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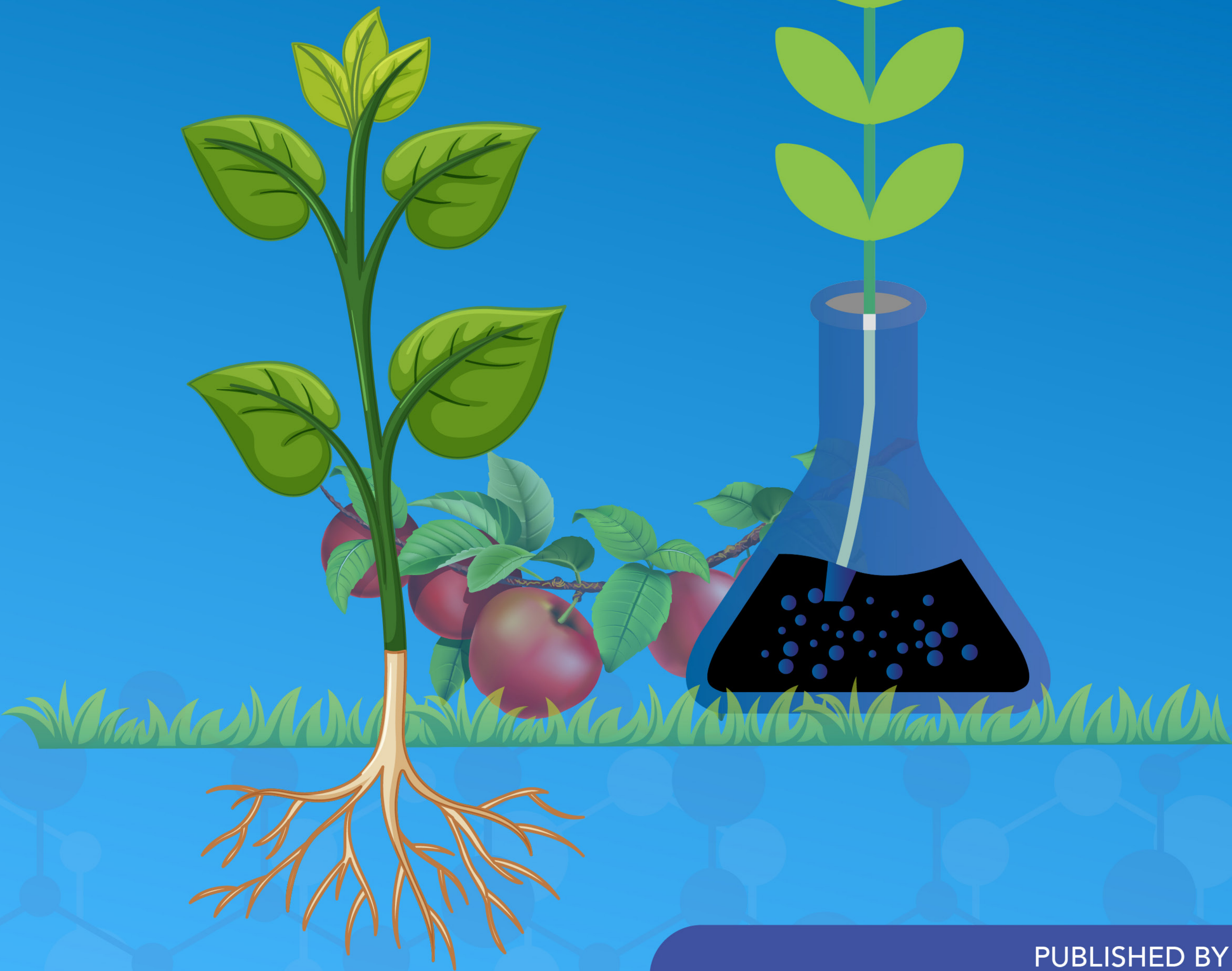

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Comprehensive Assessment of Proximate Profile and Quality Characteristics in Commercially Processed and Traditionally Prepared Red Chili Powder

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ABSTRACT

This study analyzed the proximate composition and heavy metal content of commercially processed and traditionally prepared red chili powder from Baluchara Bazar, Chattogram. Proximate analysis (AOAC, 2016) measured moisture, ash, protein, fat, and carbohydrates, while Atomic Absorption Spectroscopy detected Pb, Ni, Cd, and Hg. Traditionally prepared samples had higher carbohydrate content, whereas commercial samples showed greater protein levels. Nickel was found in all samples, with trace lead present only in commercial ones. The presence of heavy metals, even in small amounts, highlights potential health risks, emphasizing the need for stricter quality control and expanded research across regions, varieties, and quality parameters.

