

Chemically Detected Adulteration in Spices and Condiments

Reena Solanki^{1*}, Kiran Singh² and Manju Mehta³

¹Ph.D. Research Scholar, Family Resource Management, COHS, CCS HAU, Hisar (Haryana), India.

²Principal Scientist, Family Resource Management, COHS, CCS HAU, Hisar (Haryana), India.

³Professor and Head, Family Resource Management, COHS, CCS HAU, Hisar (Haryana), India.

(Corresponding author: Reena Solanki*)

(Received 30 November 2021, Accepted 07 February, 2022)

(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Indian food is incomplete without the addition of spices and condiments. To get more profit few selfish manufacturers and sellers are into practice of adulteration in food products. A common consumer may not have sufficient knowledge about purity and quality of food articles which he consumes. To ensure the safety of food, it is very important that various food materials purchased by consumers should be free from adulteration. Therefore, the present study is carried out with the objective of identifying the presence of common adulterants found in spices and condiments like chilli powder, coriander powder, turmeric powder, black pepper and salt. The present study was undertaken in Hisar district to test the adulteration in spices and condiments and 30 different samples of spices and condiments have taken from each rural and urban area of Hansi city. Qualitative analyses were carried out on total 60 different samples of spices and condiments. The results revealed that the maximum adulteration was found in 57 samples of black pepper (*i.e.* 95.0%) followed by 23 samples of chilli powder (*i.e.* 38.3%), 10 samples of coriander powder (*i.e.* 16.6%) and six number of samples of both turmeric powder and salt (*i.e.* 10.0%). This research paper follows the standards and procedures as prescribed by Food Safety and Standard Authority of India which helps the consumers to detect the common adulterants in spices and condiments.

Keywords: Adulterant, Colour, Food, Health, Spices and Condiments, Quality, Test.

INTRODUCTION

Food adulteration cheats the consumer and cause risk to their health. An adulterant is a substance found in other substances such as food, cosmetics, pharmaceuticals, fuels, or other chemicals that compromise the safety of that substance. The addition of adulterants is called adulteration. The most common reason for adulteration is the use of undeclared materials by manufacturers that are cheaper than the original and declared ones. Adulterants can even be due to mishandling of ingredients as well as improper packaging (Churi, 2021). In India, normally adulteration is done mainly for financial profit. Adulteration is common in almost all developing or backward countries. A study conducted by Banti (2020) revealed that adulteration in developing country is a serious problem because less strong regulatory bodies exist unlike developed world. Spices are consumed in various forms such as whole spices, ground spices, oleoresins, extracts etc. Spices play an important role in enhancing the flavor and taste of processed foods. And also used in medicine because of their carminative stimulating and digestive

properties. In Bangladesh, different types of grounded spices powders are available like onion, ginger, coriander, chilli, turmeric, cumin, etc. In today's life, people are busy in their own carriers and the demand of branded spices powder is increasing gradually. Most of the people buy loose spices from the local grocery store if branded and packaged spices are not available. This increases the risk of consuming adulterated spices. Unlike this particular adulterant which is not unhealthy (but illegal), most of the adulterants are unhealthy and can cause serious and fatal damage to our system if consumed regularly. Ground spices maybe adulterated with artificial colors, starch, chalk powder, etc. to increase their weight and enhance appearance. High value ground spices are frequently adulterated for economic gains (Mohiuddin, 2020). Another study by Sudhabindu and Samal (2020) also concluded that if adulterated spices are consumed daily then there will be a health hazard like nausea, anemia, paralysis, brain damage, abortions, insomnia, vomiting, constipation and even mental retardation. Dini and Laneri (2021) revealed that spices, condiments and extra virgin olive

