Detection of adulterants in some common food items available in the Bhutanese market

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Abstract

The study was conducted during 2020-2021 at the Department of Physical Science, Sherubtse College, Royal University of Bhutan with an objective to find out whether the food items that we consume daily are adulterated or not. Various food items, both locally produced and imported, were purchased from different Dzongkhags and analyzed in the laboratory for the presence of adulterants. Locally produced food items purchased were local butter, local cheese, local honey, local chili powder, beaten rice, etc. and imported food items included pulses, chili powder, turmeric powder, spices, milk, etc. Qualitative analysis of food items for detection of adulterants was done by a simple chemical test as per the standard procedure followed by various researchers. The finding showed that local butter was found to be adulterated with banana and dalda, local honey was adulterated with sugar syrup, and beaten rice was adulterated with chlorophyll pigment. Imported lentils were adulterated with Metanil yellow. Chili powder and some spices were adulterated with artificial colours and dust particles.

Keywords: Adulteration, Local Butter, Local Cheese, Artificial, Metanil Yellow.

Introduction

Like in all developing countries, food accounts for a larger part of the family budget in Bhutan. Everybody who buys and consumes any food item wants to get the maximum quantity of a commodity for as low a price as possible. This attitude of the consumers associated with the shopkeepers and manufacturer's intention to increase profit margin is as high as possible. One of the common ways the manufacturer or shopkeepers look into making easy money is by adulterating the food items.

Food adulteration can be defined as lowering food quality by intentional or unintentional substitution of food with some inferior foreign particles or by removing some value-added food substitute from the primary food item. Food Safety and Standards Authority of India (FSSAI) defines adulterant as any material employed to make the food unsafe or sub-standard or misbranded or containing extraneous matter (FSSAI, 2016). Food can be declared adulterated when foreign substances which is

injurious to health are added, or a cheaper or an inferior quality item is added to food, or any valuable constituent is extracted from the main food item, or any foreign substance has been added to increase the overall weight or to make it appear more valuable (Bansal et al., 2017).

Consumption of adulterated foods contributes to society with many diseases ranging from mild to life-threatening conditions like vision problems, liver problems, skin diseases, and stomach disorders such as diarrhea (Bansal et al., 2017). In this modern world, it is now challenging to find any company or sector of the food industry free of adulteration (Choudhary et al., 2020).

Reports of food adulteration in Bhutan has been reported by many printed medias. Business Bhutan has written an article on, Food Adulteration: Another Deadly Symptom of Human Madness by Amrith Bdr. Subba (Business Bhutan, 2018). Since Bhutan imports almost everything from foreign countries, consumers are not aware whether the imported food items are safe to eat or not. Besides this, some people complain about the quality of locally available food items like local cheese, local honey, local butter, etc. The quality becomes inferior when the food is adulterated.

Studies have shown that there is a considerable danger of food adulteration if not controlled since it directly impacts the consumer's overall health. Therefore, it is a must for consumers to know the types of food they consume. In Bhutan though Bhutan Agriculture and Food Regulatory Authority (BAFRA) monitors all the imported food items for contamination or unhealthy food items, no full-blown research has been conducted on food adulteration in Bhutan. Therefore, this research work was carried out to test locally produced and imported food items to detect various adulterants present in them.

Methodology

Analytical procedure

A simple qualitative chemical test for the detection of various adulterants was conducted in the laboratory. Before testing the food items, multiple forms of adulterants were listed, and the standard chemical test was conducted as per the Food Safety and Standard Authority of India, act (FSSAI, 2006). After making sure all the standard tests gave positive results, the food items were then tested individually.

Mustard Oil

Mustard oils are mainly adulterated by adding argemone oil, dyes, mineral oil, or prohibited color. The chemical test carried out to test the said adulterant was adopted from the Food Safety and Standard Authority of India (2012) and Navya et al. (2017).

Milk (Local plus Imported)

Common adulterants added to milk were water, detergent, and starch. Varieties of milk samples like Nandini Smart, Nestle Nourish, Nandini Goodlife, Britannia-toned milk, Amul Taza, Cantilever, etc., and local milk from the local suppliers were tested for the presence of an excess of water, the addition of starch, and detergents. The chemical test for various adulterants were conducted by following the test conducted by FSSAI, 2012.

