COMPARATIVE STUDY OF COMMERCIALLY AVAILABLE RED CHILLI POWDER IN KARACHI

FARHEEN RAFI, RUBINA PARWEEN*, FARAH KISHWER, RABIA FARHEEN, ANILA ANWAR AND AMINA SULTANA

Department of Chemistry, Federal Urdu University of Arts, Science and Technology, Karachi, Pakistan
**Corresponding author e-mail: r_ perween1@yahoo.com*

خلاصہ

موجودہ مطالعے کے لیے تجارتی طور پر دستیاب سرخ مرچ پاوڈر کے مختلف نمونوں کی فزیکل کیمیکل خصوصیات pH, conductivity, moisture and ash کی تحقیق کی گئی۔ پی ایچ کنڈیکیٹویٹی، مواسچر اور ایش کو بالترتیب مقرر حد میں ریکارڈ کیا گیا۔

4.09-5.00 692 µs/cm-794 µs/cm and 6.257%-6.562% 6.329%-6.715% جبکہ میکرو دھاتیں اور ٹرلیس دھاتیں کیلشیم، میگنیشیم اور آئرن کی مقررہ حد بالترتیب ہیں۔ 310.0mg/100g-363omg/100g,134.43mg/100g-180.0mg/100g,6.015mg/100g-17.965gm/100g موجودہ نتیجے کا موازنہ دستیاب مواد اور Asta کی قیمت سے کیا گیا ہے۔

ساتھ ہی مختلف عوامل پر بحث کی گئی جنہوں نے مقرر کردہ پیرامیٹرز کو متاثر کیا۔ نتیجے کی بنیاد پر نمونے میں نمایاں فرق دیکھا گیا،

تجارتی طور پر دستیاب برانڈ سرخ مرچ اور خود سے پرولیس سرخ مرچ پاؤڈ کی Asta کی قیمت میں مطالقت پائی گئی۔ جبکہ برانڈیڈ سرخ مرچ پاؤڈر میں نمایاں فرق نوٹ کیا گیا۔

Abstract

The current study was designed to investigate the physiochemical characteristics (pH, conductivity, moisture and ash) level of macro minerals and trace metals in the various samples of commercially available red chilli powder. The values of pH, conductivity, percentage of moisture and ash were recorded in the range of 4.91-5.00, 692µs/cm-794 µs/cm, 6.257%-6.562% and 6.329%-6.715%, respectively. While the concentration of macro metals and trace metals Ca, Mg, and Fe were determined in the range 310.0mg/100g-363.0mg/100g, 134.43mg/100g-180.0mg/100g, 16.015mg/100g-17.965mg/100g,respectively. The results were compared with available literature and ASTA value and discussed the various factors those may influence the determined parameters. The result indicates that there is significant difference were noticed among the samples. Commercially available branded red chilli powder and whole processed red chilli powder followed the ASTA values while unbranded red chilli powder showed significant difference as compared to ASTA values.

Introduction

Red chilli belongs to the family nightshade Solanaccae originated from America. Botanical name of red chilli is Capsicum. A few of the species of genus Capsicum (*Capsicum annum*, *Capsicum frutescens*, *Capsicum pubescens* and *Capsicum baceatum*) are commonly used as spices, medicines and vegetable. The fruit of Capsicum plants have a variety of name depending on location and kind. Capsaic is the active constituent of red chilli. It is an irritant for mammals, also including humans, and produces a sense of burning in any tissue with which it comes into contact (Reddy and SasiIkala, 2013). Capsicum also contains pigments like capsanthinand carotene which gives red color to the fruit. Capsicum also contains fixed oils, proteins, ascorbic acid and thiamine (Pawar *et al*., 2011).

Red chilli powder has several health benefits. It is Anti-inflammatory agent, provides Cardiovascular benefits, boost immunity, Prevents stomach ulcers and Lower the obesity. Chilli is used in diabetic neuropathy. It is antimicrobial. Red chilli is antioxidant (Ahuja and Ball, 2006).

