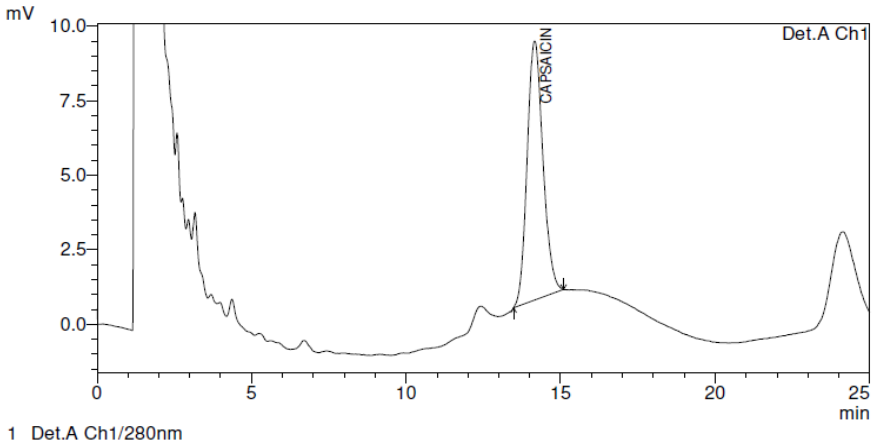



PeakTable

Detector A Ch1 280nm

| Name | Ret. Time | Area | Theoretical Plate# | Tailing Factor | Resolution |
|---|---|---|---|---|---|
| CAPSAICIN | 13.82 | 463475 | 8974 | 1.11 | 0.00 |

**Fig.2. Chromatogram of capsaicin in commercial Brand 1 chilli powder sample.**

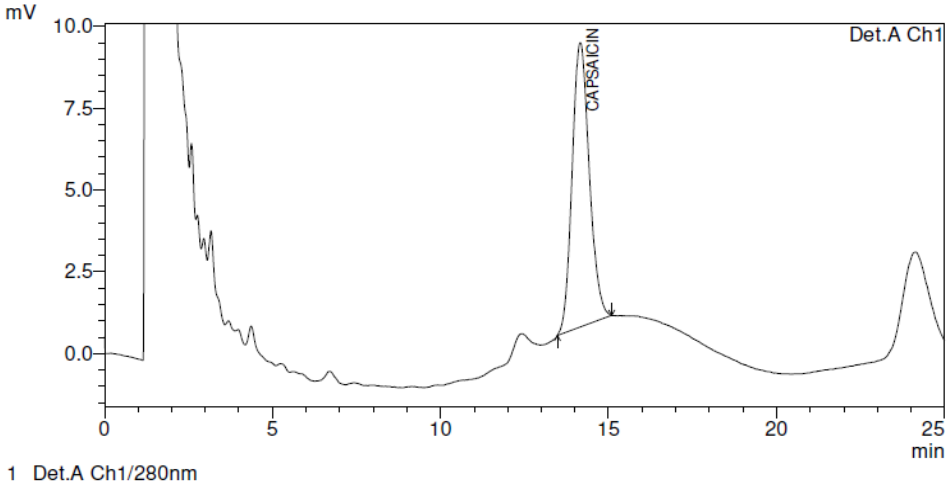



PeakTable

Detector A Ch1 280nm

| Name | Ret. Time | Area | Theoretical Plate# | Tailing Factor | Resolution |
|---|---|---|---|---|---|
| CAPSAICIN | 14.15 | 309466 | 9372 | 1.11 | 0.00 |

**Fig. 3. Chromatogram of capsaicin in commercial Brand 2 sample**




PeakTable

Detector A Ch1 280nm

| Name | Ret. Time | Area | Theoretical Plate# | Tailing Factor | Resolution |
|---|---|---|---|---|---|
| CAPSAICIN | 14.15 | 309466 | 9372 | 1.11 | 0.00 |

**Fig.4. Chromatogram of capsaicin in commercial Brand 3 chilli powder sample**

**Table 1. Capsaicin content of commercial chili powder samples (gm/100gms) and pungency in terms of Scoville Heat Value (SHV)**

| S.No | Sample | Capsaicin content | Pungency (SHV) |
|---|---|---|---|
| 1 | Brand 1 | 0.13 | 20930 |
| 2 | Brand 2 | 0.08 | 12880 |
| 3 | Brand 3 | 0.09 | 14490 |

**Capsaicin extract** **Capsaicin gel**

**Picture.1** **Picture.2**

**Table. 2. Peroxide value of oil upon thermal degradation and treatment with chilli powder extracts (mequvt. /litre)**

| Treatment groups | Peroxide value of oils at different duration of time | | | |
|---|---|---|---|---|
| | 0hrs | 24hrs | 48hrs | 72hrs |
| Sunflower oil | 6 | 20 | 24 | 30 |
| Sunflower oil + Brand 1 | 6 | 15 | 14 | 12 |
| Sunflower oil + Brand 2 | 6 | 16 | 12 | 18 |
| Sunflower oil + Brand 3 | 6 | 15 | 12 | 20 |

**Table 3. Acid value (%) of oil upon thermal degradation and treatment with chilli powder extracts**

| Treatment groups | Acid value(%) of oils at different duration of time | | | |
|---|---|---|---|---|
| | 0hrs | 24hrs | 48hrs | 72hrs |
| Sunflower oil | 0.44 | 1.6 | 2.56 | 3.33 |
| Sunflower oil + Brand 1 | 0.44 | 1.3 | 1.5 | 1.34 |
| Sunflower oil + Brand 2 | 0.44 | 1.4 | 1.78 | 1.84 |
| Sunflower oil + Brand 3 | 0.44 | 1.67 | 1.5 | 1.8 |

**Conclusions:**

This study concludes that commercial chilli powders have good amount of capsaicin. All the three brands tested had good amounts of capscaicin but Brand 1 was found to contain higher amounts than the other 2 brands. Chili peppers have a long history of use for flavoring, coloring, and preserving food, as well as for medical purposes. Capsaicin is the major pungent bioactivator in chili peppers. The receptor for capsaicin is called the transient receptor potential vanilloid subtype 1 (TRPV1). Experimental studies demonstrated that activation of TRPV1 by capsaicin could ameliorate obesity, diabetes, and hypertension. Additionally, TRPV1 activation preserved the function of cardiometabolic organs. The enjoyment of spicy flavors in food can be associated with a lower prevalence of obesity, type 2 diabetes, and cardiovascular diseases[11]. In the present study, all the samples exhibited antioxidant activity during frying when compared to control. Thus it may be suggested that chilli powders can be used to avoid thermal oxidation during deep frying of snacks which might also contribute to the taste and color.

**Conflict of interest**

The authors declare no conflict of interest

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