oil (EVOO) are crucial components of human history and nutrition and added to foods to improve flavor and taste because they have antioxidant, antiviral, antibiotic, anticoagulant and anti-inflammatory properties for preventing chronic degenerative diseases such as cardiomyopathy and cancer when used in the daily diet. Food can be contaminated by different variants such as microorganisms, heat, moistness and water. And by the consumption of this contaminated food may leads to many multiple food borne diseases. To maintain the wellness of human beings, both food safety and security are important. Thus, to maintain and ensure food safety, the biodegradable packaging materials are extensively used to preserve the quality and freshness of food products (Modi *et al.*, 2021). Adulterants found in spices and condiments can be easily detected at home by using simple test methods that can be prepared by FSSAI in DART (Detect Adulteration with Rapid Test) booklet. (FSSAI, 2018). Sometimes, consumers are not aware of the hazards of consuming adulterated foods. If the consumers know the ways and means to check the

commodities of daily use then they can save themselves. Therefore, the main aim of this research is to identifying the presence of common adulterants found in spices and condiments.

MATERIALS AND METHODS

The tests for adulteration were carried out on 30 different samples of spices and condiments have taken from each rural and urban area of Hansi city. Samples were collected in clean, dry and sterilized conical flask. The spices and condiments were tested for the following adulterants- metanil yellow colour, artificial colour, grass seeds coloured with charcoal dust, salt and immature black pepper and papaya seeds.

The given Table 1 show the standards and procedures as prescribed by Food Safety and Standard Authority of India (FSSAI, 2012) which helps the consumers to detect the common adulterants in spices and condiments.

Table: 1 Procedure followed to test the common adulterants in selected spices and condiments.

Spices and Condiments		
Food Category	Adulterant	Procedure
Turmeric Powder	Metanil Yellow colour	Take a small quantity of sample i.e. 5g in a test tube containing 5mL quantity of water into it. Add a few drops of conc. HCl acid to it. Instant appearance of pink colour which disappears on dilution with water shows the presence of turmeric.
Chilli Powder	Artificial colour	Water soluble artificial color can be detected by sprinkling small quantity of 5g sample of chilli powder in a beaker half filled with water. Artificial colourants descend as coloured streaks.
Cumin Seeds	Grass seeds coloured with charcoal dust	Rub cumin seeds between palms of the hands. If palms turns black, it indicates adulteration .
Coriander Powder	Salt	Take 5mL of sample and add 50 mL of silver nitrate solution. White precipitate indicates adulteration.
Black Pepper	Papaya seeds Immature and light black pepper	Papaya seeds can be separated out from pepper as they are shrunken, oval in shape and greenish brown or brownish black in colour. Float the 5g sample of black pepper in 15 ml of alcohol (Rectified spirit).The mature black pepper sinks while the immature and light black pepper float. Press the black pepper with the help of fingers, light and immature black pepper will break easily while the mature black pepper will not break.
Salt	Artificial white colour	Stir a spoonful of sample of salt in a glass of water. The presence of chalk will make solution white and other insoluble impurities will settle down.

RESULTS

To study some of the common food adulterants present in spices and condiments, different food items are tested in laboratory to detect the adulterants. Data pertaining to testing of common adulterants in different food items has been given in Table 2.

The findings of the present study have been discussed in the following food items:

Turmeric Powder, Chilli Powder, Black Pepper, Coriander Powder, Salt and Cumin seeds

Turmeric Powder. On chemical analysis of turmeric powder samples, out of 30 samples, 4 samples (*i.e.* 13.3%) and 2 samples (*i.e.*6.6%) each from rural and urban area were found adulterated with metanil yellow colour. A study conducted by Jaiswal *et al.* (2016) found that 10 out of 15 samples of turmeric powder were found adulterated with metanil yellow colour.

Chilli Powder. Artificial colour was found in 14 samples (*i.e.* 46.6%) and 9 samples (*i.e.* 30.0%) each of chilli powder collected from rural and urban area were found adulterated. A study conducted by Jaiswal *et al.*

(2016) reported that 9 out of 15 samples of chilli powder were found adulterated with sudan III. and artificial colours. Another study conducted by Gandhi and Mashru (2019) revealed that 10 samples of chilli powder were analyzed out of which 7 samples showed presence of artificial colours, 6 samples was detected by thin layer chromatography for presence of sudan I dye.