Red chilli powder is extensively used in most of the Pakistani food as a spice. Commercially red chilli powder is available in different packaging material. Among these, some well reputed companies produce the red chilli powder packed in aluminum laminated polythene pouches enclosed in card box, while some unknown companies packed in ordinary polythene pouches.

Environmental pollution reduces the quality of raw as well as processed food. The widespread pollution with metals due to industrialization and urbanization has raised consumers and research awareness owing to their harmful impact on health (Perween, 2015).This has directed scientists all over the world to study the contaminants with respect to the metals in spices to assess their injurious effects and to determine their permissibility for human consumption. In this perspective, the present study is designed to determine physiochemical properties, macro and micro nutrients in locally available samples of red chilli powder in various packaging.

Materials and Methods

Sampling

Three types of commercially available red chilli (*Capsicum pubescens*) samples were selected for the present study and purchased from shops in local market during summer are as follows.

- Branded chilli powder (100g) packed in aluminum laminated polythene bags enclosed in card board boxes indicated as R_1.
- Unbranded chilli powder (100g) packed in polythene pouch designated as R_2.
- Whole chillies (125g) ground in grind mills to fine powder and preserved in cleaned air tight glass bottle presented as R_3.

All samples were coded and kept in refrigerator at 5 ^{o}C and brought to room temperature before experiment all samples are replicated thrice.

Reagent and contamination control

All experimental work was done by using analytical grade reagents. All chemicals were purchased from well-known companies of BDH, Merck and Sigma. Concentrated solutions were diluted with distilled deionized water as per requirement. In whole experiment the distilled deionized water was used for rinsing, preparation of standard solution and diluting stock solution. All glassware and apparatus were washed with washing liquid and rinse with tape water and soaked in 10% nitric acid for 24 hours, times with distilled water before use.

Determination of physiochemical properties

A known amount (1.0g) of sample was dissolved in 100mL distilled water and heterogeneous mixture obtained (Satishkumar *et al*., 2015). The pH (Jenway 3510PM, UK) and conductance (Jenway 4510CM, UK) of solution was determined by immersing their respective electrodes in sample solution and values recorded. The pH meter calibrated with buffer solution of pH 4 and 7 before observations recorded. The percentage of moisture was calculated by following Satishkumar *et al.* (2015) i.e taking a small quantity (1.0g) of samples in cleaned standard vials and kept in oven 100± 5^{o} C for 2 hour, placed in desiccator until the room temperature achieved and weighed. The same process was repeated until the constant weight obtained. The percentage of moisture was calculated as follow,

% moisture= (loss in weight in sample/weight of wet sample) x100

The percentage of ash in samples was determined by muffle furnace method (AOAC, 1995).The known amount (10.0gm) of sample was taken in porcelain crucible. Charred on flame then high flame and then kept in muffle furnace at (550 ^{o}C) for ~ 2 hour, Ash of samples was obtained and ash percent was calculated by weight.

Determination of calcium and Magnesium

Took 100 mL volumetric flask dissolved the known amount of ash of sample (ash of 10g sample) and made the volume up to the mark with distilled water and labeled as stock sample solution. An aliquot of sample solution (10mL) was taken in conical flask and 40mL of distilled water, 2g KOH, and one pinch of calcon indicator were added and titrated with standard disodium salt of EDTA solution until color changed from blue to red and concentration of calcium was calculated through end point volume. For magnesium appropriate volume of sample solution was taken in a 250mL conical flask and40mL distilled water, 0.25g of hydroxyl ammonium chloride, 2mL buffer solution of pH= 10, one drop of indicator EBT were added. There appeared pink color and this solution was titrated directly with the standard EDTA titrated with standard EDTA solution until blue color appeared and then 0.25g NaF added and titrated with standard solution of Mn^{+2} until blue turns to pink and recorded the end point (Jeffery *et al*., 1989)