Butter (Local)

It is believed that local butter is usually adulterated with ripen bananas, mashed potatoes, and Vanaspati or Dalda. These adulterants can be easily detected by adopting the procedure from (Navale and Gupta, 2016)

Honey

Honey is mainly adulterated with sugar syrup, which consist of dissolved sugar crystal in water. Adulteration of honey with sugar syrup can be detected by following the test conducted by FSSAI, 2018.

Chili Powder (local and imported)

The chili powder is adulterated with numerous adulterants such as red-colored lead salts, artificial color, Sudan red III, and dust particles. They can be easily detected by adopting the procedure of Sen et al., (2017).

Coriander Powder

The husk or the dust particles are the common adulterants added in coriander powder. They can be detected by adopting the procedure of Sen et al., (2017).

Pulses (Lentils)

Yellow lentils, commonly seen in every meal in feeding schools, restaurants, and homes, is usually adulterated with Metanil yellow. It can be easily tested by adopting the procedure of Purba et. al., (2015).

Beaten Rice (Local)

Local beaten rice is usually adulterated with chlorophyll pigment to make it looks greenish and fresh. Extraction of chlorophyll from any sample can be done by adopting the procedure of Rajalakshmi and Banu, (2015).

Result and Discussion

Mustard oil

Four samples of imported mustard oil (S_1, S_2, S_3 and S_4) were tested for adulterants like prohibited color, dye, mineral oil, and Argemone. Figure 1 shows the negative and positive results of dye and prohibited color as adulterants in imported mustard oil.

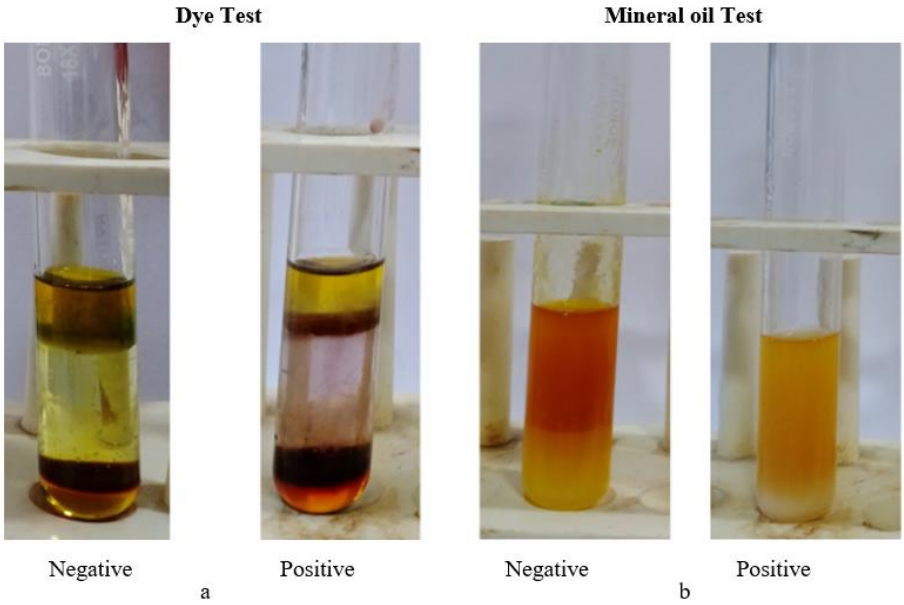

Figure 1. Positive and Negative test result of a. Dye b. Prohibited color in mustard oil.

The result showed that one sample of mustard oil (S_2) gave a positive test for added dye (Fig. 1 a) and added mineral oil (Fig. 1 b). Cheap industrial oils are usually adulterated with dyes and butter yellow to get the mustard yellow colour to be sold as pure mustard oil at a higher price (FSSAI, 2015). Adulterants mineral oil causes damage to the liver and cancer (Rajakumar and Manimegalai, 2013). Adulterants like butter yellow dye can cause the gall bladder cancer in humans (Yadav, 2018).

Local Butter

Local butter from five different Dzongkhags (Thimphu, Paro, Haa, Mongar, Trashigang) was purchased from vegetable market sheds, local shops, local suppliers, and some grocery shops. Adulterants like banana, vanaspati, and mashed potatoes were tested in all the samples. The result is shown in figure 2.