Black Pepper. In black pepper samples, all the 30 samples (100%) were found adulterated with immature black pepper seeds in rural area while 27 samples (90.0%) were found adulterated in urban area. Malpani *et al.* (2017) in his study revealed that out of various ingredients (besan flour, khoa, milk, ghee, black pepper, sugar, powdered sugar, green vegetables, food colour and edible oil) black pepper and edible oil shows 100% adulteration.

Coriander Powder. On chemical analysis of coriander powder samples, out of 30 samples, 7 samples (*i.e.* 23.3%) and 3 samples (*i.e.* 10.0%) each from rural and urban area were found adulterated with salt. Faizunisa *et al.* (2016) results revealed that out of 15 samples of coriander powder the frequency of adulterant was found to be present in four loosely available samples.

Salt. In salt samples, 4 samples (*i.e.* 13.3%) from rural and 2 samples (*i.e.* 6.6%) from urban area were found adulterated with artificial colour. Abidfaheem *et al.* (2013) results revealed that out of 75 samples tested, 10.7 percent of the common salt samples were adulterated with insoluble impurities and 2.7 percent of chilli powder samples were adulterated with artificial colour.

Cumin seeds. Astonishingly out of 30 samples of cumin seeds, no adulteration were observed in the samples of both rural and in urban area.

Conclusively, results regarding spices and condiments in Fig. 1 depicted that out of 60 samples, 57 samples of black pepper (95.0%) were found adulterated with immature black pepper seeds followed by 23 samples of chilli powder (38.3%) were adulterated with artificial colour, 10 samples of coriander powder (16.6%) were adulterated with salt, 6 samples of turmeric powder (10.0%) and salt (10.0%) were adulterated with metanil yellow colour and artificial colour and in cumin seeds, no adulteration was observed in the samples of both rural and in urban area.

Table 2: Testing of Spices and Condiments Samples.

Testing of Spices and Condiments Samples	Metanil Yellow colour (Through conc. HCl)			Artificial colour (Through water)			Immature black Pepper and Papaya seeds (Through Rectified spirit)			Salt (Through Silver Nitrate)		
	Rural N=30	Urban N=30	Total N=60	Rural N=30	Urban N=30	Total N=60	Rural N=30	Urban N=30	Total N=60	Rural N=30	Urban N=30	Total N=60
Turmeric Powder	4 (13.3)	2 (6.66)	6 (10.0)	-	-	-	-	-	-	-	-	-
Chilli Powder	-	-	-	14 (46.6)	9 (30.0)	23 (38.3)	-	-	-	-	-	-
Black Pepper	-	-	-	-	-	-	30 (100.0)	27 (90.0)	57 (95.0)	-	-	-
Coriander Powder	-	-	-	-	-	-	-	-	-	7 (23.3)	3 (10.0)	10 (16.6)
Salt	-	-	-	4 (13.33)	2 (6.66)	6 (10.0)	-	-	-	-	-	-