Determination of iron

The concentration of iron was determined by following standard method of Jeffery *et al.* (1989). Appropriate volume of sample solution was taken in 50mL volumetric flask , then added 5mL KSN and 3mL HNO_3 then distilled water was added up to mark. Absorbance was recorded at 480nm by using spectrophotometer and then determined concentration of iron in sample (Jeffery *et al*., 1989). While for the calibration curve was drawn between absorbance and concentration standard of iron were prepared by taken various volume of standard solution of ferrous ammonium sulphate.

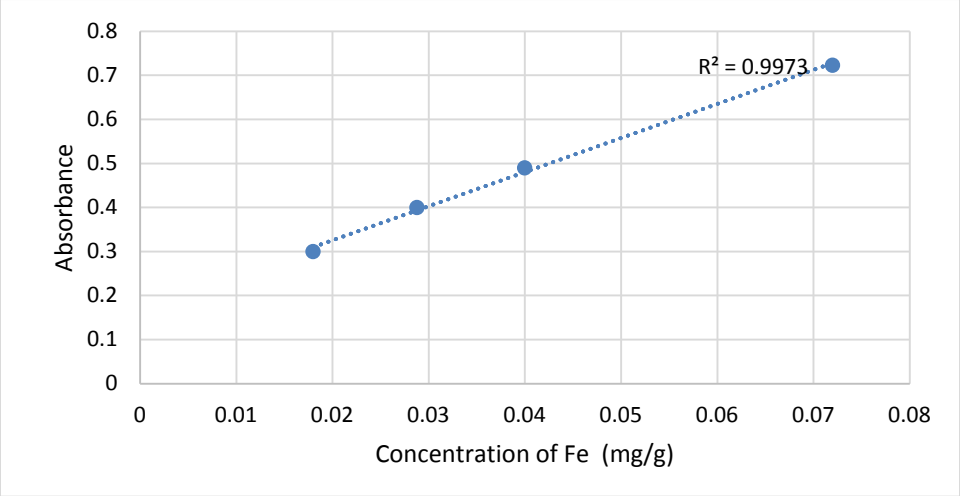

Fig 1: Calibration curve for iron.

Result and Discussion

Table 1: Physical properties of samples of red chilli powder.

Sample code	pH (Mean ± S.D)	Conductivity (Mean ± S.D) µs cm^{-1}	Moisture (Mean ± S.D) %	Ash (Mean ± S.D) %
R_1*(Branded chilli powder samples)	4.91 ± 0.01 a	794 ± 0.01 a	6.257±0.66 a	6.701±0.282 a
R_2**	4.92 ± 0.02 a	692±0.01 b	6.257±0.02 a	6.329±0.707 a
R_3***	5.00 ± 0.01 a	748±0.02 c	6.562±0.794 a	6.715±0.403 a

*:Branded chilli powder samples, **: Unbranded chilli powder samples and ***: Whole chillies ground in grind mill.
Note: Figures in a column followed by different alphabets are significantly different at p≤0.05.

Table 2: Levels (mg/100g) of macro and micro metals in red chilli powder sample.

Sample code	Ca Mean ± SD mg/100g	Mg Mean ± S.D mg/100g	Fe Mean ± SD mg/100g
R_1	352.0 ± 45.250 a	144.0 ± 13.58 a	16.01 ± 0.52 a
R_2	363.0 ± 42.40 b	180.0 ± 84.85 a	16.79 ± 0.55 a
R_3	310.0 ±14.140 c	134.4 ± 27.12 a	17.96 ± 2.21 a

*:Branded chilli powder samples, **: Unbranded chilli powder samples and ***: Whole chillies ground in grind mill.
Note: Figures in a column followed by different alphabets are significantly different at p≤0.05.

