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SIRKA (VINEGAR): FROM TRADITIONAL USE TO SCIENTIFIC APPROACH.

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ABSTRACT

Traditional medicine is the summation of knowledge, skills and practices based on theories, beliefs and experiences which are indigenous to different cultures. Sirka (Vinegar) has a long historical background and besides its usage as a common condiment, food ingredient, preservative, flavoring and culinary agent it has also been extensively exploited as a potent medicinal substance. The use of vinegar to fight infections and other acute conditions dates back to Hippocrates who recommended a vinegar preparation named sikanjabeen for cleaning ulcerations and for the treatment of sores. Sikanjabeen was also used in conventional system of medicine by the name of oxymel. According to Unani classical literature, it is obtained after fermentation of various substances such as grapes, sugarcane, dried grapes, figs, jamun, honey, onions, grains etc and prepared by a specific procedure in which the juice of ingredient is taken in a vessel and kept in sunlight, until proper fermentation of that liquid takes place. Various actions and clinical indications have been elaborated in the Unani classical literature and some properties namely Anti-infective, Antihypertensive, Cardio-protective, Antitumor, Antiglycemic, Antioxidant and Antitubercular activities have been revalidated in the light of recent scientific researches. A number of clinical researches have also been performed to explore medicinal properties of Sirka (Vinegar). This review provides significant information on Sirka (Vinegar) as a traditional asset and furthers the scientific validation of pre existing facts.

Keywords: Sirka, Vinegar, Unani System of Medicine

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INTRODUCTION

Traditional medicine has a very long history and by definition it is the sum total of knowledge, skills and practices based on theories, beliefs and experiences which are indigenous to different cultures, and are used in the maintenance of health, prevention, diagnosis, improvement or treatment of physical and mental illnesses [1]. *Sirka* (vinegar) is one of the common culinary agents, and had been used as a condiment and food ingredient for thousands of years. Although *Sirka* is highly valued as a flavoring and preservative for foods, much scrutiny surrounds its medicinal use. The word vinegar is derived from the French word "*vin aigre"*, meaning "sour wine" [2]. The use of vinegar to fight infections and other acute conditions dates back to Hippocrates (460-377 BC) who recommended a vinegar preparation named *sikanjabeen* for cleaning ulcerations and for the treatment of sores. The word *sikanjabeen* is derived from the Persian word "*sirkanjabeen*" which is composed of two different components, namely s*irka* (vinegar) and *angbeen* (honey). *Sikanjabeen*, a popular syrup based dosage form in Unani System of Medicine composed of vinegar and honey, was prescribed for persistent coughs by Hippocrates, and by the physicians up to modern day [3]. Initially, only vinegar and honey were used to make *sikanjabeen*, but later on, owing to its tremendous efficacy others drugs were also incorporated into this formulation. These formulations were named accordingly on the basis of ingredient used. For instance, *Sikanjabeen-e-nanaai* named due to its main ingredient *naanaa* (*Mentha arvensis*), *Sikanjabeen-e-unsuli* named because of main ingredient *unsul* (*Allium cepa*), *Sikanjabeen-e-bazoori* due to the inclusion of different seeds, *Sikanjabeen-e-fawakeh* named because of addition of different fruits, etc. In modern day, sometimes sugar is also used in preparing *sikanjabeen* instead of honey. This *sikanjabeen* is termed as *sikanjabeen-e-sadah* [4]. *Sikanjabeen* was also used in conventional system of medicine by the name of oxymel. The formulation of oxymel was detailed in the British Pharmacopoeia (1898) and the German Pharmacopoeia (1872), and according to the French Codex (1898), the medicine was prepared by mixing honey (4 parts) with white wine vinegar (1 part), concentrating and clarifying with paper pulp [5].