INTRODUCTION

Capsicum is a genus of plants belonging to the nightshade family Solanaceae, tribe Solaneae, subtribe Capsicinae. It is the oldest cultivated crops of the America. It is the most produced type of spice used for coloring and flavoring food as well as providing minerals and vitamins. Red peppers are the berries of Capsicum plant, and these are used for culinary purposes as an essential ingredient of the culinary throughout the world. (Khan *et al.,* 2019). Red chili peppers are good sources of vitamins A and C are rich in β carotene and minerals such as potassium. In order to extend the shelf life of chili pepper and utilize it in all seasons, it is usually dried after harvest (Tavakolipour & Mokhtarian, 2015). Chili peppers are generally sundried conventionally, but it is time-consuming, and it is hard to control the final moisture content, thus yielding a low-quality product with bird, rodent, and insect infestation. Moreover, post-harvest losses are as much as 40–60%. One of the most common and comparatively low-cost dehydration techniques is forced convection drying, which can lead to the degradation of vital constituents like vitamins, antioxidants, and capsaicin. This is because elevated temperatures are needed to speed up the drying process (Krzykowski *et al.,* 2024). The differences in red chili powder's quality go beyond the nutritional profile. Parameters like color, flavor, pungency, and microbial content also contribute significantly towards the product's overall quality (Navin Venketeish *et al.,* 2024). The conventional process of preparation involving hand selection and sun-drying can lead to a richer color and stronger flavor profile (Khan *et al.,* 2019).

This difference in the moisture, protein, fat, fiber, ash and carbohydrates content both in commercially processed and traditionally prepared red chili can alter the health of consumers and their market preferences. Over processing has been associated with loss of essential micronutrients and antioxidants which modifies the dietary and functional values of the spice. Additionally, there are worries regarding contamination with artificial colors, aflatoxins, and pesticide residues in commercially processed products. This study, therefore, attempts an overall assessment of proximate profile and quality differences in commercially processed versus traditionally prepared red chili powder. Such studies will provide insight into how the processing techniques apply to this common spice influence nutritional and functional properties.

Aims And Objectives

Red chili powder is widely utilized across the globe, cherished for its sharp pungency and bright coloration. The method of processing, whether commercial or subsistent, has a great bearing on its nutritional value and grade. The present study seeks to investigate such differences to ensure the consumers are educated well with regards to the nutritional safety and content of the chili powder that they use in daily cooking.

The objectives of this study are:

- Compare Nutritional Content: To compare the proximate composition (moisture, protein, fat, ash, fiber, and carbohydrates) of the traditionally prepared and commercially produced red chili powder.
- Determine Quality Differences: To ascertain and examine the quality differences between the two chili powders in terms of color, taste, and texture.
- Determine Safety and Purity: To determine that both

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types of chili powder are safe for human consumption and free of adulterants and contaminants.

- Consumer Preference Analysis: To determine the preference and perception of consumers regarding the taste, aroma, and acceptability of both types of chili powder.
- Recommendations: To suggest recommendations on how the processing steps of red chili powder can be enhanced to enhance its nutritional content and quality.

Scope of The Study

The research aims to comprehensively compare the proximate composition and quality of traditionally prepared and commercially processed red chili powder. The research will entail analysis of the key parameters such as moisture content, ash content, crude fiber, protein, fat, and carbohydrate content to establish a comparative proximate profile.

The research will compare physicochemical properties, including color, texture, particle size distribution, and potential adulterants, to determine differences in quality. Besides, the study will analyze the impact of different processing methods on nutritional retention, bioactive compounds, and contamination risks, including artificial additives, heavy metals, and microbial load. The analysis will be conducted through laboratory-based analytical techniques such as proximate analysis, spectrophotometry, and chromatography for an unbiased evaluation of quality parameters.

LITERATURE REVIEW

Red chili powder, a commonly used spice, undergoes various processing techniques that significantly affect its nutritional value, bioactive components, and quality. Conventional processing techniques, like sun drying and grinding by hand, can retain more nutrients and antioxidants; however, industrial processing techniques of mechanical drying and milling can result in the loss of nutrients, with the inclusion of microbial safety and Spices are common flavoring ingredients used in the preparation of culinary items and food products.

Red chili powder, a widely used spice, is processed using different methods that significantly influence its nutritional composition, bioactive compounds, and overall quality. Traditional preparation methods, such as sun-drying and hand grinding, may preserve more nutrients and antioxidants, while commercial processing, involving mechanical drying and milling, may lead to nutrient degradation but offer better microbial safety and consistency (Krithika & Radhai Sri, 2014). Understanding the proximate composition, mineral content, bioactive retention, and quality variations between these two processing methods is crucial for both consumers and the food industry.

