

Original article**Assessment of relative Salty taste of Unani drugs by serial dilution method and its relation with Mizaj and Pharmacological action**Md Shahbaz Alam¹, Ghulamuddin Sofi², Hamiduddin³**Abstract**

Introduction: *Mizaj-e-Advia* (Temperament of drug) is the central concept for drug action in traditional Unani medicine. *Mizaj-e-Advia* is determined by different methods, of them *Qiyas* (Analogy) and *Tajriba* (Experimentation) are the conventional one. *Tajriba* is applied to confirm the *Mizaj-e-Advia* of drugs and *Qiyas* is undertaken by comparison of different physico-chemical properties of drug substances with a known comparator drug. Organoleptic characters i.e. colour, taste, smell, weight, texture, etc., are the most important determinants to predict *Mizaj-e-Advia* in humans. Taste is considered as one of the strongest determinant in assessment of *Mizaj-e-Advia*. Since, they are very subjective indicators, so there is a need to assess them with an objective technique. The present study attempted to evaluate the relative saltiness of drugs with salty taste. **Methodology:** The taste of different salty drugs in relation to standard as prescribed in Unani system of Medicine i.e., *Namak Ta'am* (Sodium chloride, NaCl) was assessed by serial dilution method. The value has been expressed as a ratio with respect to NaCl. The *Darjat-e-Mizaj* (grades of temperament) of various salt tasting drugs was recorded from classical Unani literature and their correlation coefficient was calculated. **Results:** A positive moderate correlation was observed between the *Darjat-e-Mizaj* and the saltiness values of various drugs of salt taste. The observation from the data employed that there was variation in salt detection limit among various salt tasting drugs. *Naushadar* (Ammonium Chloride) was observed to have greater tendency to retain its saltiness value, and *Namak-e-Sanbhar* (Impure Sodium Chloride) was observed to have least saltiness value among the various salt tasting drugs.

Keywords: Detection threshold; Relative Saltiness; Correlation Coefficient; *Darjat-e-Mizaj Advia*

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Introduction

The Arabic word “*ta'am*” signifies “taste.” Taste is the *Kaifiyat* (quality) of a substance that is perceived by the human when it acts on the sensory organ, the tongue, and affects the faculty of taste. The person attributes a quality to the substance, either in actuality or potentially¹. Taste has remained one of the most effective indicators for determining a *Mizaj*

(Temperament) of a drug via *Qiyas* (Analogy)². The process of analyzing *Mizaj* of a drug via *Qiyaswa Tajriba* (Analogy & Experimentation) on humans is described in Unani medicine³. *Qiyas* forecasts *Mizaj* of a drug in people before it is administered to them, based on organoleptic and physical qualities, and *Tajriba* validates it in humans. Taste is preferred over smell for predicting *Mizaj* by *Qiyas*, according to

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Ibn Sina (980-1037 CE). Ancient Unani physicians classified tastes into nine categories: *Tafeh* (Tasteless), *Huloo* (Sweet), *Hirreef* (Pungent), *Murr* (Bitter), *Maleh* (Salty), *Hamiz* (Sour), *Dasim* (Greasing), *Qabiz* (Astringent), and *Afis* (Acrid), and later Unani scholars described eight categories, excluding *Tafeh* (Tasteless) taste from the above mentioned list³. The Sanskrit word '*Rasa*' is commonly translated as 'Taste' in English. *Rasa* refers to the total subjective experience that arises from putting the substance in one's mouth, which includes not only the six primary tastes recognized by Ayurveda (Sweet, Sour, Salty, Bitter, Pungent, and Astringent), but also the 'Flavors' experienced through retro nasal olfaction (nasal smell receptor stimulation by food warmed in the mouth)⁴. Taste is one of the earliest predictors of food intake, and variations in a person's capacity to taste salt can help to explain some of the diversity in sodium intake⁵. The identities of the individual substances that stimulate certain taste receptors remain unknown. Despite this, psychophysiological and neurophysiologic investigations have discovered at least 13 chemical receptors in taste cells, including two sodium, two potassium, one chloride, one adenosine, one inosine, two sweet, two bitter, one glutamate, and one hydrogen ion receptor. The above-mentioned receptor capacities have also been divided into five main categories called primary taste sensations⁵ for practical taste analysis. These include sour, salty, sweet, bitter, and Umami,⁶ which are occasionally two tastes present in one thing at the same time. Bitterness and astringency, for example, combine in the extract of ophthalmic barberry to produce a disagreeable taste. Honey that has been cooked has both pungency and sweetness; *Brinjal* contains *Qabiz* (Astringent) and *Hirreef* (Pungent) taste. Two tastes combine together, in most cases, to produce an additional effect⁷.