SIRKA (VINEGAR) AS A TRADITIONAL ASSET

According to Unani classical literature, it is a common condiment which is obtained after fermentation of various substances such as grapes, sugarcane, dried grapes, figs, jamun, honey, onions, grains etc. It is prepared by a specific procedure in which the juice of ingredient is taken in a vessel and kept in sunlight, until proper fermentation of that liquid takes place. The taste of S*irka* is very sour. The term 'S*irka mutlaq*' refers to S*irka* made from grapes [6,7]. The *Mizaj* (temperament) of S*irka* described in Unani classics is *Murakkab ul quwa* (It is composed of both cold as well as hot property. Although, the cold property is a little bit dominant). But, according to some physicians, it is Cold (*sard*) and Dry (*Khushk*) in 2nd degree [6-8].

ACTIONS OF SIRKA DESCRIBED IN UNANI CLASSICS

Various medicinal actions of *Sirka* described in Unani classical literature are *Mubarrid* (Refrigerant) [8-10], *Daf-e-taffun* (Antiseptic) [8-10], *Mulattif* (Demulcent) [7-11], *Qate akhlat-e-ghaliz* [7,9-11], *Munzij* (Concoctive) [9,10], *Mujaffif* (Desicant) [7-12], *Qabiz* (Astringent) [7-10,12], *Dafe qai* (Antiemetic) [7,9], *Saree-un-nafooz* (Penetration enhancer) [7-10,12], *Mufarreh* (Exhilarant) [13], *Manay Nazf-ud-dam* (Anti haemorrhagic) [9,10], *Habis* (Absorbent) [9,10], *Muqawwi-e-dimagh* (Brain tonic) [9,10], *Muqawwi-e-meda* (Stomachic) [8,12], *Mushtahi* (Appetiser) [8-13], *Hazim* (Digestive) [7-13], *Mufatteh sudad* (Deobstruent) [8,13], *Qatil-e-kirm-e-shikam* (Anthelmintic) [7,9,10,13], *Muhallil* (Resolvent) [8-10,12], *Muqawwi-e-tihal* (Tonic for spleen) [8,13], *Muqawwi-e-dandan wa lissa* (Makes teeth and gums strong) [8-11], *Muhallil-e-dam-e-munjamid* (Haemolytic) [8-11], *Muhallil-e-warm* (Anti inflammatory) [8-11], *Musakkin-e-atash* (Relieves thirst) [8], *Qate balgham* (Phlegmagogue) [8-11], *Musakkin-e-alam* (Analgesic) [7], *Mudir* (Diuretic) [9,10].

CLINICAL INDICATIONS OF SIRKA AS PER UNANI LITERATURE

The clinical indications of *Sirka* described in Unani classical literature are *Nazf-ud-dam* (Haemorrhage) [8-11], *Ghisyan* (Nausea) [7,8], *Qai*

(Vomiting) [7,8], *Busoor wa Surkhbadah* (Abscess and Carbuncle) [8,11], *Humrah* (Boils) [9-11], *Jarah wa quruh* (Ulcer and wounds) [11], *Jumrah* [9,10], *Hikka* (Itching) [8-11], *Jarb* (Scabies) [9,10], *Namla* (Freckles) [9,10], *Daad* (Dermatophysis/ Eczema) [8-10], *Bawaseer* (Haemorrhoids) [8], *Niqras* (Gout) [8,11], *Suda* (Cephalgia) [7-11], *Sarsam haar* (Meningitis) [7], *Nazla* (Catarhh) [9,10], *Istisqa* (Ascitis) [8,11], *Bardah* (Chalazion) [9,10], *Amraz-e-uzn* (Ailments of ear) [7-11], *Sual-e-muzmin* (Chronic cough) [8-11], *Dama* (Asthma) [8-11], *Khunaq* (Diphtheria) [7-10], *Warm-e-lozatein* (Tonsillitis) [8-11], *Dard-e-Dandan* (Toothache) [7-11], *Qate Khoon-e-lissa* (Bleeding gums) [9,10], *Harq* (Burns) [8,11], *Warm-e-pistan* (Mastitis) [7], *Nafakh* (Flatulence) [9,10,13], *Sozish-e-meda* (Heartburn) [8], *Huzaal* (Weight loss) [8-10], *Amraz-e-tihal* (Ailments of spleen) [9,10], *Bars* (Leukoderma/ Vitiligo) [8-10], *Beheq* (Ptyriasis) [8-10], *Safrawi bukhar* (Bilious fevers) [7,9,10], *Quruh-e-ama* (Peptic ulcer) [11], Insect bite [8,11], Opium poisoning [11].