In present study the observed range of pH was noted as 4.91 to 5.00. The lowest pH value was calculated in sample R_1, while the maximum value observed in sample R_3 (Table 1). Sample R_1 was represented the well reputed company which was packed in aluminium laminated polythene pouch enclosed in printed card board box, whereas sample R_3 was related the unknown brand packed in ordinary polythene pouch. The pH content of the sample depends on the maturity of the plant, soil type, harvesting conditions and freshness of the sample (Shankuntala *et al*., 1995). Satishkumar *et al*. (2015) reported the pH values of Byadagichilli powder ranged from 4.90 to 5.06. Our result resemble with a previous study on dried chilli powder.Toontom *et al*. (2012) reported the pH value between 3.21 and 4.84. According to recorded level of pH in samples it was concluded that red chilli powder samples does not have high acidity. However, it means that the acid in the chilli was not the cause for indigestion (Kristen. 2006). Conductivity does not have any direct impact on health fitness. Determined for more than a few reason such as determination of mineralization rate (existence of minerals such as potassium, calcium, and sodium) (Rahmanian et al., 2015). In present study the observed range of conductivity was noted as 692µs/cm to 794µs/cm (Table 1). The lowest conductivity was measured in sample R_2, while the highest value observed in sample R_1. The recorded results it is established that sample R_1 have

maximum quantity of electrolytes. In human body K/Na is essential in the management of cardiovascular diseases (Etonihu *et al.*, 2013).

In present study the observed range of moisture was noted as 6.25% to 6.65%. The minimum value of moisture was measured in sample R_1, while the maximum value observed in sample R_3 (Table 1). It has been found that % of moisture in R_2 sample (unbranded chilli powder) was significant change. The moisture content in samples of chilli powder is very important since it is strongly correlated with the stability of ascorbic acid and pigment as well as any unhygienic problems (Kim *et al*., 1982). The moisture content is a very important quality factor in red pepper powder as it can affect the chemical components (Kyung-Hyung*et al*., 2012). Some studies Carbonell *et al.* (1986); Lee *et al.* (1992) and Kanner *et al*. (1977) reported that the moisture content of dried chilli ranged from 10% to 14% which indicates the loss of pigments. Wall and Bosland, (1993) reported that final moisture content at 8% is ideal and moisture content above 11% allows mould to grow. Krithika and Radhai, (2014) reported the moisture content in Sattur S4, SangaliSannam, Tomatto and Byadagichilli powder ranged from 7.8-8.6%. Satishkumar *et al.* (2015) reported the moisture values of Byadagichilli powder ranged from 8.9 to 10.08%. Kyung-hyung *et al.* (2012) reported that the moisture content of dried chilli red from 9.40 and 11.92%. On the basis of above discussion it can be conclude that the sample has enough moisture to maintain its freshness. In present study the observed range of ash was noted as 6.329% to 6.715%. The lowest ash was measured in sample R_2, while the highest value observed in sample R_3 (Table 2). It was found that % of ash in R_1 sample was significant change. Krithika and Radhai**,** (2014) reported the ash values of Sattur S4, SangliSannam, Tomato and Byadagichilli powder ranged from 3.6% to 7.4%.Our result resemble with a previous study on dried chilli powder. Satishkumar *et al.* (2015) reported the ash values of Byadagichilli powder ranged from 8.25% to 12.08%. Etonihu *et al.* (2013) reported the percentage of ash 4.35%. Our result was found within the range of some reported range. However, there are variations in reported values of ash in red chilli powder that reflect the fact that influence of several factors like environmental and geographical factors**.**

In present study the observed range of mean concentration with standard deviation level ($p<0.01$) (95%) of calcium was noted as 310.0mg/100g to 363.0mg/100g (Table 2). The lowest calcium was measured in sample R_3, while the maximum concentration observed in sample R_2. Analysis of T test of macro element was determined research indicate that level of Ca in R_3 sample was significant. Etonihu *et al.* (2013) reported the calcium concentration of chilli in Nigeria, Ghana, and Saudi-Arabia 23.45mg/100g. However, there are variations in reported concentration of calcium in red chilli powder that reflect the fact that influence of several factors like environmental and geographical factors.