For thousands of years, the therapeutic use of salt has been an important aspect of medicine. It has been used as a medicine; the ancient Egyptian papyrus Smith suggests salt for the treatment of an infected chest wound, as does Imhotep of the third pre-Christian millennium. Many salt prescriptions are mentioned in Papyrus Ebers (1600 BC), mainly for creating laxatives and anti-infectives.⁸ Salt and salt-based medicines were widely used by Hippocrates (460 BC). Dioscorides (100 AD) said that salty vinegar might be used to treat "bingeing and rotting callosities," as well as to stop bleeding after surgery, kill leeches, and remove "scab and crust." Salt was

claimed to be a laxative when added to wine and water⁸. Salt was also used in the Galen medical system to treat infectious wounds, skin ailments, callosities, and digestive problems. Emetics and laxatives were included on his list of salt-based medicines. The presence of iodine and iron in coastal sea salt was highlighted by Ibn Sina. In his "The Preservation of Youth: Essays on Health," the Jewish doctor Maimonides (1135-1138 CE), physician-in-ordinary to the caliph in Persia, wrote that the only healthy meal is bread with adequate salt. Inhalations, salt-water baths, and drinking-therapy are all examples of how salt is used as a natural therapeutic factor today. Salt infusion therapy⁹ was a new and important invention in medicine in the twentieth century. In Unani medicine, various salty / salt-containing medications, as well as isolated salts from the drug, are used in treatments. Because drug *Mizaj* is linked to drug action, which may be examined using taste as an indicator of *Mizaj*, this study was conducted. It attempted to assess the relative salty taste of Unani drugs of mineral and plant origin by serial dilution method and its relation with its *Mizaj* and Pharmacological action.

Methodology

Selection of drugs: *Mufrad* (single) Unani drugs which are salty in taste were selected on the basis of reference from the classical Unani books like, *Khazainul Advia*, *Al Qanoon*, *Mukhzanul Mufradat*, *Bustanul Mufradat*, *Mukhzane Mufradat wa Murakkabat* (known as *Khwas-ul-Advia*), *Al Jamiul Mufradat al Advial wal Aghziya*, *Tazkera oliel Albab*. Their *Mizaj*, *Afa'al* (pharmacological action) and *Istemaal* (uses) were documented from these texts. (Table 2). Documentation of taste and associated *Mizaj* (temperament) and *Afa'al* (pharmacological actions) of Unani drugs was recorded from authentic Unani classical text.

Procurement of the salty tasting drugs: The drugs were purchased from the Local Market of Bengaluru and were authenticated at Dept of *Ilmul Advia* National Institute of Unani Medicine (NIUM), Bengaluru India.

Subjects and test conditions: Five healthy non smoking adult volunteers participated in this study. Taste threshold was estimated by using the forced-choice thresholds with descending concentration of taste thresholds. Before the test, subjects were advised that they had to abstain from eating, drinking, chewing, or brushing their teeth for at least 1 hour

before the procedure¹⁰, the tests were conducted in standardization Lab of department of Ilmul Advia (Pharmacology), NIUM, Bengaluru.

All the observations were carried out in triplicate, and wherever an outlier observation was found it repeated once again. Detection limit of the salt taste was carried out three times in different participants with serial dilution method. The statistical test for correlation of *Mizaj* and detection limit "Mean and Standard Deviation" was carried out by standard Graph pad Software In stat 3.