The proximate composition of red chili powder is different based on the variety and processing method employed. The literature indicates that conventional processing techniques conserve greater percentages of crude protein, crude fiber, and vital minerals than commercial processing techniques.

For instance, Akhand *et al.* (2021) found that the level of crude protein (4.81%) and crude fiber (2.48%) in commercially processed chilies was significantly lower than in unprocessed ones (6.02% and 9.31%, respectively). In another similar study, (Khan *et al.,* 2019) reported that cherry-type chilies contained the highest crude fat (2.15%), ash (8.93%), and protein (9.09%) content, while intermediate-sized chilies contained the highest carbohydrate content at 52.28%. These studies, however, did not analyze the impact of various commercial processing methods on nutrient retention.

Mineral content is important in determining the nutritional value of chili powder. Appreciable differences in the content of calcium, magnesium, and potassium have been determined in various chilies and processes (Esayas *et al.,* 2011)).

Ethiopian varieties of chili, for example, Marako Fana, had the highest crude protein content (11.9%) and oleoresin content (11.2%), thus rendering them more suitable for industrial extraction. Besides, Oda Haro was also determined to contain the highest potassium (1.8 mg/100 g), calcium (54.6 mg/100 g), and iron (9.6 mg/100 g) content, thereby indicating its nutritional value (K *et al.,* 2011). In terms of phytochemical content, (Kalauni *et al.,* 2024) noted that Capsicum frutescens had the highest phenolic content (71.80 ± 3.36 mg GAE/g), whereas the lowest was recorded for C. annuum var. cerasiforme (6.59 ± 0.50 mg GAE/g).

Phytochemicals such as flavonoids, tannins, and phenolic compounds play a crucial role in the antioxidant activity of red chili powder (Krithika & Radhai Sri, 2014). Commercial processing, however, always comes with a loss of phenolic constituents as well as antioxidant activity. (Akhand *et al.,* 2021) stated that total phenolic content and antioxidant activity were considerably lower in commercially processed chilies than in their raw form.

The methods of the study affect the sensory and physicochemical properties of chili powder which includes color, pungency, and texture. It was observed that unbranded commercial chili powders, as compared to traditionally prepared ones, had lower fiber and mineral content (Krithika & Radhai Sri, 2014). Furthermore, commercial processing normally causes more degradation of capsaicin and pigments because of high temperatures, as well as prolonged storage time.

A different unbranded product may also have higher contamination and microbial safety risks. Moreover, some unbranded chili powders were found to be contaminated with heavy metals where lead (Pb) and chromium (Cr) concentrations are above permissible limits (Khalid *et al.,* 2021; Zhou & Liu, 2024).

While existing studies provide insights into the nutritional and quality differences between traditionally prepared and commercially processed chili powder, several research gaps remain:

- Impact of Processing on Bioactive Compound

Stability: More studies are needed to assess how different commercial processing methods affect capsaicinoid and carotenoid stability (Krithika & Radhai Sri, 2014).

- Storage and Shelf-Life Analysis: There is limited research on the effects of humidity, temperature, and light exposure on the long-term quality of chili powders (Krithika & Radhai Sri, 2014).
- Nutrient Bioavailability: While mineral composition has been reported, studies on how antinutritional factors influence mineral absorption remain scarce (Moulick *et al.,* 2023).
- Consumer Preferences and Market Demand: Limited research exists on consumer perception regarding sensory attributes such as pungency, color, and texture in chili powders processed using different methods (Raji Abdul Ganiy *et al.,* 2010).

The comparison of commercially processed and traditionally prepared red chili powder highlights significant differences in proximate composition, phytochemical content, and quality parameters. While traditional methods retain more nutrients and bioactive compounds (Kamal *et al.,* 2019), commercial processing ensures better safety and standardization.

MATERIALS AND METHODS

Location of Experimental Area

The experiment was conducted during January to February 2025 in the phytochemistry division of Bangladesh Council of Scientific and Industrial Research (BCSIR) laboratories Chattogram.

Sample Collection

Samples of commercially processed red chili powder and traditionally prepared red chili powder were collected from various markets and households in different regions. A total of 30 samples (15 commercial and 15 traditional) were selected to ensure diversity and representativeness.

Proximate Analysis

Accepted AOAC methodology used to determine the samples' moisture, ash, crude protein and crude fat were determined in triplicate (AOAC, 2016). The moisture content was determined by oven drying to a constant weight at 105°C.

The Kjeldahl method was used to determine the crude protein concentration (crude protein for plant origin: 5.85 N). To extract crude lipid, a Soxhlet system was employed. Ash was heated to a constant weight at 550 degrees Celsius and then measured gravimetrically in a muffle furnace. Each sample was analyzed in triplicate to ensure accuracy and reproducibility.