SCIENTIFIC VALIDATION OF SIRKA (VINEGAR)

According to conventional literature, Vinegar is a famous culinary agent which can be made from almost any fermentable carbohydrate source, including wine, molasses, dates, sorghum, apples, pears, grapes, cane, berries, melons, coconut, honey, beer, maple syrup, potatoes, beets, malt, grains, and whey. Initially, yeasts ferment the natural food sugars to alcohol. Next, acetic acid bacteria (*Acetobacter*) convert the alcohol to acetic acid. However, acetic acid should not be considered synonymous with vinegar. The US Food and Drug Administration (FDA) states that diluted acetic acid is not vinegar and should not be added to food products customarily expected to contain vinegar. Traditional vinegars are produced from regional foods according to well-established customs. Commercial vinegar is produced by either fast or slow fermentation processes. For the quick methods, the liquid is oxygenated by agitation and the bacteria culture is submerged permitting rapid fermentation. The slow methods are generally used for the production of the traditional wine vinegars and fermentation proceeds slowly over the course of weeks or months [2].

Phytochemical Studies

The chemical and organoleptic properties of vinegars are a function of the starting material and the fermentation method. Acetic acid, the volatile organic acid that identifies the product as vinegar, is responsible for the tart flavor and pungent, biting odor of vinegars. Other constituents of vinegar include vitamins, mineral salts, amino acids, polyphenolic compounds (eg, galic acid, catechin, caffeic acid, ferulic acid), and nonvolatile organic acids (eg, tartaric, citric, malic, lactic) [14,15].

Pharmacological Studies

- **Anti-infective activity**

  In a study, the bacteriostatic and bactericidal actions of vinegar on food-borne pathogenic bacteria including enterohemorrhagic E. coli (EHEC) O157:H7 were examined. The growth of all strains evaluated was inhibited with a 0.1% concentration of acetic acid in the vinegar. Vinegar had a bactericidal effect on food-borne pathogenic bacteria including EHEC O157:H7. The bactericidal activity of vinegar increased with the temperature. The use of vinegar with use of an appropriate treatment temperature, was found to be markedly effective for the prevention of bacterial food poisoning [16].

  In a separate study, the efficacy levels of different physical and chemical washing treatments in the reduction of viral and bacterial pathogens from inoculated strawberries were evaluated. Escherichia coli O157:H7, Salmonella Montevideo, poliovirus 1, and the bacteriophages PRD1, phiX174, and MS2 were used as model and surrogate organisms. Solutions containing table salt (2% NaCl) or vinegar (10%) reduced the numbers of bacteria by about 90%, whereas only the vinegar wash reduced the numbers of viruses significantly (95%) [17].

  Although not a treatment modality, vinegar washes are used in some remote, poorly resourced locations to screen women for the human papilloma virus infection [18]. Contact with acetic acid causes visual alterations of

the viral lesions permitting rapid detection of infection with 77% sensitivity and the option of immediate treatment [19].

- **Antihypertensive activity**

  In a study, a significant reduction in systolic blood pressure (approximately 20 mm Hg) in spontaneously hypertensive (SHR) rats fed a standard laboratory diet mixed with either vinegar or an acetic acid solution (approximately 0.86 mmol acetic acid/day for 6 weeks) was observed when compared with SHR rats fed with the same diet mixed with deionized water. These observed reductions in systolic blood pressure were associated with reductions in both plasma renin activity and plasma aldosterone concentrations (35% to 40% and 15% to 25% reductions in renin activity and aldosterone concentrations, respectively, in the experimental vs control SHR rats) [20].

- **Cardio-protective activity**

  An *in-vivo* study was performed and it was concluded that vinegar administration (approximately 0.57 mmol acetic acid, orally) inhibited the renin-angiotensin system in nonhypertensive Sprague-Dawley rats [21].