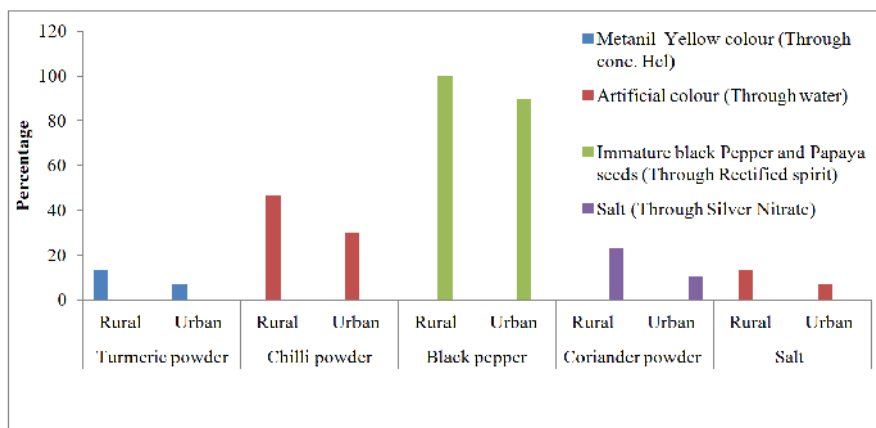


Fig. 1. Adulterants in Spices and Condiments.

DISCUSSION

Food adulteration is the act of intentionally degrading the quality of food offered for sale either by adding or substituting inferior materials or by the removal of some valuable ingredients. Just for limited economic advantages, foods are being adulterated without caring for an individual's health (Bansal *et al.*, 2017). The present study was conducted with the objective of identifying the presence of common adulterants found in spices and condiments like artificial colour found in chilli powder, salt in coriander powder, metanil yellow colour in turmeric powder, immature black pepper and papaya seeds in black pepper and artificial colour in salt. Qualitative analyses were carried out on total 60 different samples of spices and condiments. The study includes use of standards and procedures as prescribed by the FSSAI and results revealed that out of 60 samples, 57 samples of black pepper (95.0%) were found adulterated with immature black pepper seeds followed by 23 samples of chilli powder (38.3%) were adulterated with artificial colour, 10 samples of coriander powder (16.6%) were adulterated with salt, 6 samples of turmeric powder (10.0%) and salt (10.0%) were adulterated with metanil yellow colour and artificial colour and in cumin seeds, no adulteration was observed in the samples of both rural and in urban area. Due to lack of proper awareness and knowledge, majority of consumers don't understand the fraudulent practices and tactics adopted by manufacturers and sellers relating to food adulteration. And that's why they purchase low quality food products which is injurious to health. To ensure the safety and quality of food, it is very important that various food materials purchased by consumers should be free from adulteration. Sartar *et al.* (2019) conducted a study to analyze the consumer opinion towards the quality of few selected spices powder (turmeric, coriander, chili, cumin and mixed spices) available in Bangladesh and found that 90.70% people believed that the spices powders are not of good quality. And concluded that the processing entity should strictly follow the rules and regulations of the Bangladesh Food Safety Authority (BFSA) and Bangladesh Standards and Testing Institution (BSTI) standards. Another study by Sharma *et al.* (2017) revealed that adulterants like metanil yellow (an artificial color) is used to intensify the color of the turmeric powder also adulterants like chalk powder, brick powder and toxic substances are added to gain profit and to lower the cost to compete with the market. Such adulterants can lead to anemia, paralysis, brain damage, stomach disorders and also cancer. Contaminated spices have been reported to cause certain food-borne illnesses and spoilage. Al Mamun *et al.*, (2021) in his study also concluded that concentration levels of adulterants in the collected samples are higher which may cause health disease to the consumers for a long time.

The incidence of adulteration happens due to ignorance of consumer regarding their rights and responsibilities towards safe food practices leads to faulty purchasing practices. A study by Sen *et al.* (2017) revealed that major spices such as chilli powder, turmeric powder and coriander powder were collected from Vellore to detect adulterants. And chemical analysis and visual inspection were carried out to analysed the presence of adulterants. The result showed adulterants in some spices and this study brings public awareness about spice adulteration. Another study by Chandila and Puri (2019) aimed to identify the commonly used spices such as turmeric, cumin, coriander, black pepper and red chilli powder at household level and the results showed that adulteration mostly occurred in unpackaged spices and adulteration was mainly found in the form of dust, dirt and synthetic colours. And also the findings indicated that rural women have limited knowledge about spice adulteration.