Estimation of saltiness value: The saltiness value was calculated using a serial dilution method based on Giguere JF et al¹⁰. It is a simple and reliable method for measuring salt taste and threshold recognition. By comparing the salty threshold concentration of a medicine to that of a dilute solution of NaCl, the salty characteristics of salts used in Unani medicine for therapeutic purpose were determined. The saltiness was measured in units comparable to the saltiness of a 50 ml solution containing 1 g of NaCl. Distilled water was used to dissolve the herbal components as well as to rinse the mouth after each tasting. Prior to the test, five volunteers were chosen for their good taste sense.¹⁰

Preparation of solution: Stock and dilute salt solutions were prepared by dissolving 1.0 g of salt in 50 ml of distilled water. Further 25 ml of this stock solution mixed with another 25 ml of distilled water and it was diluted in the same manner in descending concentration of the salt until the perception of taste was denied by the subjects. Tasters received a series of 20 samples in 3-alternative forced choice (3-AFC) presentation. The first presentation consisted of 2 blanks samples (distilled water) and a sucrose solution (105 mM) to introduce the tasters to the procedure. The second presentation contained only water (blank presentation). The next eighteen presentation contained 2 blank sample and descending concentration of salt solution (500 mg% to 0.003815 mg %). Before the test, each taster was advised that each presentation consisted of 2 samples containing only water and 1 taste sample. For each presentation, tasters were asked to take the samples sequentially from left to right, to put each sample solution in their mouths all at once, and to carefully gargle the solution to ensure the whole mouth was exposed to the tested solution. Tasters rinsed their mouths with distilled water between each series of presentation.

Tasters were advised to indicate which of the samples contained no salty taste (detection threshold) each presentation was spaced at least 10 second apart. Each test tube was labeled with 3 digit serial number in the middle position for the taste sample and even number for the blank sample for making it to be blind from taster. Dilution procedure was carried on till the subjects could not sense the taste, even when the remaining taste, sweet, bitter, acrid, pungent were suggested to him at the next higher dilution subjects denied recognizing the taste^[10].

Results

Documentation of taste and associated Afa'al (actions) of Unani drugs: Different tastes and its temperament and pharmacological actions are described by Unani physician,^[3, 11] which are summarized in **Table 1**.

Table 1: Different tastes and its Mizaj (Temperament) and Pharmacological action^[3, 11]

| | Tastes / (Mizaj) | Pharmacological actions |
|---|---|---|
| 1 | Tafeh/Tasteless (Moderate) | Febrile, <i>Musakkin Hararat</i> (Sedative), <i>Dafe Atash</i> (Removes thirst), <i>Dafe Hiddate Khoon wa Safra</i> (Moderator for bile and blood) |
| 2 | Hamiz Taste / (cold and dry) | <i>Mufattehe Sudad</i> (deobstruent), <i>Qate Safra</i> (antibilious), <i>Qate dam</i> , <i>Hazim</i> (Digestive), <i>Muhallil</i> (Resolvent), <i>Mushtahi</i> (Appetizer)), <i>Muquawwie Qalb</i> (Cardiotonic) |
| 3 | Hulool/ Sweet: (Moderate) | <i>Murakkhi</i> (Emollient), <i>Muwallide Mani</i> (Semenagogue), <i>Munaffis Balgham</i> (Mucolytic), <i>Munziz</i> (Concoctive) |
| 4 | Dasim/ greasing (cold and dry) | <i>QabizAma'a</i> (Intestinal astringent), <i>Aasirmawad</i> (Expressive), <i>Mukhashshin</i> (Roughning) |
| 5 | Qabiz / astringent (cold and dry) | <i>Muwallide Dame Saudawi</i> (procreator for black bile), <i>Muhazzil Habise Shikaam</i> (styptic), <i>Mushtahi</i> (Appetizer)), <i>Rade</i> (Repellant), <i>Mughalliz</i> (Concentrative), <i>Mubarrid</i> (Refrigerant) |
| 6 | Murr/ Bitter (hot and dry) | <i>Qabiz</i> (Astringent), <i>Mulattif</i> (Demulcent), <i>Dafeta'affun</i> (Antiseptic) |
| 7 | Maleh/ Salty (hot and dry) | <i>Muhallil waram</i> (Anti-inflammatory), <i>Mukhashshin</i> (Sloughing agent), <i>Murakkhi</i> (Emollient), <i>Mulattif</i> (Demulcent)), <i>Ghassal</i> (Irrigator), <i>DafeTa'affun</i> (Antiseptic), <i>Mujaffif</i> (Calorific) |
| 8 | Hirreef / Pungent (hot and dry) | <i>Mufattehe Sudad</i> (Deobstruent), <i>Qate Balgham</i> (Antiphlegmatic), <i>Muqashshire Jild</i> (Sloughing agent), <i>Muhallil</i> (Resolvent)), <i>Mulattif</i> (Demulcent) |

Documentation of Mizaj (temperament), and Afaal (pharmacological actions) of salty drugs in Unani medicine: Mizaj and afaal of salty drugs documented from Unani classical texts are summarized in **Table 2**.

