INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN CHEMISTRY AND PHARMACEUTICAL SCIENCES
(p-ISSN: 2348-5213: e-ISSN: 2348-5221)
www.ijcrcps.com
(A Peer Reviewed, Referred, Indexed and Open Access Journal)
DOI: 10.22192/ijcrcps Coden: IJCROO(USA) Volume 10, Issue 7 - 2023

Research Article

DOI: http://dx.doi.org/10.22192/ijcrcps.2023.10.07.001

Investigating the amount of unauthorized colors used in cherry and barberry juice in Ilam city

Moayed Adiban[1], Leila Mirzaei[2], Abdullah Sheykhi[3], Zeinab Gholami[1], Leila Mirshekar jahangiri[1*]

[1]Health and Environment Research Center, Ilam University of Medical Sciences, Ilam, Iran.
[2]Department of Paramedical, School of Nutrition Science, Ahvaz Jundishapur University of Medical Science, Ahvaz, Iran.
[3]Department of Environmental Health Engineering, School of Health, Ahvaz Jundishapur University of Medical Science, Ahvaz, Iran.
* Corresponding author (Leilamirshekar2@gmail.com)

Abstract

Edible dyes are a group of additives that are made naturally or artificially. Colors are one of the important factors influencing the appearance and marketability of food. The purpose of this study was to determine the amount of unauthorized dyes used in cherry juice and barberry juice in the city of Ilam.In this study, 132 samples of traditional cherry juice and barberry juice (66 samples of each one) from different areas of Ilam were sampled and analyzed. The samples were analyzed after extraction of dye with Hydrochloric acid and then purified by Thin Layer Chromatography. The samples were identified according their retention factor (Rf).Overall, 67.42% of all samples contained dye. Of total the samples, 22 samples (16.67%) were unacceptability artificial edible dye, 67 samples (50.75%) were authorized artificial edible dye and 43 samples (32.58%) were natural. The most commonly used dyes were Brilliant Blue and Carmoisine in cherry juice and barberry juice.The use of authorized and unauthorized dyes in the production of cherry juice and barberry juice is on the rise due to its simplicity, low cost, availability, lack of continuous and careful monitoring and lack of awareness of the effects of dyes. Therefore, there is complete oversight of how to prepare and explain beverages and informing to the manufacturers class and to inform the consumer public of the necessities.

Keywords: cherry juice, barberry juice, unauthorized colors

1. Introduction

Much of a community's culture and civilization comprise food, its type and characteristics, including; appearance, aroma, taste, odor, color, method of cooking and its presentation. Eating habits are specific to a nation and along with other habits and characteristics, it creates a nation's culture. There for the evaluation of dietary toxicity is considered unique(1). There is a direct link between nutrition and human health, also the results of many studies show that there is some direct relationship between nutrition and human behavior.