Moisture Content

The samples' moisture content was assessed using the accepted AOAC methodology (AOAC, 2016).

Principle: The moisture content was determined by heating the samples at 105°C to a constant weight under normal atmospheric pressure.

Apparatus: Electric balance, hot air oven, desiccators, metal tongs, crucible.

Procedure

- Accurately weigh a crucible of appropriate size.
- Add 10g of sample to the crucible and weigh.
- Place the crucible in a hot air oven at 105°C and dry for 48-72 hours.
- Remove the crucible from the oven, cover, cool in desiccators, and weigh.
- Re-dry repeatedly until a constant weight is achieved.

Calculation: % Moisture=$((w-w_1)/w) \times 100$

Where,

w = weight of fresh/air-dried sample, w_1 = weight of dried sample.

Ash Content

The samples' ash content was assessed using the accepted AOAC methodology (AOAC, 2016).

Principle: The ash fraction contains all the mineral elements and is determined by oxidizing all organic matter through incineration.

Apparatus: Electric balance, muffle furnace, electric heater, desiccators, metal tongs, crucible

Procedure:

- Clean and dry the crucible in a hot air oven.
- Cool the crucible in desiccators and weigh.
- Place 5-10g of the sample in the crucible.
- Burn the sample until no smoke is observed.
- Cool the sample and transfer to a muffle furnace.
- Ignite the sample at 550-600°C for 6-8 hours until white ash is obtained.
- Cool the furnace to 150°C and transfer the crucible to the desiccators.
- Cool the sample and weigh while it is mildly warm.

Calculation: % Ash=$((w-w_1)/w_2) \times 100$

Where,

w = weight of crucible and ash, w_1 = weight of crucible, w_2 = weight of sample.

Crude Protein Content (Kjeldahl Method)

Protein content was determined by using Kjeldahl Method, for estimation of protein, the steps were followed:

- Digestion
- Distillation
- Titration

Principle: The crude protein content is estimated based on nitrogen content using the Kjeldahl method, which includes digestion, distillation, and titration step

Apparatus: Kjeldahl apparatus, electric balance, hot air oven, desiccators, metal tongs, crucible, measuring cylinder, burette, pipette, hand gloves.

Reagents: Concentrated H2SO4, 40% NaOH solution, 2% boric acid solution, standard 0.1N HCl solution, digestion mixture (CuSO4 and K2SO4 in a ratio of 1:20), mixed indicator.

- Procedure

- Digestion
- Weigh accurately 1g of the food sample.
- Add 5g of the digestion mixture and 20ml of concentrated H2SO4.
- Place the digestion flask on the Kjeldahl digestion set, gradually increase heat, and digest until a clear residue is obtained.

Distillation

- Add 20ml of distilled water and transfer the content to the distillation flask.
- Add 100ml of 40% NaOH solution and boric acid solution with the mixed indicator in a conical flask.
- Heat the distillation flask and continue until approximately 100ml of distillate is collected.

Titration

- Titrate the distillate against standard 0.1N HCl solution.
- Calculate the titration volume and predict the value.

Calculation: % Crude protein = (A × B × 0.014× 6.25 ×100)/W

Where,

A = volume of standard 0.1N HCl solution, B = normality of standard HCl solution, W = weight of the sample.

Crude Fat Content

The samples' moisture content was assessed using the accepted AOAC methodology (AOAC, 2016).

Principle: Ether extract is estimated by extracting a known amount of the food sample with an organic solvent (diethyl ether) in a Soxhlet apparatus.

Apparatus: Soxhlet apparatus, hot water bath, electric balance, hot air oven, desiccators, hand gloves.

Reagents: Anhydrous diethyl ether (boiling point 40-60°C).

Procedure

- Dry the sample to moisture-free.
- Weigh the dry extraction flask carefully.
- Weigh 2g of the sample and transfer it into the thimble.
- Place the thimble into the extractor and close the top with cotton.
- Fit the extractor and pour ether up to siphoning.
- Pour ether again, half of the previous amount.
- Heat at 40-60°C for 6-8 hours.
- After extraction, dismantle the extraction flask and dry on the extraction bath.
- Place the flask in a desiccator and weigh to measure ether extracts.

Calculation: % Ether extract = ((A - B) /W) ×100

Where,

A = weight of the flask with ether extract, B = weight of the flask, W = weight of the sample.

Estimation of total carbohydrate

The available carbohydrate content was determined by subtracting the sum of the values of moisture, ash, protein and fat from 100/100gm (AOAC, 2016). Hence, it was calculated using the formula:

% Carbohydrate = 100 − (Moisture % + Ash% + Protein% + Fat%)

Heavy Metal Determination

Heavy metal was determined using AAS (Atomic Absorption Spectroscopy) (Islam *et al.,* 2023).