Table 2: Salt tasting drugs and their Mizaj pharmacological action

| S. N. | NAME | Mizaj | Afa'al (Pharmacological action) |
|-------|---|--|---|
| 1 | <i>Namak- E -Sanbhar /</i> Milhul Basar, (Impure Sodium Chloride) ¹² . | H2°D2° ¹³ H2°D3° ¹⁴ | <i>Jaali</i> (Detergent), <i>Muhallil</i> (Resolvent), <i>Mushille Balgham</i> (Phlegmagogue), <i>Hazim</i> (Digestive), <i>Moatish</i> (Thirsty) ¹⁴ , <i>Kasire Riyah</i> (Carminative), <i>Mushtahi</i> (Appetizer), <i>Mufattehe Sudad</i> (Deobstruent), <i>Mudirre Baul</i> (Diuretic), <i>MudirreHaiz</i> (Emmenagogue), <i>Muqi</i> (Emetic) ¹⁵ . |
| 2 | <i>Shora Qalmi/</i> Sea salt/ <i>Abqar</i> , Salt petre (Potassium Nitrate) ¹² . | H3°D3° ¹⁶ . | <i>MudirreBaul</i> (Diuretic), <i>MuffateheUrooque</i> (Vasodilator), <i>Mufattehe Sudad</i> (Deobstruent), <i>Jaali</i> (Detergent), <i>Mushil</i> (Purgative), <i>Mugharri</i> (Glutinous) ¹⁷ , <i>Moarrique</i> (Diaphoretic) ¹⁸ , <i>Mane Injmadud Dam</i> (Anticoagulant), <i>Dafe Humma</i> (Antipyretic) ¹⁹ , <i>Mujaffif</i> (Concoctive) ²⁰ , <i>Mubhi</i> (Aphrodisiac) ²¹ , <i>Mubarrid</i> (Refrigerant), <i>Mukharrish</i> (Irritant) ²² . |
| 3 | <i>Saji Khar/</i> <i>Qalma</i> , Dhobi's Earth, Sodium Carbonate, <i>Nard Zarbah</i> ^{12,22} | H1°D4° ²³ . H1°D3° ^{24, 21} H4° D2° ²⁵ . | <i>Akkal</i> (Corrosive), <i>Jaali</i> (Detergent), <i>Muqarreh</i> (Ulcerative), <i>Kasire Riyah</i> (Carminative), <i>Mushtahi</i> (Appetizer), <i>Munaffise Balgham</i> (Expectorant), <i>Muhammir</i> (Rubefaciant) ²³ . <i>Dafe Hamoozate Medi</i> (Antacid). <i>Mane Naubat</i> (Antiperiodic) ²² . |
| 4 | <i>Namak- e-sulaimani</i> ²⁶ . | H2°D2° ¹³ | <i>Hazim</i> (Digestive), <i>Muquwwi Meda</i> (Stomachic) ¹³ . <i>Dafe Tashannuj</i> (Antispasmodic) ²⁶ . |
| 5 | <i>Namak-e-Lahori/</i> <i>Milh-e-Indarani/</i> Rock Salt ¹² (Sodium Chloride) ²⁵ . | H2° D2° ¹¹ | <i>MushileSauda</i> (Melanagogue), <i>Aasir</i> (expressive), <i>Munaffise Balgham</i> (Expectorant), <i>KasireRiyah</i> (Carminative), <i>Hazim</i> (Digestive), <i>Dafe Tashannuj</i> (Antiflatulant), <i>Dafe Jusa</i> (Antieructation) ¹¹ , <i>Mulattif</i> (Demulcent) ¹³ . <i>Munaffise Balgham</i> (Expectorant) ²³ . <i>Mushtahi</i> (Appetizer) ¹⁵ . |
| 6 | <i>Namak- e-Mooli</i> ²³ (Radish salt) | H2°D3° ²³ H1°D2° ²⁰ | <i>Kasire Riyah</i> (Carminative), <i>Mudirre Baul</i> (diuretic), <i>Hazim</i> (Digestive), <i>Muqi</i> (Emetic) ²³ , <i>Mulattif</i> (Demulcent) ²⁸ . <i>Muhallile Waram</i> (Anti-inflammatory) ²⁵ . |
