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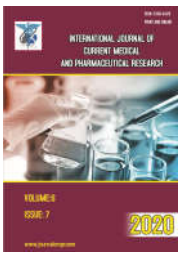

EVALUATION OF FAKESAFFRON IN THE KABUL CITY

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ABSTRACT

Saffron is a medically famous and important spice, derived from the flower of *Crocus sativus*, commonly known as the "saffron crocus". it belongs to the Genus Crocus, Order Lilacs, and Family Iridaceae. There won't be any place in the world, that won't be familiar with saffron, including Afghanistan too. The original way to obtain saffron is the stigma and styles, collected and dried for use mainly as a seasoning and coloring agent in food. The three crimson stigmas of it are the most valuable part of the plant. Saffron as a medicinal plant has many therapeutic effects. saffron is composed of at least four active phytochemicals which include crocin, crocetin, picrocrocin, and safranal. pharmacological effects such as anticonvulsant, antidepressant, anti-inflammatory, antitumor, radical scavenger effects, learning, and memory-improving effects, etc... this cross-sectional research is applied to saffron samples in the Kabul city. The results of organoleptic studies and chemical tests were obtained by examination of fifty saffron samples that are founded 4% adulteration.

INTRODUCTION

Saffron is a spice derived from the flower of *Crocus sativus*, commonly known as the "saffron crocus". it belongs to the Genus Crocus, Order Lilacs, and Family Iridaceae. The stigma and styles are collected and dried for use mainly as a seasoning and coloring agent in food. The three crimson stigmas of it are the most valuable part of the plant. These stigmas are rich in aroma, flavor, and color, used as an aromatic or coloring agent in various food preparation it is believed that saffron originated in Iran. However, Greece and Mesopotamia have also been suggested as the possible region of origin of this plant: Harold McGee states that it was domesticated in or near Greece during the Bronze Age. Countries like Iran, Spain, Italy, Switzerland, and India produce saffron. Recently saffron is cultivated largely in different provinces of Afghanistan, instead of opium, especially in Herat province and exported to Europe, USA, Australia, China, Turkish and Arabic Countries. The high price and large demand often result in adulteration of it. Adulteration of the Saffron in the present era is heinous white-collar crime as it has a direct effect on the economy of the country and has serious health impacts. The forensic examination of adulterated saffron is always a challenge to the forensic scientist to detect and determine the degree of adulteration in it.

Pharmacokinetic properties and its active components

Saffron as a medicinal plant has many therapeutic effects. saffron is composed of at least four active phytochemicals which include crocin, crocetin, picrocrocin, and safranal. The carotenoids of saffron are sensitive to oxygen, light, heat, and enzymatic oxidization. Some pharmacologic effects of saffron and its active compounds include cardioprotective, neuroprotective, memory enhancer, antidepressant, and anxiolytic.. investigations have shown that crocin is converted to crocetin in the intestine, so it isn't available after oral administration in blood circulation. Also after intravenous injection, the level of crocetin in plasma is low. Crocetin has a weak interaction with albumin therefore it can distribute in different tissues. Crocetin has the ability to penetrate the blood-brain barrier, so it can easily reach to CNS by passive transcellular diffusion. Crocetin is effective in neurodegenerative disorders. Crocetin has been known to inhibit the aggregation of β-amyloid, a nerve tissue protein. α-Synuclein (αS) is a 140-amino acid protein found abundantly in various regions of the brain. Its abnormal aggregation and accumulation in nerve tissue are said to cause neurodegenerative diseases such as Parkinson's disease Crocin-1, crocin-2, and crocetin showed anti-aggregation and fibril dissociation effects, with crocetin being the most potent [3].

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Pharmacological effects

pharmacological effects such as anticonvulsant, antidepressant, anti-inflammatory, antitumor, radical scavenger effects, learning, and memory-improving effects, etc... sativus extract has been studied in 8 anti-depressant clinical trials in comparison to placebo or some antidepressant drugs, in which saffron showed effectiveness as an antidepressant drug. Clinical trials on the anti-Alzheimer effect of saffron demonstrated that it was more effective than the placebo, and as effective as donepezil. 2 clinical trials on antipruritic and complexion promoter in skincare effects of saffron both confirmed that saffron was more efficient than the placebo. Several lines of evidence suggest that C. sativus, crocins and safranal are implicated in anxiety and schizophrenia [3]. Aqueous extract of saffron and its active compound, crocin, on the withdrawal behavior induced after repeated administration of ethanol. The muscular strength, pulmonary function, and reaction time are vital to the athlete's performance, and this study aimed to investigate an ergogenic effect of saffron. Saffron supplementation was also possibly responsible for the improvement of muscle blood perfusion and facilitation in oxygen transport. Crocetin significantly reduced Aβ40 and Aβ42 secretion in Hela cells [4] .Saffron has pharmacological properties of Anticonvulsant, Analgesic, Neuroprotective, Memory, Anti-genotoxic, Anti-oxidant, Antimicrobial and promotes the Immune system, prevents Gastric ulcer [5].