Wrong eating habits are one of the important factors in causing nutrient deficiencies as a result of behavioral changes in humans. It has also been shown that excessive intake of certain foods, such as consuming control beverages and foods containing artificial dyes and excessive consuming sugar and allergens can lead to impaired body control mechanisms (nerves and hormones) and as a result they cause behavioral disorders (2). Food additives are a generic term for compounds that are added to food in order to maintain or improve the appearance, composition, taste and nutritional value of the food or to protect against microbial corruption.This definition includes any material added during manufacture, handling, preparation, packaging, transportation or storage of food (3,4). Colors and additives added to food have less known benefits to the consumer, but maybe important to manufacturers. The main reason for using them is to create variety and attractiveness in food products (5). Edible dyes are a group of additives that are made naturally or artificially and are among the important factors affecting the appearance and marketability of food (6).Color are classified into three groups of mineral or non-edible artificial dyes (These compounds are not found in nature and are made artificially and are not commonly used in the food), natural, edible dyes (Of plant origin example; Chlorophyll, Carotenoids, Tannins, Anthocyanins) and artificial edible dyes (example; Quinolin Yellow, Sunset Yellow, Ponceau 4R and etc.) in terms of origin (7-9). The advantage of synthetic dyes is that they are better in color durability, brightness and durability than natural dyes, but their use can have toxic and even carcinogenic effects on humans (10, 11). Variety, easy accessibility and cheapness are other advantages of artificial dyes (12, 13).The interplay of dyes with some genetic factors may also lead to some behavioral disorders in humans, so the use of these colors is one of the effective factors in ADHD in children (14). It should be noted that even natural dyes can have adverse effects on humans, so the absolute safety of any material, special dyes, has not been proven (15). Boris and Mendel (1994) studied the effect of using artificial dyes on hyperactive children and concluded that removing artificial dyes from these children’s diets improved them (16). They also reported that the use of tartrazine dye causes auger, fatigue and sleep disturbances in hypertonic children aged 2 to 14 years(17). Despite the damages caused by the use of artificial dyes on human health, research shows that the use of these dyes is unauthorized in the county. Soltan Dallal et al (2008) studied the status of the colors used in traditional cherry and barberry juice from different parts of Tehran. The results showed that 89% of the total samples contained dyes, of which 18.5% contained unacceptable edible artificial dyes and 70.5% contained authorized edible artificial dyes for industrial producer and 11% all of the samples contained natural dyes. However the use of authorized edible artificial dyes is prohibited for non-technical units(13).Given the increasing popularity of traditional juice, especially in summer and the use of dyes to attract more customers and the lack of attention to the type of dye consumed and the consequences of its use, this study was conducted in the Chemical Laboratory of Ilam University of Medical Sciences.

2. Materials and Methods

2.1.*Experimental Design*

In this study 132 samples of cherry juice and barberry juice were sampledtraditionally from production and distribution centers of Ilam city and analyzed according to the type of dye used.

Samples were evaluated for natural dye index, artificial dye permissible in the food industry (but it is not usable in the production traditional food products) and artificial dye unauthorized. Uses samples include cherries and barberries that contain edible authorized artificial dye or edible unauthorized artificial dye. Due to the solubility of dyes in water, they are increasingly used in food. The artificial edible dyes used in food are soluble in water and they are called acidic dyes. Therefore, the test was performed according to the instructions of the general administration of laboratories, including the following steps (18).

2.2. Materials and chemical solutions

All chemicals and solutions used in the experiment were made by the Merck Company that including hydrochloric acid or sulfuric acid, ammonia and the 20 x 20 plates with aluminum coating ready, Hamilton's syringe, Hematocrit tube and fat white wool taken.

2.3. The study population

66 samples of traditional cherry juice and 66 samples of traditional barberry juice were sampled from production and supply sites of Ilam city and transferred to Ilam University of Medical Sciences Chemical Laboratory for testing.

2.4. Color extraction step

Due to the solubility of the colored food in water and using this feature, the color extraction step from food sample was performed.

2.5. Purification and color extraction of water-soluble foods

To acidify the samples of cherry juice and barberry juice was added to 100 cc of sample, 1 ml of concentrated hydrochloric acid or acetic acid,then container was put on a boiling steam and a piece of white wool was thrown into the solution. After one hour under acidic conditions, the artificial dyes absorbed the wool fibers and the solution became almost colorless. Then wash the wool with coldwater and put it in a container and add about 50 ml of distilled water and 1 ml of concentrated ammonia and then place the container on a Bain Marie boiling. After almost 30 to 60 minutes, the color absorbed by the wool fibers was removed and entered the alkaline medium. At this time, the wool was discarded, which it returned all its colors or was still slightly color and the colored solution was kept on the Bain Marie boiling until it dried. After evaporation of the liquid inside the container only the color and probably a small amount of cherry or barberry juice were dried in the bottom of the container.

2.6. Chromatography step

Chromatography was performed on silica gel plate (prepared by Merck Company) with 20 x 20 dimensions.

2.7. Preparation of silica gel plate

To perform the chromatography, first activate the silica gel on the plate. By placing the plate in the Oven for 8-10 minutes at 90-100 °C until the moisture is removed and the silica gel activated, then pulled it out and let it cool.