In present study the observed range of average concentration with standard deviation level ($p<0.01$) (95%) of magnesium was noted as 134.43mg/100g-180.0mg/100g (Table 2) Sample R_3 showed minimum level of magnesium whereas sample R_2 exhibited maximum level of magnesium. It was found that % of Mg in R_1sample was significant. Amount of magnesium in red chilli powder influence ascorbic acid content (Khadi, *et al*., 1987). Krithika and Radhai**,** (2014) reported that the level of magnesium in red chilli powder is 10.00 mg/100g-12.20mg/100g. The present work show that the level of magnesium in all samples are not resemble with the previous work which may be due to some geographical and environmental factors.

In present study the observed range of mean concentration with standard deviation level ($p<0.01$) (95%) of iron was noted as 16.015mg/100g-17.965mg/100g (Table 2). Sample R_1 showed minimum level of iron whereas sample R_3 showed maximum level of iron. Iron is essential metal but they were toxic to humans when too high concentrations were present in edibles. Analysis of micro element was carried out it determined that level of Fe in two samples (R_1 and R_2) was significant. Plants in mining areas might have relatively high concentrations of iron (Wong, 1985). Kochhar (2008) provided the data on iron content of dry red chilli powder as 2.3 mg/g. Nkansah and Amoako (2010) reported 494mg/kg of iron in red chilli powder. Limmatvapirat *et al*. (2012) reported the iron concentration of Red Peppers ranged from 15.23 mg/100g- 49.513mg/100g in different provinces of Thailand. The lowest concentrations of iron were found in province Samut Songkhramand maximum concentration reported in province Nakhon Pathom. Which indicated that geographical factor also influence the concentration of iron in red chilli powder. Etonihu *et al.* (2013) reported value of iron 3.39mg/g. Kumaravel and Alagusundaram, (2014) reported the iron concentration in specie 5.40mg/100g. Krithika and Radhai Sri**,** (2014) reported the iron concentration in variety of vegetables including Tomato and Byadagichilli powder ranged from 31.56mg to 43.36mg. According to the reported value of different species indicated that concentration of iron varies from species to species.

Conclusion

The results were compared with available literature and ASTA value and discussed the various factors those influence on the determined parameter. The result revealed that there is significant difference were noticed among the sample. Commercially available branded red chilli powder and whole processed red chilli powder followed the ASTA value while unbranded red chilli powder showed significant difference as compared to ASTA value.

Reference

Ahuja, K.D., Ball, M.J. (2006). Effects of daily ingestion of chili on serum lipoprotein oxidation in adult men and women.*Br J Nutr*., 96(2):239-42.

AOAC, (1995), Official Methods of Analysis, (16th Edn.), Vol.II.*Association of Official Analytical Chemists, Arlington, Virginia, USA.*

Carbonell, J. V., Pinaga, F, Yusá, V. and Peña, J. L. (1986). The dehydration of paprika with ambient and heated air and the kinetics of colour degradation during Storage.*Journal of Food Engineering.* 5:179-193.

Etonihu, A.C., Obelle, F., and Nweze, C. (2013). Chemical Perspectives on Some Readily Consumed Spices and Food Condiments. *Food Science and Quality Management*.15:12.

Jeffery. G.H, Jmandham J. and Denney R.C. (1989). Vogel Text Book of Quantitative Chemical Analysis, Addison Wesley long man; *NewYork, edition* 5, 690-691,311.

Kanner, J., Harel, S., Palevitch, D., and Ben-gera, I. (1977). Colour retention in sweet paprika powder as affected by moisture contents and ripening stage. *Journal of Food Technology.* 12: 59-64.