MATERIAL AND METHODS

1-5 grams of the Saffron is collected from various parts of Kabul city randomly during the month of December 2019 and were examined according to the guidelines given in the ISO (E) 3632-2 (2010)9. All chemicals used are standard. Organoleptic investigation of the saffron samples involves the sense organs to test the characters such as color, odor, size, flavor, and shape to set up the preliminary identity of saffron. Organoleptic studies revealed the preliminary idea of the originality of the saffron which includes characteristic aroma and peculiar bitter taste (table-1).

Chemical color Tests: Pure saffron gives yellow in methanol and water due to Carotenoid pigments-Crocin and Crocetin, but not in benzene, Xylene, ether, chloroform, and toluene solution. Fake saffron imparts varieties of color in different solvents. The Carotenoid pigments like Crocin, Crocetin, and Picocrocin reacts with the regent (Diphenylamine in 20 ml sulphuric Acid and 4ml water) to give a bluish color immediately, which finally changes to brownish according to the guidelines of ISO3632.

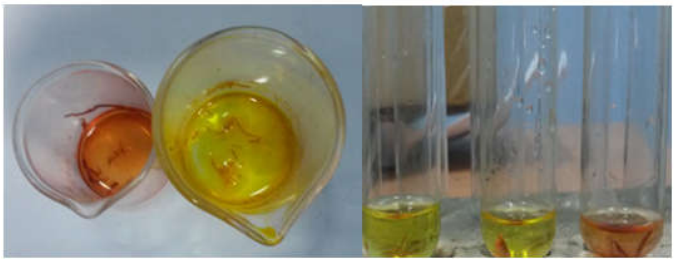

Figure 1 reaction of regent to genuine(a) and fake(b) saffron.

A = Genuine saffron
B = fake saffron

Figure 2 genuine(a) saffron and fake(b) saffron or safflower

Table 1 Organoleptic and chemical reactionresults

samples	color*	flavor	reaction*	smell	results	samples	color*	flavor	reaction*	smell	results
S1	+	bitter	+	characteristic	Genuine	S26	+	bitter	+	Characteristic	genuine
S2	+	bitter	+		Genuine	S27	+	bitter	+		genuine
S3	+	bitter	+		Genuine	S28	+	bitter	+		genuine
S4	+	bitter	+		Genuine	S29	+	bitter	+		genuine
S5	+	bitter	+		Genuine	S30	+	bitter	+		genuine
S6	+	bitter	+		Genuine	S31	+	bitter	+		Genuine
S7	+	bitter	+		Genuine	S32	+	bitter	+		Genuine
S8	+	bitter	+		Genuine	S33	+	bitter	+		Genuine
S9	-	sour	-	No smell	Genuine	S34	+	bitter	+		Genuine
S10	+	bitter	+		Genuine	S35	+	bitter	+		Genuine
S11	+	bitter	+		Genuine	S36	+	bitter	+		Genuine
S12	-	bitter	-	No smell	Fake	S37	+	bitter	+		Genuine
S13	+	bitter	+		Genuine	S38	+	bitter	+		Genuine
S14	+	bitter	+		Genuine	S39	+	bitter	+		Genuine
S15	+	bitter	+		Genuine	S40	+	bitter	+		Genuine
S16	+	bitter	+		Genuine	S41	-	sour	-		Fake
S17	+	bitter	+		Genuine	S42	+	bitter	+		Genuine
S18	+	bitter	+		Genuine	S43	+	bitter	+		Genuine
S19	+	bitter	+		Genuine	S44	+	bitter	+		Genuine
S20	+	bitter	+		Genuine	S45	+	bitter	+		Genuine
S21	+	bitter	+		Genuine	S46	+	bitter	+		Genuine
S22	+	bitter	+		Genuine	S47	+	bitter	+		Genuine
S23	+	bitter	+		Genuine	S48	+	bitter	+		Genuine
S24	-	sour	-	No smell	Fake	S49	+	bitter	+		Genuine
S25	+	bitter	+		Genuine	S50	+	bitter	+		Genuine

Thin Layer Chromatography (TLC)

Sample preparation: Methanol extract of equal aliquots of pure and fake saffron (2- stigma thread of saffron in 3ml of methanol).