2.8. Stain step

The prepared plate was drawn horizontally with a pencil in one direction at a distance of 3 cm from the bottom and at intervals of 3 cm were marked with a pencil on the ruler. From the extracted dye solution by sedimentation tube, it was stained in small quantities and in a short contact with the plate (The diameter of each color spot must not be more than 2 to 3 mm). The specifications of each sample were written under the marked stain and were assisted by a Hairdryer to dry each stain. If the color of each stain was low, the staining was repeated until the appropriate color concentration was obtained. This was done to determine the type of sample color.

2.9. T.L.C Tank preparation

In the case of thin-membrane chromatography or T.L.C on silica gel plate, the chromatography was

ascending and the solvent was poured into the bottom of the tank.

For this purpose, the tank was first thoroughly washed and then poured from Normal Butane + Distilled water + Acetic acid in a ratio of (5 + 6 + 10) into the tank and it was stirred until completely mixed. After the tank was prepared, the stained plate was put into the tank and placed in the tank. When the solvent front reached the bottom of the plate about 4 cm high, the plate was ejected from the tank and placed under the hood until complete drying.

2.10. Color Detection and RF Measurement Step

At this level, the sample color spot motion (RF) was measured relative to the standard color spot motion. There are different tables of motion of different colors on the plate in different solvents, but it should be noted that environmental conditions such as temperature and air pressure and airflow and recently used solvents are involved in the size of the color movement. For this reason, relying solely on the tables presented in the various books cannot be the basis for verification and Measurement. Finally, due to the colors movement rate, the desired color was recognized.

3. Results and Discussion

In this study, after analyzing and detecting colors in the samples, it was found that 89 samples (67.42%) of total samples were unusable. So that, 22 samples (16.67%) of the total samples contained unauthorized edible artificial color, 67 samples (50.75%) contained authorized edible artificial color and 43 samples (32.58%) contained natural color (Table 1).

Table 1.Status of the type of dyes in the samples of cherry and barberry juice

Color type	Number	Percentage
Authorized edible artificial dye	67	50.75
Unauthorized edible artificialdye	22	16.67
Natural dye	43	32.58

Since P value is > 0.05, there is no significant difference unauthorized edible artificial color in cherry juice and barberry juice.The use of unauthorized artificial colors in the samples of cherry juice to barberry juice has been 1 to 1. This means that against 11 samples of cherry juice, 11 samples of barberry juice contained unauthorized artificial colors.

The highest level of contamination (non-consumable samples) was observed in barberry juice samples (Table 2).

Table 2: Frequency distribution of samples of cherry and barberry juice according to consumption status

Sample status Number of samples	Consumable (n = 43)		Non-Consumable (n = 89)		Total (n=336)	
	Percent	Number	Percent	Number	Percent	Number
Cherry juice	37.88	25	62.12	41	100	66
Barberry juice	27.28	18	72.72	48	100	66

Since the P value is < 0.05, due to the presence of natural color in the samples of cherry juice and barberry juice (consumable samples), there was a significant difference and it is more in the cherry juice. The most commonly used colors in cherry juice and barberry juice were brilliant blue, followed by Carmoisine. Also, 54 samples of cherry juice (81/81%) and 57 samples of barberry juice (86/36%) were contaminated with more than one color (Table 3).

Table 3: Frequency Distribution of Samples according to Type of Unauthorized Color

Color type / Sample type	Brilliant Blue	Ponceau 4R	Sunset Yellow	Quinolin Yellow	Carmoisine	Unauthorized artificial color	Total
Cherry juice	41(100)	23(56.1)	20(48.8)	24(58.54)	40(97.57)	11(26.82)	41
Barberry juice	46(95.84)	24(50)	21(43.75)	25(52.09)	41(85.42)	11(22.91)	48

Because p value is <0.05, there is no significant difference between the two types of cherry juice and barberry juice due to the presence of the colors of Brilliant Blue and Ponceau 4R, Sunset Yellow, Quinolin Yellow and Carmoisine.

There was no significant difference in terms of geographical dispersion in the use of unauthorized or authorized edible artificial color in different parts of the city (Table 4).