  In another study, a significantly lower risk for fatal ischemic heart disease has been reported among participants in the Nurses' Health Study who consumed oil-and-vinegar salad dressings frequently (5-6 times or more per week) compared with those who rarely consumed them. This happens because oil and vinegar dressings are a major dietary source of dietary alpha-linolenic acid, an antiarrhythmic agent [22].

- **Antitumor activity**

  In a study, the induction of apoptosis in human leukemia cell HL-60 was investigated with sugar cane vinegar, for the elucidation of food factor for cancer prevention contained in naturally fermented vinegar. Fraction eluted by 40% methanol from Amberlite XAD 2 chromatography of sugar cane vinegar showed potent radical scavenging activity and also the activity repressing growth of typical human leukemia cells such as HL-60, THP-1, Molt-4, U-937, Jurkat, Raji and K-562. From cell sorting FACS analyses, electron microscopic observations and cytochemical staining of chromatin and nuclear segments in human leukemia cell HL-60 treated with the active fraction, it was concluded that apoptosis was induced in the leukemia cell by the fraction of sugar cane vinegar and resulted in the repression of growth of the human leukemia cells. These results led us the consideration that active components in sugar cane juice could be converted to more lipophilic compounds with activity to induce apoptosis in HL-60 by microbial fermentation with yeast and acetic acid bacteria [23].

  In another study, the effects of the ethyl acetate extract of "Kurosu" (EK), Japanese traditional vinegar from unpolished rice, on the proliferation of a variety of human cancer cell lines were investigated by using the alamar blue assay. Cancer cell lines included colon adenocarcinoma (Caco-2), lung carcinoma (A549), breast adenocarcinoma (MCF-7), bladder carcinoma (5637), and prostate carcinoma (LNCaP) cells. EK inhibited the proliferation of all tested cell lines in a dose-dependent manner, with inhibition mostly pronounced in Caco-2 cells (up to 62% inhibition at a dose level of 0.025%). Flow cytometry of EK-treated Caco-2 cells showed a decrease in cell number in the G2/M phase and an increase in the sub-G1 phase (apoptotic) [24].

  Another study reports the antitumor activity of vinegar via oral administration in a mouse model. Vinegar (0.3 - 1.5%) was mixed into a chemically defined diet. The tumor size and life span of tumor-bearing mice that were fed the diet were investigated for 72 d. The vinegar- (> 0.5%) fed mice had significantly smaller sized tumors than the control group ($p < 0.01$). We also found that those mice had prolonged life spans. Oral administration of vinegar also prolonged the life spans of mice that were implanted with Colon 38 cells. These results indicated that dietary vinegar suppressed tumor growth [25].

- **Antiglycemic activity**

A study demonstrated that in normoglycemic subjects 20 ml white vinegar (5% acetic acid) as a salad dressing ingredient reduced the glycemic response to a mixed meal (lettuce salad and white bread containing 50 g carbohydrate) by over 30% (P< .05) [26].

- **Antioxidant activity**

  The *in-vitro* antioxidative activities of various kinds of vinegar were investigated by using a linoleic acid autoxidation model detected by the thiobarbituric acid (TBA) method and the 1,1-diphenyl-2-picrylhydrazyl radical system. An ethyl acetate extract of Kurosu (EK), a vinegar made from unpolished rice, exhibited the highest antioxidative activity in both systems. Kurosu vinegar is particularly rich in phenolic compounds, and the in-vitro antioxidant activity of an ethyl acetate extract of Kurosu vinegar was similar to the antioxidant activity of alpha-tocopherol (vitamin E) and significantly greater than the antioxidant activities of other vinegar extracts, including wine and apple vinegars [27].

- **Antitubercular activity**

  In a study, efficiency of vinegar was tested against *Mycobacterium tuberculosis*. It was found that exposure to 6% solution of vinegar for duration of 30 minutes successfully killed the bacteria. It was concluded that vinegar is an effective mycobactericidal disinfectant [28].