Principle: The Atomic Absorption Spectroscopy (AAS) is a widely used method for detecting and quantifying the concentration of heavy metals in samples. It relies on the absorption of light by free atoms in the gaseous state.

In this process, a sample containing heavy metals is first atomized, usually in a flame or graphite furnace. A light source, typically a hollow cathode lamp, emits specific wavelengths corresponding to the target metal. As this light passes through the atomized sample, atoms of the target metal absorb the light at their characteristic wavelengths.

The amount of light absorbed is directly proportional to the concentration of the metal in the sample. By measuring this absorbance, the concentration of heavy metals can be accurately determined, making AAS a powerful and precise analytical technique.

Apparatus: Electric balance, muffle furnace, electric heater, desiccators, metal tongs, crucible, AAS.

Procedure

- Clean and dry the crucible in a hot air oven.
- Cool the crucible in desiccators and weigh.
- Place 5-10g of the sample in the crucible.
- Burn the sample until no smoke is observed.
- Cool the sample and transfer to a muffle furnace.
- Ignite the sample at 550-600°C for 6-8 hours until white ash is obtained.
- Cool the furnace to 150°C and transfer the crucible to the desiccators.
- Digest with 10ml HNO3
- The mixture was then cooled and filtered using a filter paper in a 25 ml glass beaker and the volume was completed to 25 ml by adding deionized water.
- Measure the concentration using AAS.

RESULTS AND DISCUSSION

Nutritional Composition Analysis Result

The proximate analysis of commercially processed and traditionally prepared red chili powder is done using the accepted AOAC methodology (AOAC, 2016). The moisture, protein, fat, ash, carbohydrate content found in commercially processed and traditionally prepared red chili powder are listed in table 1.

Table 1: Proximate Composition

Sample	Ash	Moisture	Protein	Fat	Carbohydrate
Commercial	5.58±0.52^{a}	13.27±5.24^{a}	14.47±2.70^{a}	23.70±1.81^{a}	42.98±2.24^{a}
Traditional	5.50±0.22^{a}	8.09±0.74^{a}	10.60±0.74^{a}	19.50±1.04^{a}	56.32±1.26^{b}

The proximate analysis reveals notable differences between commercially processed and traditionally prepared red chili powder. Commercial processed red chili powder has higher protein (14.47%) content, whereas traditionally prepared red chili powder contains more Carbohydrate. Ash content is relatively similar in both types.

Heavy Metal Detection Result

Atomic Absorption Spectroscopy is used to identify heavy metals. nickel, lead, cadmium, and mercury were measured. The result of the heavy metal detection is given below,

Table 2: Heavy Metal Detection Result

Sample	**Pb**	**Cd**	**Hg**	**Ni**
Commercial	0.03±0.05[a]	BDL	0.01±0.02[a]	0.76±0.03[a]
Traditional	BDL	BDL	0.01±0.02[a]	1.24±0.66[a]

The heavy metal detection reveals slight difference between commercially processed and traditionally prepared red chili powder. Commercially processed red chili powder has presence of Pb, whereas traditionally prepared red chili powder contains trace number of heavy metals.

Nickel (Ni) is present in both types. The proximate composition of red chili powder as recommended by the Food and Agriculture Organization (FAO) typically includes the following components:

Table 3: Proximate Composition of Red Chili Powder (FAO)

Parameters	**RDA by FAO**
Moisture	≤ 12%
Crude Protein	10-15%
Crude Fat	8-12%
Ash (Minerals)	≤ 8%
Carbohydrates:	50-60%