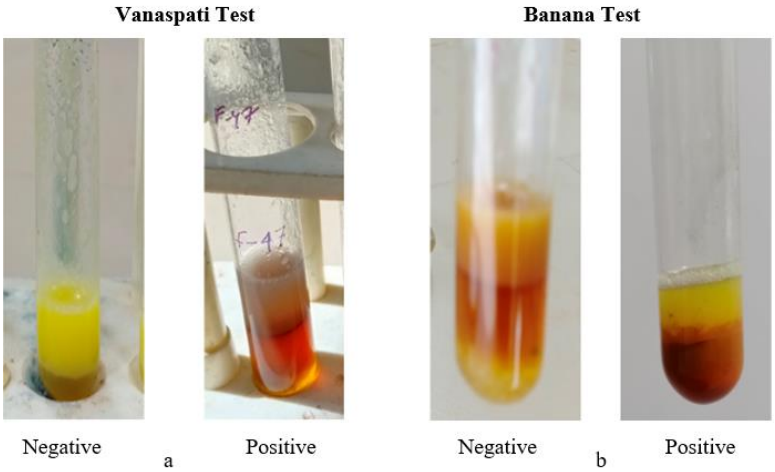

Figure 2. Positive and Negative test of a). Vanaspati b). Banana in Local Butter.

It was found that more than 50% of the local butter samples that were analyzed were adulterated with either vanaspati or banana, or both (Fig. 2a and Fig. 2b). People tend to adulterate local butter with bananas and vanaspati because it is challenging to detect with naked eyes due to their camouflage properties. Vanaspati has a high amount of trans fatty acid, which is not suitable for the human heart; therefore, butter adulterated with vanaspati will lead to heart problems in the long term (Navale and Gupta, 2016). Though banana has no immediate harmful effect, butter adulterated with it will be of low quality.

Honey

The local honey samples (3 samples from Tsirang), Bumthang honey, and Dabur honey were analyzed for the presence and absence of sugar syrup. Figure 3 shows the result of the adulteration of honey with sugar syrup.

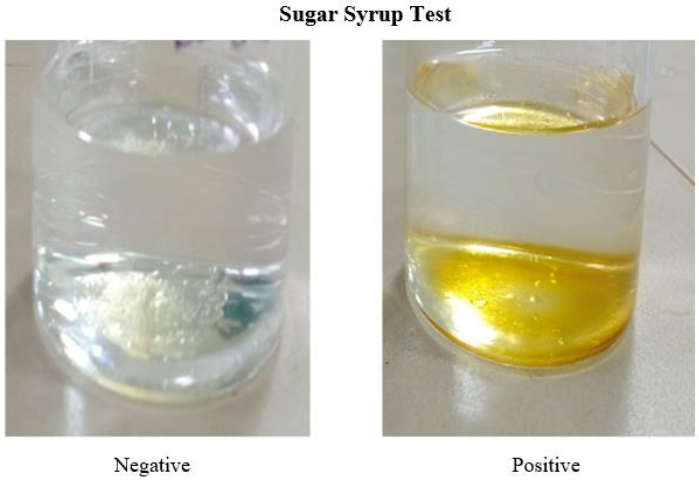

Figure 3. Negative and Positive test of adulterant sugar syrup in honey.

From the three samples of local honey, two samples were found to be adulterated with sugar solution. People tend to adulterate honey with sugar solutions to increase the volume and get maximum profit. It is because local honey is high in demand for some medicinal purposes. Though adulterant sugar syrup in honey has no immediate health impact, those who are consuming it are actually consuming inferior quality of local honey.

Lentils

Various brands of imported yellow lentils, polished to unpolished samples, were purchased from multiple grocery shops. All the samples were analyzed mainly for Metanil yellow. Figure 4 shows the results of the test.