Stationary phase: A standard Pre-coated TLC plates of Silica gel G 60 (12×5); Merck.

Mobile Phase: 1- Butanol, Acetic acid, Water (4, 1, 5 by v/v.).

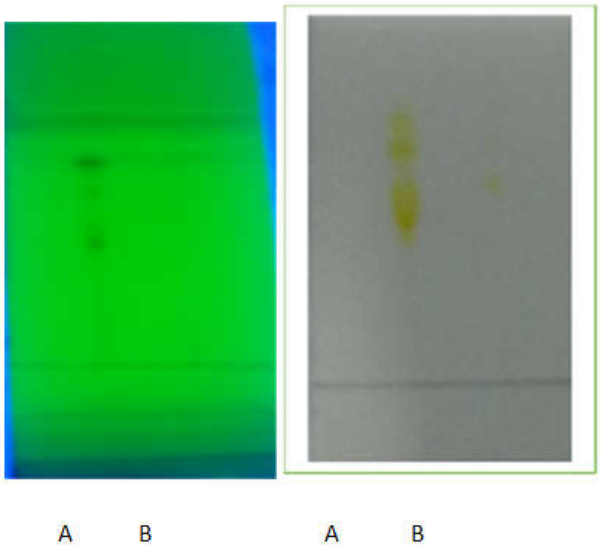

Figure 3 result of chromatography.

A = genuine saffron
B = fake saffron

Crocin and crocetin of pure saffron show yellow spots. and fake saffron shows violet spots. Short wave (254nm) visualization of TLC plate, gives light green fluorescence; and gives yellowish and pink fluorescence at Longwave (365nm) visualization of the TLC plate. A Normal daylight visualization, shows yellow spots of Crocin and crocetin of pure saffron.

Microscopic features of entire saffron (stigma) are studied using a compound light microscope of SMARTe-320. Saffron was depigmented by methanol for 4 hours, followed by three washing with a solution of methanol & water (1:1) and final washing of saffron by methanol only, then exposed saffron samples were observed directly by microscope. Observation of the anatomical elements which includes fingerlike projections on the top extremity, small adaxial dermal papillae, Pollens, etc. constitute peculiar features of the original saffron. The fake saffron lacks such anatomical elements and exhibits varieties of structures like irregular pigment distribution, presence of lacunae, absence of abaxial and adaxial epidermis etc.

Microscopic Investigation

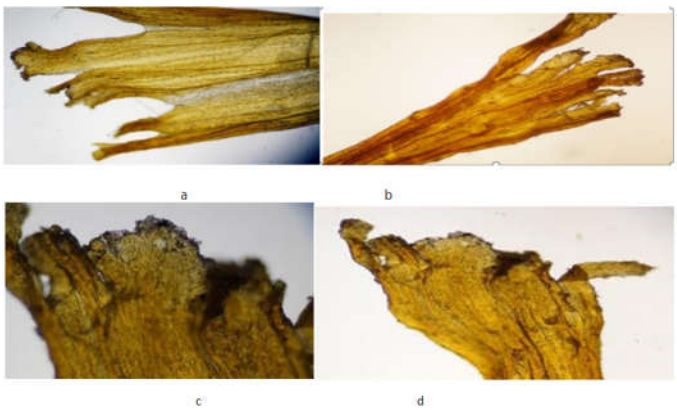

Figure 4 genuine (a, b) and fake (c, d) saffron.

RESUTLS

The results of organoleptic studies and chemical tests were obtained by examination of fifty varieties of saffron samples that are founded 4% adulteration.

Table 1 Organoleptic and Chemical characteristics

Saffron	Condition	Smell	Taste	Chemical test	Result
S1	dried	No smell	sour	yellow colour	-
S2	dried	No smell	sweet	yellow colour	-
S3	dried	characteristic	bitter	blue colour	+
S4	dried	characteristic	bitter	blue colour	+
S5	dried	No smell	sour	yellow colour	-
S6	dried	No smell	sour	yellow colour	-

CONCLUSION

In the present research, preliminary the organoleptic and microscopical examination was conducted on the saffron of Kabul city supermarkets for the determination of frauds and adulteration. Out of fifty of saffron samples, two saffron were found fake and sold in the market as genuine saffron to mislead the consumers.

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