Table 4: Frequency distribution of the tested samples in terms of geographical area

Sample type / Geographical region	Cherry juice				Cherry juice			
	Consumable		non consumable		Consumable		non consumable	
	(Percent)	Number	(Percent)	Number	(Percent)	Number	(Percent)	Number
North	40	2	60	3	20	1	80	4
South	50	9	50	9	22.22	4	77.78	14
East	50	6	50	6	25	3	75	9
West	33.3	1	66.7	2	0	0	100	3
City center	25	7	75	21	35.71	10	64.29	18
Total	37.88	25	62.12	41	27.28	18	72.72	48

Since the P value is > 0.05, there is no significant difference in terms of geographical dispersion in the use of unauthorized or authorized edible artificial color.

4. Conclusion

The results of this study showed that 16.67% of all samples had unauthorized edible artificial color, 50.75% had authorized edible artificial color and 32.58% had natural color. Finally, 67.42% of all samples were reported to be useless due to the use of artificial color. On the other hand, 62.12% of cherry juice samples and 72.72% of barberry juice samples were not consumable. In the samples of cherry juice and barberry juice, the color of Brilliant Blue and Carmoisine were the most used colors, respectively.

In Iran, so far, a study has been done on the type of colors used in cherry juice and barberry juice by Dr. Soltan Dallal et al., In Tehran that the Carmoisine is also most commonly used color in his study (13).The present study, which was conducted in Ilam, is the second study in this field. This study Compared with Dr. Soltan Dallal's study the use of artificial colors is less and more of the natural colors are used that this may be due to consumers' awareness of the dangers of unauthorized colors or because of careful monitoring done by health and control authorities. Studies of colors indicate that edible dyes (natural or synthetic) can cause a wide range of allergic reactions only in sensitive individuals or in some individuals (19), therefore, it is not possible to comment on the absolute safety of colored materials without relying on toxicological research. There are many food additives used in the food industry today, most of which are dyes (6). Dyes and additives added to foods have less known benefits to the consumer, but may be important for manufacturers. Variety and attractiveness in food products are the main reasons for their use. (5) The high cost of extraction and instability against changing environmental conditions and low color value of natural colors have led to more use of artificial colors, but another important factor is the lack of information about the type of artificial color (edible or non-edible) by people who use these colors (3, 11).In traditional juice products, due to lack of Technical Assistant in the production unit and lack of manufacturing licenses and hygienic code, it is declared unavailable and consumable even if authorized artificial colors are used. Therefore, such production units are only permitted to use natural and herbal colors (20).Traditional drinks and juices in our country have a special place for families since ancient times and nowadays many factories are equipped with automatic machines. But alongside these factories, there are inappropriate workshops and sometimes homes that unfortunately, people use colors similar to the natural color of the fruit, manually, for the sake of greater profitability and less use of natural fruit, Due to providing in inappropriate places, lack of Technical Assistant, lack of knowledge of production instructions and lack of hygienic authorization, purely on the basis of individual's taste, they produce abnormal juices as natural and deceive customer. This is a health issue that is causing problems for the community and it is legally burdened with fraud. While fruits such as cherries and barberry, given their significant amounts of minerals such as Calcium-Iron-Potassium-Magnesium and large amounts of B_3, B_2, B_1, C, A vitamins and their natural color can be used as a good drink especially in summer. (3 and 4 and 13).

Acknowledgments

This study is related to the project NO 904003/81 from Student Research Committee, Ilam University of Medical Sciences, Ilam, Iran. We also appreciate the “Student Research Committee” and “Research & Technology Chancellor” in Ilam University of Medical Sciences for their financial support of this study.

References

1- Excellence Center of toxicology and food chemistry. [Toxicology] Persian. 1st ed. Tehran University of Medical Sciences Press; 2008: 855-867.

2- Mota IG, Neves RA, Nascimento SS, Maciel BL, Morais AH, Passos TS. Artificial dyes: Health risks and the need for revision of international regulations. Food Reviews International. 2021 Jul 8:1-6.