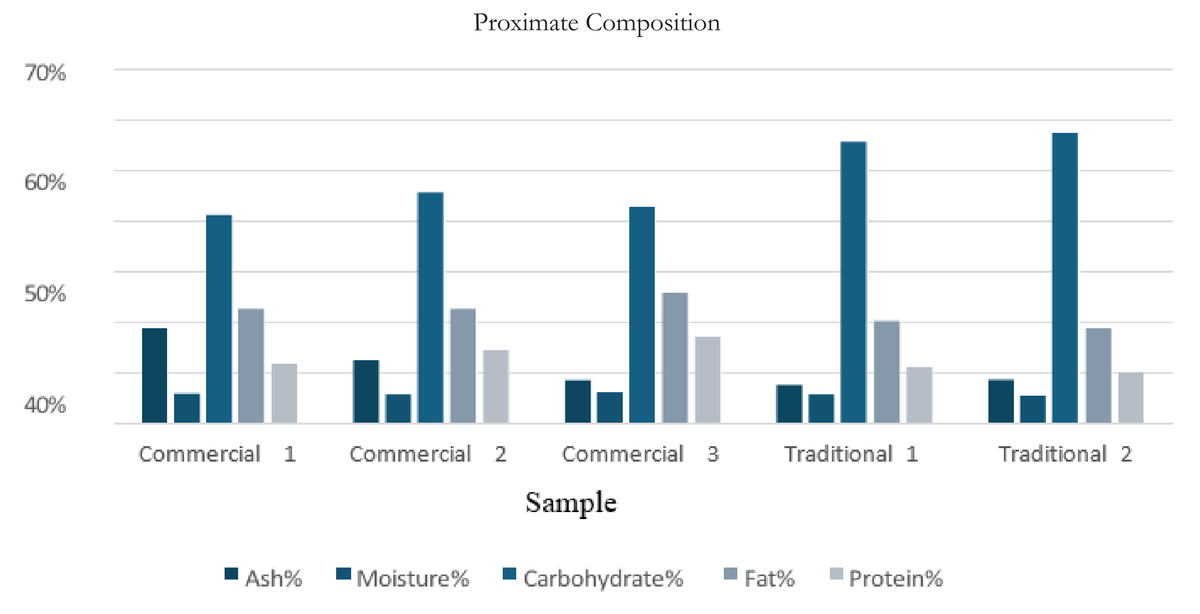

Figure 1: The graphical representation of proximate composition of commercially processed and traditionally prepared red chili powder

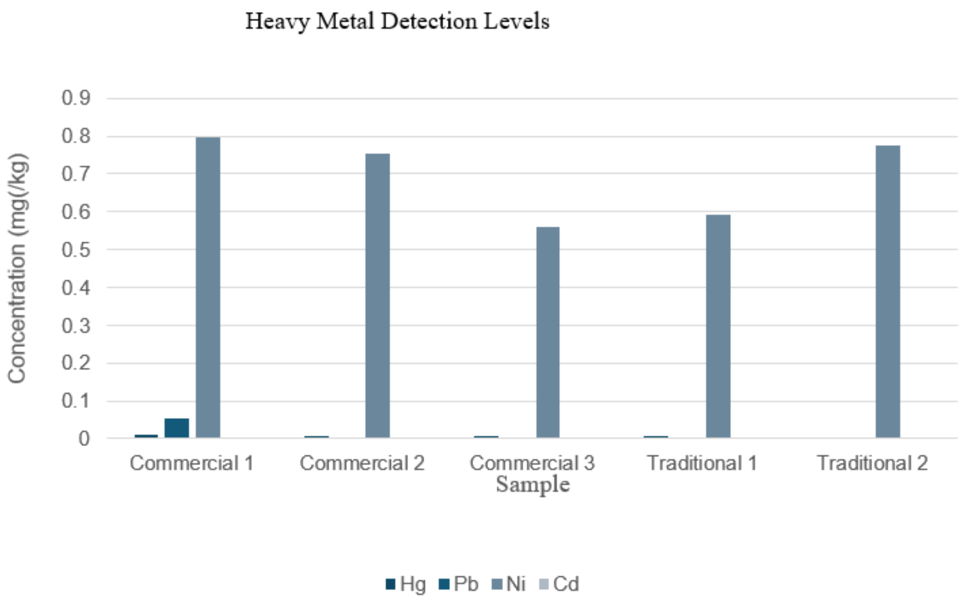

Figure 2: The graphical representation of heavy metal detection level of commercially processed and traditionally prepared red chili powder

Discussion

The comparative study of industrially processed and traditionally prepared red chili powders revealed striking differences in their proximate content and heavy metal content. These variations can be attributed to differences in processing techniques, procurement of raw materials, and potential contamination during processing.

The proximate analysis indicated that the homemade chili powders had higher carbohydrate (55.43%–57.21%) than commercial samples (40.97%–45.40%). This can be explained by the variations in drying and grinding procedures, which could affect the breakdown and retention of starch and fiber components. Conversely, industrial chili powders were richer in fat (22.67%–25.79%) and protein (11.76%–17.15%) than domestic samples, Commercial 19 producers may use chili varieties with naturally higher oil content to impart more flavor and texture. Research on the different types of chilies determined that some of them contain a higher level of fatty acids, which provides the flavor with a stronger character (Zhang *et al.,* 2024).

Industrial drying methods, such as hot air drying, can influence the retention of fatty acids in chili powders. Research indicates that hot air-treated samples maintain higher levels of fatty acids, potentially leading to increased fat content in the final product (Zhang *et al.,* 2024). Commercial chili powders may also contain oil-based additives or be treated with oil during processing for enhanced color, texture, and shelf life. Even though there are few specific studies on oil addition to commercial chili powders, oil-based additives being utilized for the enhancement of spice blends is a widespread practice among the food industry.