| 7 | <i>Namak -e- Siyah /</i> Black Salt ¹² | H2° D2° ²⁷ | <i>Hazim</i> (Digestive), <i>Qatile Deedan shikam</i> (Anthelmintic), <i>Muqi</i> (Emetic) ²⁵ , <i>Kasire Riyah</i> (Carminative), <i>Mulayyin</i> (Laxative), <i>Mushil</i> (Purgative), <i>Dafe Tashannuj</i> (antispasmodic), <i>Muwallide Mani</i> (Semen procreator) ¹¹ . <i>Musakkin</i> (Analgesic), <i>Mulattif</i> (Demulcent) ¹³ . |
| 8 | <i>JawaKhar/</i> <i>Milhul Shaeer</i> , (Potassium Carbonate) ¹² . | H2° D3° ²⁵ | <i>Mudirrebaul</i> (Diuretic), <i>Mufattehe sang Kulya wa Masana</i> (lithontriptic), <i>Dafe Hamoozate Medi</i> (Antacid) <i>Mushtahi</i> (Appetizer), <i>Munaffise Balgham</i> (Expectorant), <i>Hazim</i> (Digestive) ²⁷ . <i>Mushil</i> (Purgative) ²⁵ . |
| 9 | <i>Namak-e- Ta'am/</i> <i>Mil hulAjeen/</i> <i>Namak-e-khurdam</i> (Sodium Chloride) ²² . | H2° D2° ¹¹ . H D2° ²⁸ | <i>Muhallile Balgham</i> (Phlegmagogue), <i>Muquwwi Dimagh</i> , (Brain tonic) ²⁸ . <i>DafeTa'affun</i> (Antiseptic), <i>Mane Naubat</i> (Antiperiodic) ²² . <i>Munaffiz</i> (Penetrator), <i>Muwallid</i> (procreator) ²⁵ , <i>Mudirre Baul</i> (Diuretic), <i>Qatile Deedane shiakam</i> (Anthelmintic), <i>Hazim</i> (Digestive), <i>Dafe Sumoom</i> (Antidote), <i>Muhammir</i> (Rubefaciant), <i>Kasire Riyah</i> (Carminative), <i>Moattish</i> (Thirsty), <i>Jaali</i> (Detergent) ¹¹ . <i>Mufattehe sudad</i> (Deobstruent), <i>Muwallide Dam</i> (Haematinic), <i>Mushtahi</i> (Appetizer) ²⁹ . |
| 10 | <i>Suhagah/</i> <i>Tinkar</i> ¹² . (Mixture of Boric acid with Sodium borate) | H2°D3° ¹⁶ . H2°D2° ³⁰ . | <i>Jaali</i> (Detergent), <i>Akkal</i> (Corrosive), <i>Dafe Jarasim</i> (Anti-bacterial), <i>Hazim</i> (Digestive), <i>Kasire Riyah</i> (Carminative), <i>Mudirre Baul</i> (Diuretic), <i>MudirreHaiz</i> (Emmenagogue) ²⁵ , <i>Munaffise Balgham</i> (Expectorant), <i>DafeTa'affun</i> (Antiseptic) ¹⁵ , <i>Dafe Tashannuj</i> (antispasmodic) ¹⁹ , Stomachic, Anticonvulsant ³¹ , <i>Musakkin</i> (Sedative), <i>DafeTa'affun</i> (Antiseptic) ²² . |
| 11 | <i>Naushadar/ Milhunnar</i> ²² . <i>Salmiai</i> ³² (Ammonium Chloride) ¹² | H2°D2° ³³ H3°D3° ¹⁶ H3°D2° ¹⁷ . | <i>Mulattif</i> (Demulcent) ³³ , <i>Mujaffif</i> (siccative), <i>Muhallile Waram</i> (anti-inflammatory), <i>Mufattehe sudad</i> (Deobstruent), <i>Muwallide Dam</i> (Haemostatic), <i>Munaffise Balgham</i> (Expectorant), <i>Kasire Riyah</i> (Carminative) ¹⁴ , <i>Mubarrid</i> (Frigorific), <i>Musakkin</i> (Analgesic), <i>Mudirre Haiz</i> (Emmenagogue), <i>Hazim</i> (Digestive), <i>Mushtahi</i> (Appetizer), <i>Tiryaaq</i> (Antidote), <i>Mubhi</i> (Aphrodisiac) ¹¹ , <i>Jaali</i> (Detergent) ¹⁵ , <i>Dafe Nakseer</i> (Anti-epistaxis) ²⁸ . |