3- Moore L. Black cherry. Natural Resources Conservation Service. Plant Guide. 2006.

4- Kenneth . J., Black cherry, Prunes Serotina.www. pub. med. 2006.

5- Pourahmad J. [General Toxicology] Persian. 1st ed. Tehran: Smat; 2006. P. 178-840.

6- Hosseini F, Habibi NMB, Sadaghat N, Effect of different packaging materials and storage conditions on the color of black cherry preserves. Journal of sciences and food Industry. 2009; 6(1): 45-51.

7- Us. Food and Drug Administration. Toxicological principles for the safety assessment of food ingredients. Office of food additive safety red book 2004.

8- Us. Food and Drug Administration. Toxicological testing of food Additives. Office of remarket approval. Center for food safety and applied nutrition. 1997.
9- Collins TF, Sprando RL, Shackelford ME, Hansen DK, Welsh JJ. Food and Drug Administration proposed testing guidelines for Developmental toxicity Studies. Revision Committee. FDA Guidelines for Developmental Toxicity and Reproduction. Food and Drug Administration. RegualToxicolPharmacol 1999; 30(1):39- 44.
10- Center for Science in the public Intrest. Chemical Cuisine: A Guide to food Additives. Nutrition action Health Letter; 2008. P. 1-8.
11- Revision C, Tomes FX, Collins C, Robert L, Sprado M, Shackelford D. Food and Drug Administration. Proposed Testing Guidelines for Developmental Toxicity Studies. Journal of Regulatory Toxicology and Pharmacology. 2002; 30: 39-44.
12- Pratimo R, Studershan RV, Risk assessment of synthetic food colors: a case study in Heydarabad, India. Jurnal of food safety, Nutrition and public Health. 2008; 1(1): 68-87.
13- SoltanDalal MM, Vahidi S, Najarian A, Dastbaz A, Kaashi T, Pirhadi A, Kamkar A, Faaramarzi T, Mahdavi V. To measure unpermitted used colors in presented black cherry and barberry juice in Tehran city. Payavard Salamat Journal of Tehran university of Medical science. 2008; 2(1): 55-62.
14- kleinman RE, Brown RT, Cutter GR, Dupaul GJ, Clydesdale FM. A Research model for investigating the effect of artificial food colorings on children with ADHD. American j ped 2011; 127(6): 1575- 84.
15- Hagiwara A, Imai N, Ichihara T, Sano M. Tamanos, Aoki H, et al. A thirteen – week Oral toxicity Study of annatto extract (norobixin), a natural food Color extracted from the Seed Coat of annatto (Bixaorellana L.). in Sprague- Dawley rats. Food chem. Toxicol 2003; 41: 1157-64.
16- Boris M. Mandel FS. Food and additives are common causes of the attention defict hyperactive disorder in children. Annals of Allergy. 1994; 73: 462- 467.
17- Rowe KS, Rowe KJ. Synthetic food Coloring and behaviour: A dose response effect in a double- blind, placebo-controlled. Repreated- measures study. Journal of paediatrics. 1994; 125: 691-698.
18- National Iran Standard. [Permmitted artificial colors] Persian. 4th ed. Tehran: Food & Drug Administration. 2002: 147.
19- Alison Downham, Paul Collins. Colouring our food in the last and next millennium. Received 14 July 1999; Accepted in revised from 18 November 1999.
20- Institute of Standards and Industrial Research of Iran ISIR no 740. 4th revision. 5th edition.2008.

Access this Article in Online

Website: www.ijcrcps.com

Subject: Toxicology

Quick Response Code

DOI: 10.22192/ijcrcps.2023.10.07.001

How to cite this article:

Moayed Adiban, Leila Mirzaei, Abdullah Sheykhi, Zeinab Gholami, Leila Mirshekar jahangiri. (2023). Investigating the amount of unauthorized colors used in cherry and barberry juice in Ilam city. Int. J. Curr. Res. Chem. Pharm. Sci. 10(7): 1-7.
DOI: http://dx.doi.org/10.22192/ijcrcps.2023.10.07.001