Interestingly, ash content, an indicator of mineral presence, was remarkably greater in commercially processed (8.48%–18.86%) than in traditionally prepared samples (7.56%–8.61%), which could be attributed to the presence of added stabilizers or metallic impurities during commercial processing (Rajeswari M *et al.,* 2018). Heavy metal analysis revealed the presence of mercury (Hg), lead (Pb), nickel (Ni), and cadmium (Cd) in both the samples at varying concentrations. Nickel was found in all of the samples, and commercial samples had a little more (0.559–0.797 mg/kg) than homemade ones (0.593–0.776 mg/kg). The presence of lead was found in just one commercial sample (0.0532 mg/kg), and no cadmium was found in any of the samples tested. Chili peppers have the potential to accumulate lead from polluted soil, water, and air during their cultivation.

Industrial processes and the application of lead-containing pesticides are responsible for high concentrations of lead in farm products. The results presuppose that commercially processed chili powders have a higher likelihood of contamination from industrial processing procedures and packaging materials (Zhou & Liu, 2024). The American Spice Trade Association (ASTA) suggests a maximum limit of 0.6 mg/kg of lead content for fruit-based spices, including chili powder. Likewise, the European Union has set a maximum of 0.5 mg/kg for lead in dried capsicum spices, i.e., chili powder. Nickel levels in spices have varied between 3.90 and 6.70 mg/kg in research (Adugna *et al.,* 2024). The research had a limited scope because of the limited sample size and samples taken from a limited geographical area. The analyzed samples were confined to a geographical location, which might not represent the range of variability in the quality of red chili powder based on varying processing conditions and climatic regions.

Laboratory facilities utilized would not have offered the broadest analysis in addition, only some of the quality attributes were analyzed and other determinants like flavor profile, antioxidant, antinutrients, and sensory properties were not considered. Future studies should include a larger range of samples and incorporate sensory evaluation procedures to give a clearer indication of variation in quality.

More research should be conducted to identify hybrid processing methods that can achieve a balance between microbial safety and nutrient retention. Investigation of other drying technologies, such as low-temperature air drying or vacuum drying, could yield alternatives that are minimally destructive to nutrients but still achieve food safety. More research should also investigate the storage stability of these two processing technologies over an extended period to ascertain their effects on quality during storage. Extending studies to toxicological examination of impurities in other processing techniques would also be beneficial to food safety regulation

CONCLUSION

The study provides a comparative analysis of the nutritional characteristics and quality parameters of red chili powder. From the results, it is apparent that red chili powder processed by traditional methods holds a higher carbohydrate content, whereas commercially processed red chili powder possesses a significantly higher protein content. These variations are a result of differences in the selection of raw materials, drying processes, processing conditions, and potential additives during industrial processing. The research offers a scientific foundation for subsequent research seeking to improve spice processing techniques in a manner that retains vital nutrients.

The findings also have implications for food safety, quality control, and nutritional labeling, informing consumers and regulatory agencies to make informed decisions regarding spice utilization and standardization. It shows how different processes affect key nutrients like carbohydrates and protein. Later studies may further improve chili powder production processes. The manufacturers can utilize this research for developing processing technologies to preserve better nutrients without loss in product quality

Future research can help improve chili powder production techniques. These improvements can ensure products meet health and quality standards. Additionally, it can guide both consumers and manufacturers in making informed choices.

REFERENCE

Adugna, T., Selale, G., & Regassa, G. (2024). Assessment of Heavy Metal Contents in Some Common Spices Available in the Local Market of North Shewa Zone, Oromia Regional State, Ethiopia. *Biological Trace Element Research, 202*(7), 3349–3361. https://doi.org/10.1007/S12011-023-03921-8

Akhand, R. N., Islam, S., & Khan, M. M. H. (2021). Comparative Analysis of Crude Protein, Total Phenolic and Antioxidant Contents of Raw and Commercially Packed Turmeric and Red Chilies. *Asian Journal of Biology*, 47–56. https://doi.org/10.9734/AJOB/2021/V11I230139

Islam, M. S., Chowdhury, A. I., Shill, L. C., Reza, S., & Alam, M. R. (2023). Heavy metals induced health risk assessment through consumption of selected commercially available spices in Noakhali district of Bangladesh. *Heliyon, 9*(11). https://doi.org/10.1016/j.heliyon.2023.e21746

K., E., A., S., F., A., R., N., B., T., & D., G. (2011). Proximate composition, mineral content and antinutritional factors of some capsicum (Capsicum annum) varieties grown in Ethiopia. *Bulletin of the Chemical Society of Ethiopia, 25*(3). https://doi.org/10.4314/BCSE.V25I3.68602