The safety of food products is intrinsically linked to the method of food packaging. Moisture, heat, and microorganisms often pollute food, and its quality is diminished. Microorganisms contribute to the threat of diseases transmitted to food among people and thereby pose a public health concern. Thus, the packaging material is used to avoid food contamination and reduce food waste and preserve food quality (Han *et al.*, 2018). Plastic packaging materials represent a vulnerability to the ecological system since they are not degradable in the environment. Therefore, today's society needs both environment-friendly and degradable packaging materials. Scientists and researchers worldwide have been intrigued by the adoption of biodegradable plastics for food packaging (Hoffman *et al.*, 2018).

CONCLUSION

It can be concluded from research results and discussions lastly that the adulteration is considered as a big major problem of today's life and makes the food items unsafe and unhygienic which we use in our daily life for use. Though we all know "health is wealth," and different manufacturers, producers and sellers with an economically motivated mentality do not even leave food by making food adulterated. And for the common consumer, adulterated and contaminated food becomes a part of daily life because adulteration is everywhere. Adulteration can be prevented by few alerting steps of our society. Consumers gave more importance to expiry date while purchasing/ buying packaged but when purchasing open spices and condiments then to make ensure that such spices and condiments are of good quality and safe which don't cause any health problems. When toxic contaminants are present in very low level then it is impossible to detect adulterants in any food items. But before purchase, visual examination can help to ensure absence of insects, fungus and other foreign materials. To maintain and ensure food safety and to preserve the quality and freshness of food products,

biodegradable packing materials (*i.e.* eco -friendly) are extensively used. Consumers purchase food only those places which maintain proper hygienic conditions. Also, both local and branded food stores and prices of food items should be inspected and checked by government bodies. The increasing number of food adulterants in spices and condiments could be an alarming problem for any country regarding the health issue of the people about food safety and security. With the help of easy detection methods and various simple procedures that can be prepared by FSSAI in DART (Detect Adulteration with Rapid Test) booklet consumer's can bring this problem to an end. To combat the problem of food adulteration, government follows strict implementation of the act and stringent punishment measures for the offenders, creating awareness among the public about different adulterants present in food items. The above general consciousness is simple and easy to initiate and the possible way to control food adulteration.

Acknowledgement. I express my heartiest gratitude to my guide Dr. Kiran Singh (Principal Scientist), Department of Family Resource Management and Dr. Veenu Sangwan (Assistant Professor), Department of Foods and Nutrition for their encouragement, support and for providing good lab facilities to carry out this research work. I hereby declare that to the best of my knowledge this research is original, no part of it was earlier submitted in any institution. At last but not least, I would like to thank to all authors of references article which I studied and used in my research.

Conflict of Interest. None.