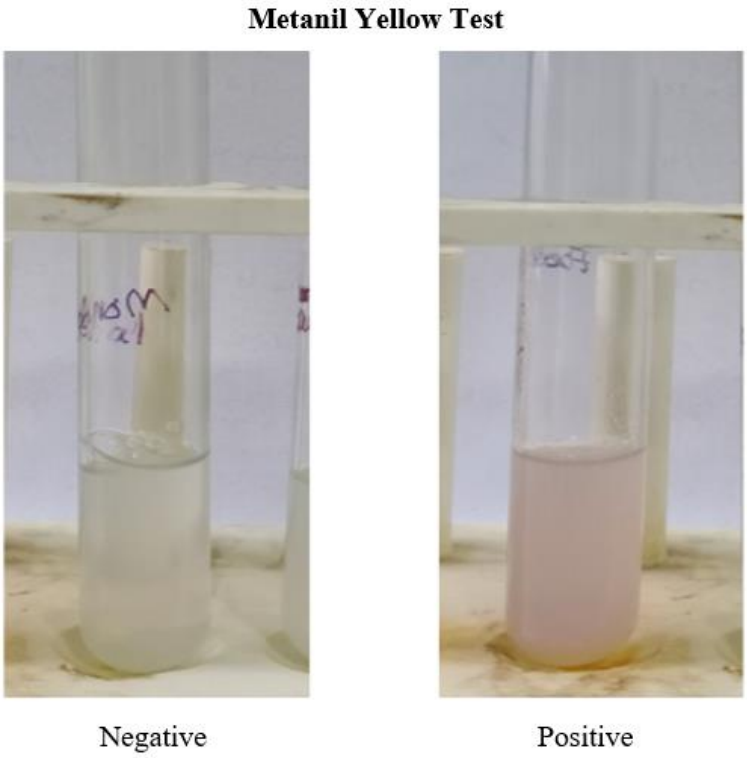

Figure 4. Negative and Positive test of Metanil Yellow in Lentils.

The finding shows that both polished and unpolished pulses (yellow lentils) were adulterated with Metanil yellow. It has been classified under category CII by the joint FAO/WHO expert committee for food additives (Rahman et al., 2019). According to the US Food and Drug Administration, Metanil Yellow has only been allowed for external use (FDA, 2012). Consumption of Metanil yellow has huge health impacts on humans for instance study have shown that it causes toxic methemoglobinemia and

cyanosis in humans (Sachdeva et al., 1992). It also has tumor-inducing effects and causes enzymatic disorders in the human body (Das et al., 1997).

Beaten Rice

Freshly made beaten rice from the first harvest of the paddy looks very fresh and greenish. Therefore, the vendor tends to adulterate old beaten rice with green pigments like pigments extracted from green leaves. A sample of beaten rice, was analyzed for the presence of chlorophyll pigment as adulterants. The result showed the positive test for chlorophyll pigment (Figure 5b). Though there is no immediate health impact of chlorophyll, the overall quality of the beaten rice is poor because vendors try to cheat customers by selling old stock beaten rice as fresh one.

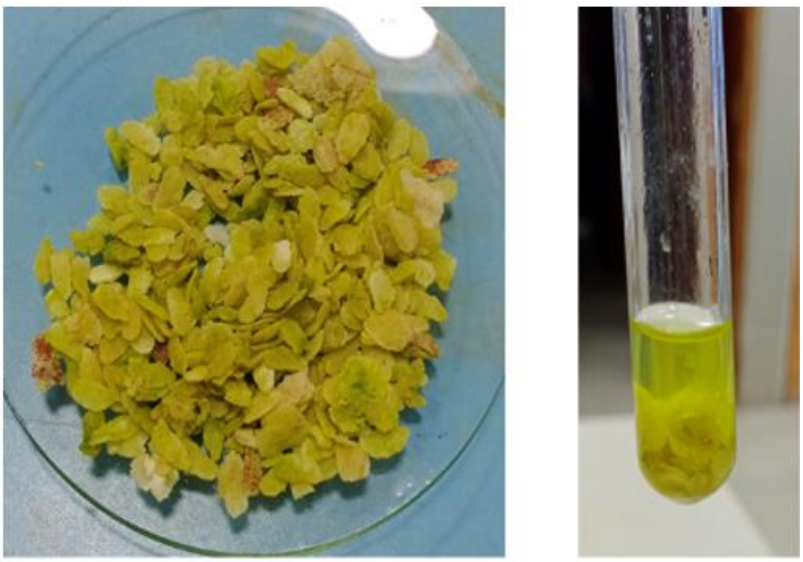

Figure 5. a. Sample of Beaten Rice b. Positive Test for Chlorophyll pigment.

Conclusion

This research was carried out with the objective to detect various adulterants in local and imported common food items qualitatively. Finding shows that there is a presence of adulterants in both local and imported food items. Local butter and honey was found to be heavily adulterated with various adulterants. Other local products like cheese and chilli powder free from any adulterants. Imported food items like mustard oil, lentils were found adulterated with coloring dye, butter yellow, mineral oil and Metanil yellow. It was found that items that are bit expensive in the market are found to be mostly adulterated.

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