Khadi, B. M., Goud J. V. and Patil V. B. (1987). Variation in ascorbic acid and mineral content in fruits of some varieties of chilli (Capsicum annuum L.). *Plant Foods for Human Nutrition (FormerleyQualitasPlantarum*). 37(1):9-15.

Kim, D. Y., Rhee, C. O. and Shin, S. C. (1982). Changes in color of red pepper during drying and milling. *Journal of the Korean Chemical Society*. 25: 1-7.

Kochhar K.P. (2008). Dietary spices in Health and Diseases-II. *Indian J. of Physiol*., 52:327–354.

Kristen, A. (2006). California stalic science fair, project number JO539.

Krithika, V, and Radhai, Sri, (2014). Physicochemical and Nutritional Characteristics of Chilli Cultivars. *International Journal of Research in Science*. 1(2):117–123.

Kumaravel, S. and Alagusundaram, K. (2014). Determination of mineral content in Indian spices by icp-oes. *Oriental journal of chemistry*. 30(2): 631-636.

Kyung-Hyung, K.U., kyung, A., Lee, J.B. (2012). Physicochemical Properties and Sensory Evaluation for the Heat Level (Hot Taste) of Korean Red Pepper Powder. *Preventive nutrition and food science*.17 (1):29-35.

Lee, D. S., Chung, S. K. and Yam, K. L. (1992). Carotenoid loss in dried red pepper products. *International Journal of Food Science and Technology*. 27: 179-185.

Limmatvapirat, C., Phaechamud, T., and Charoenteeraboon, J. (2012). Simultaneous Determination of Heavy Metals in Long Red Peppers by Inductively Coupled Plasma Mass Spectrometry.Silpakorn University International Conference on Academic Research and Creative Arts: *Integration of Art and Science*.95-96.

Nkansah, M.A., Amoako, C.O. (2010). Marian AsantewahNkansah, Cosmos OpokuAmoako.*American Journal of scientific and industrial research*. 1(2): 158-163.

Pawar, S.S., Bharude, N.V, Sonone, S.S., Deshmukh, R.S, .Raut, A.K and Umarkar A.R. (2011).chillies as food. Spice and medicine: a perspective. International *Journal of Pharmacy and Biological Sciences* .1(3):311-318.

Perween, Rubina, (2015). Review-Factors involving in fluctuation of trace metals concentrations in bovine milk.Pakistan *Journal of Pharmaceutical Sciences*. 28(3):1033-8.

Rahmanian, N., Ali, S.H.,Homayoonfard, M., Ali, N.J., Rehan, M., Sadaf, Y., Nizami, A.S. (2015). Analysis of Physiochemical Parameters to Evaluate the Drinking Water Quality in the State of Perak, Malaysia. *Journal of Chemistry*. 2015:10.

Reddy, V.B., and SasiIkala, P. (2013). Capsaicin and colour extraction from different verities of green and red chilli peppers of andhrapradesh. *International journal of advanced scientific and technical research*. 2(3):555.

Satishkumar, Karthik S. K. and Basamma K. A.Study of Different Physico-Chemical Properties of Byadagi Chilli Powder International *Journal of Tropical Agriculture*, 33: 2, 559-564.

Shankuntala, N.M., and Shadaksharaswamy. (1995). Food, Facts and Principles. *New Age International Publisher*.

Toontom, N., Meenune, M., Posri, W., and Lertsiri, S. (2012). International food research journal.Effect of drying method on physical and chemical quality, *hotness and volatile flavour characteristics of dried chilli*. 19(3):1023-1031.

Wall, M.M., and Bosland, P.W. (1993). The shelf-life of chillies and chilli containing products. In Charalambous, G., (Ed). *Shelf Life Studies of Food and Beverages*. 487-500.

Wong, M. H. (1985). Toxic effects of iron oretailings and response of watercress at high concentrations of Fe, Zn and Mn. Environ Pollut. A. 38:129-140.