References

- Abidfaheem, T. K., Nayak, B. S. and Andrade, M. (2013). Food Adulteration and Family's Knowledge on Food Adulteration in Selected Village of Udupi Taluk, Karnataka. *Nitte University Journal of Health Science*, 3(2): 33-37.
- Al Mamun, M. A., Biswas, B. K., Tamanna, S. T. and Islam, M. B. (2021). An Overview of Food Adulterants and Their Health Impacts. *International Journal of Scientific and Research Publications*, 11(5): 780-796.
- Bansal, S., Singh, A., Mangal, M. A., Mangal, K., and Kumar, S. (2017). Food Adulteration: Sources, Health Risks and Detection Methods. *Critical Reviews in Food Science and Nutrition*, 57(6): 1174-1189.
- Banti, M. (2020). Food Adulteration and Some Methods of Detection, Review. *International Journal of Nutrition and Food Sciences*, 9(3): 86-94.
- Chandila, J. and Puri, D. (2019). A Comparative Study on Consumer Perception Towards Packaged Spices Among Rural and Urban Women. *International Journal of Health Sciences and Research*, 9(8): 399-405.
- Churi, S. K. (2021). Methods for Detection of Common Adulterants in Food. *VIVA-Tech International Journal for Research and Innovation*, 1(4): 1-9.
- Dini, I. and Laneri, S. (2021). Spices, Condiments, Extra Virgin Olive Oil and Aromas as Not Only Flavorings, but Precious Allies for Our Well being. *Antioxidants (Basel, Switzerland)*, 10(6): 868.
- Faizunisa, H., Vaishnavi, Priyadarshini, I. and Chaly, P. (2016). Evaluation of Food Adulteration Among Selected Food Items - In Vitro Study. *International Journal of Health Sciences and Research*, 6(5): 139-145.
- FSSAI, (2012). Quick test for some adulterants in food. https://www.dfda.goa.gov.in/images/PDFDOCUMENTS/quick_test_for_some_adulterants_in_food-fssai_initiative.pdf
- FSSAI, (2018). Detect adulteration with rapid test (DART) - Common quick tests for detection of some food adulterants at household.
- Gandhi, M. and Mashru, R. (2019). Detection of Adulterants in Red Chilli Powder with Special Emphasis on Qualitative and Quantitative Estimation of Sudan I Dye in Red Chilli Powder. *International Journal of Research and Review*, 6(12): 107-112.
- Han, J.W., Garcia, L. R., Qian, J. P. and Yang, X. T. (2018). Food Packaging: A Comprehensive Review and Future Trends. *Comprehensive Reviews in Food Science and Food Safety*, 17(4): 860-877.
- Hoffman, L. S., Lane, J. L., Grant, T., Pratt, S., Lant, P. A. and Laycock, B. (2018). Environmental Impact of Biodegradable Food Packaging When Considering Food Waste. *Journal of Cleaner Production*, 180: 325-334.
- Jaiswal, S., Yadav, D. S., Mishra, M. K. and Gupta, A. K. (2016). Detection of Adulterants in Spices Through Chemical Method and Thin Layer Chromatography for Forensic Consideration. *International Journal of Development Research*, 6(8): 8824-8827.
- Malpani, M. O., Masane, A. S., Pande, P. S. and Mane, V. D. (2017). Detection of Food Adulteration in Food Samples Collected Randomly in Akola Region. *An Online International Journal of Interdisciplinary Research*, 33-44.
- Modi, B., Timilsina, H., Bhandari, S., Achhami, A., Pakka, S., Shrestha, P., Kandel, D., Gc, D. B., Khatri, S., Chhetri, P. M., and Parajuli, N. (2021). Current Trends of Food Analysis, Safety, and Packaging. *International Journal of Food Science*, 1-20.
- Mohiuddin, A. K. (2020). Health Hazards with Adulterated Spices: Save the "Onion Tears". *Asian Journal of Research in Pharmaceutical Sciences*, 10(1): 21-25.
- Sattar, S., Das, P. C., Hossain, M. S., Sarower, K., and Uddin, M. B. (2019). Study on Consumer Perception towards Quality of Spices Powder Available in Bangladesh. *Open Journal of Safety Science and Technology*, 9(4): 137-144.
- Sen, S., Mohanty, P. S. and Suneetha, V. (2017). Detection of Food Adulterants in Chilli, Turmeric and Coriander Powders by Physical and Chemical Methods. *Research Journal of Pharmacy and Technology*, 10(9): 3057-3060.
- Sharma, A., Batra, N., Garg, A., Saxena, A. (2017). Food Adulteration: A Review. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, 5(3): 686-689.
- Sudhabindu, K. and Samal, K. C. (2020). Common Adulteration In Spices and Do-at-Home Tests to Ensure the Purity of Spices. *Food and Scientific Reports*, 1(9): 66-68.

How to cite this article: Reena Solanki, Kiran Singh and Manju Mehta (2022). Chemically Detected Adulteration in Spices and Condiments. *Biological Forum – An International Journal*, 14(1): 1407-1411.