Clinical Studies

- In a study, the antiglycemic property of vinegar was demonstrated to extend to individuals with marked insulin resistance or type-II diabetes. In this crossover trial, individuals with insulin resistance (n = 11, fasting insulin concentrations greater than 20 mU/ml) or with diagnosed type-II diabetes (n = 10) consumed a vinegar test drink (20 g vinegar, 40 g water, 1 tsp saccharine) or placebo immediately before the consumption of a mixed meal (87 g total carbohydrate). In the insulin-resistant subjects, vinegar ingestion reduced postprandial glycemia 64% as compared with placebo values (P = .014) and improved postprandial insulin sensitivity by 34% (P= .01). In individuals with type-II diabetes, vinegar ingestion was less effective at reducing mealtime glycemia (−17%, P = .149); however, vinegar ingestion was associated with a slight improvement in postprandial insulin sensitivity in these subjects (+19%, P = .07) [29].

- In a separate blinded, randomized, placebo-controlled, crossover design trial, fasting participants consumed a test drink (placebo or vinegar) followed by the test meal composed of a buttered bagel and orange juice (87 g carbohydrate). Blood samples were collected for 1 hour after the meal. At the end of testing, participants were allowed to follow their normal activities and eating patterns the remainder of the day, but they were instructed to record food and beverage consumption until bedtime. Vinegar ingestion, as compared with placebo, reduced the 60-minute glucose response to the test meal (−54%, P < .05) and weakly affected later energy consumption (−200 kilocalories, P = .111). Regression analyses indicated that 60-minute glucose responses to test meals explained 11% to 16% of the variance in later energy consumption (P < 0.05). Thus, vinegar may affect satiety by reducing the meal-time glycemic load [30].

- A study was conducted to compare the therapeutic efficacy in the management of granular myringitis. Fifteen patients with chronic granular myringitis were treated with antibiotic ear drops that were used twice to four times a day, and another 15 patients were treated with daily irrigation of the external canal with dilute vinegar solution. All patients treated with dilute vinegar solution had resolution of their original otorrhoea within three weeks, whereas two-thirds of patients recovered within three weeks when treated with antibiotic ear drops. When the therapeutic efficacy was compared statistically, a dry ear was attained in the dilute vinegar-treated group at six weeks and six months in the antibiotic ear drop treated group (p<0.01). These results suggest that very low pH therapy using dilute vinegar solution is definitely effective in the management of granular myringitis [31].

- A study was conducted to evaluate the use of vinegar as an antimicrobial agent for control of Candida spp. in complete upper denture wearers. Fifty-five patients were submitted to a detailed clinical interview and oral clinical examination, and were instructed to keep their dentures immersed in a 10% vinegar solution (pH less than 3) overnight for 45 days. Before and after the experimental period, saliva samples were collected for detection of Candida. The results were analyzed using Spearman's correlation and Student's t-test (p<or=0.05). Candida yeasts were present in 87.3% of saliva samples before the treatment. A significant reduction was verified in CFU/ml counts of Candida after treatment. A positive correlation between Candida and denture stomatitis was verified, since the decrease of cfu/mL counts was correlated with a reduction in cases of denture stomatitis. Although it was not able to eliminate *C. albicans*, the immersion of the complete denture in 10% vinegar solution, during the night, reduced the amounts (cfu/ml) of Candida spp. in the saliva and the presence of denture stomatitis in the studied patients [32].

CONCLUSION

The traditional use of medicines implies to ample historical usage and this is perhaps true for almost all traditional medicines. In many developing countries, like India, a major population relies on traditional medicines for healthcare and the trend is now gradually shifting to developed countries as well. WHO has developed separate guidelines for assessment of traditional medicines. *Sirka* (Vinegar) has a long historical background and besides its usage as a potent medicinal substance, it has been extensively exploited as a common condiment, food ingredient, preservative, flavoring and culinary agent. This review provides significant information regarding the actions and therapeutic uses of *Sirka* mentioned in traditional Unani Medicine. It also provides substantial information regarding various recent pharmacological and clinical researches validating the already mentioned clinical indications of *Sirka*. The review also provides a new ray for research. More pharmacological and clinical researches may be designed to search and revalidate the unexplored aspects of *Sirka* that are already mentioned in Unani classics.

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CONFLICT OF INTEREST

There is no conflict of interest to declare.

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