Kalauni, S. K., Pokhrel, K. P., C., A. K., & Khanal, L. N. (2024). Proximate Analysis and Comparative Evaluation of Antioxidant, Antidiabetic and Antibacterial Activities of Capsicum Species Consumed in Nepal. *Amrit Journal, 4*(1), 48–59. https://doi.org/10.3126/AMRITJ.V4I1.73752

Kamal, M. M., Ali, M. R., Rahman, M. M., Shishir, M. R. I., Yasmin, S., & Sarker, M. S. H. (2019). Effects of processing techniques on drying characteristics, physicochemical properties and functional compounds of green and red chilli (C apsicum annum L.) powder. *Journal of Food Science and Technology, 56*(7), 3185–3194. https://doi.org/10.1007/S13197-019-03733-6

Khalid, S., Tufail, S., Hussain, S., & Iqbal, M. (2021). Comparative Studies of Lead and Chromium Concentration in Red Chili and Turmeric Powder. *Biological Sciences - PJSIR, 64*(2), 198–201. https://doi.org/10.52763/PJSIR.BIOL.SCI.64.2.2021.198.201

Khan, N., Ahmed, M. J., & Shah, S. Z. A. (2019). Comparative analysis of mineral content and proximate composition from chilli pepper (Capsicum annuum L.) germplasm. *Pesquisa Agropecuaria Brasileira, 8*(2), 1338–1347. https://doi.org/10.19045/BSPAB.2019.80075

Krithika, V., & Radhai Sri, S. (2014). Physicochemical and Nutritional Characteristics of Chilli Cultivars. *ScieXplore: International Journal of Research in Science, 1*(2), 117. https://doi.org/10.15613/SIJRS/2014/V1I2/67550

Krzykowski, A., Rudy, S., Polak, R., Biernacka, B., Krajewska, A., Janiszewska-Turak, E., Kowalska, I., Żuchowski, J., Skalski, B., & Dziki, D. (2024). Drying of Red Chili Pepper (Capsicum annuum L.): Process Kinetics, Color Changes, Carotenoid Content and Phenolic Profile. *Molecules, 29*(21), 5164. https://doi.org/10.3390/MOLECULES29215164/S1

Moulick, S. P., Jahan, F., Mamun, M. Z. U. Al, Hossain, M. I. S., Waliullah, M., & Sathee, R. A. (2023). Analysis of indigenous spices widely consumed in Bangladesh: An assessment to explore its proximate contents, minerals, phytochemical compositions, and antioxidant activities. *Journal of Agriculture and Food Research, 14*. https://doi.org/10.1016/J.JAFR.2023.100720

Navin Venketeish, K. S., Govindarajan, N., & Pandiselvam, R. (2024). Influence of Processing Techniques on the Proximate Composition, Anti-Nutritional Factors, and Amino Acid Profile of Red Kidney Beans (Phaseolus vulgaris L). *Plant Foods for Human Nutrition (Dordrecht, Netherlands), 80*(1), 13–13. https://doi.org/10.1007/S11130-024-01247-X

Raji Abdul Ganiy, O., Falade Kolawole, O., & Abimbolu Fadeke, W. (2010). Effect of sucrose and binary solution on osmotic dehydration of bell pepper (chilli) (Capsicum spp.) varieties. *Journal of Food Science and Technology, 47*(3), 305. https://doi.org/10.1007/S13197-010-0048-7

Tata, S., & Bhagavatula, S. V. (2018). Estimation of Capscaicin content in Commercial chilli powders by HPLC and study of its functional properties. *International Journal of Pharmaceutics & Drug Analysis, 6*, 50–55. http://ijpda.com;

Tavakolipour, H., & Mokhtarian, M. (2016). Drying of chilli pepper in various conditions. *Quality Assurance and Safety of Crops and Foods, 8*(1), 87–93. https://doi.org/10.3920/QAS2014.0518

Zhang, R., Lv, J., Li, P., Mo, Y., Zhou, H., Wu, R., Li, M., Cheng, H., Zhang, H., Wen, J., Gui, M., & Deng, M. (2024). Analysis of changes in nutritional compounds of dried yellow chili after different processing treatments. *Scientific Reports, 14*(1), 1–15. https://doi.org/10.1038/S41598-024-72464-2;SUBJMETA

Zhou, L. Q., & Liu, W. Z. (2024). Pollution of four heavy metal elements in dried chili peppers in Guizhou Province and its health risk assessment. *Scientific Reports, 14*(1), 1–10. https://doi.org/10.1038/S41598-024-68564-8;SUBJMETA