H=Hot, D= Dry

Salt detection limit for various salty drugs of Unani medicine and correlation with Mizaj: In the present study out of various salty drugs, the Minimum dilution limit at which the salty taste was not found was 31.25 mg/100ml of water and Mean and SD among the five Subjects of the same drug was 10.35 ± 12.03. Similarly the Maximum dilution limit at which the salty taste not found was 0.12 mg/100 ml of water and

Mean and SD of the same drug among the Subjects was 3.64 ± 3.87. *Namak-e-Sanbhar* lost its saltiness at higher concentration as compared to other salty drug i.e. 31.25 mg/100 ml of water, whereas *Namak-e-Ta'am* and *Namak-e-Siyah* retained the saltiness up to the concentration of 0.12 mg/100 ml of water. 40% similarity was found in salty taste recognition of each drug in all the subjects. The individual detection limit

(Fig 1) and mean detection limit of various salty drugs are mentioned in (Table 3, Fig 2), a correlation in *Darjat-e-Mizaj Advia* (Degree of Temperament of drug) and mean detection limit of salty taste is given and it was attempted to evaluate the relationship between the *Darjat-e-Mizaj Advia* and dilution of salty drugs (Table 3).

Table 3: Darjat -e- Mizaj and Detection Limit of Various Salt

| S. no. | Name of salt | Mean detection limit (mg %) | Darjat -e- Mizaj | Relative score with respect to NaCl |
|--------|-------------------|-----------------------------|------------------|-------------------------------------|
| 1 | Namak-E-Sanbhar | 10.35 | Hot2° Dry2° | 4.04 |
| 2 | ShoraQalmi | 8.99 | Hot3° Dry3° | 3.51 |
| 3 | SajiKhar | 8.40 | Hot4° Dry3° | 3.28 |
| 4 | Namak-E-Sulaimani | 5.47 | Hot2° Dry2° | 2.14 |
| 5 | Namak-E-Lahori | 4.25 | Hot2° Dry2° | 1.66 |
| 6 | Namak-E-Moli | 3.71 | Hot2° Dry2° | 1.45 |
| 7 | Namak-E-Siyah | 3.64 | Hot2° Dry2° | 1.42 |
| 8 | JawaKhar | 3.37 | Hot2° Dry3° | 1.32 |
| 9 | Namak-E-Ta'am | 2.56 | Hot2° Dry2° | 1.00 |
| 10 | Suhagah | 1.56 | Hot3° Dry3° | 0.61 |
| 11 | Naushadar | 1.51 | Hot3° Dry3° | 0.45 |

A correlation matrix of *Darjat-e- Mizaj Advia* and Saltiness of drugs is given (Table 4).

Table 4: Correlation Matrix of Darjat – E - Mizaj and Salt Detection Limit along with Regression equation

| Characteristics | Mizajha'ar (Hot) | Mizaj dry | Detection limit | Regression equation |
|---------------------|----------------------------------|---------------------------------|-----------------|---|
| Mizajha'ar | 1 | - | 0.47 | Mizajha'ar = 2.06+0.1061× D.L. |
| Mizaj dry | - | 1 | 0.04 | Mizaj dry = 2.488-0.0068× D.L. |
| Detection limit | 0.47 | 0.04 | 1 | - |
| Regression equation | Mizajha'ar = 2.06 + 0.1061× D.L. | Mizaj dry = 2.488- 0.0068× D.L. | - | Multiple Regression Equation:-0.11+0.86× Mizaj dry+0.11× D.L. |

Discussion

In a few plant different type of organic acid are found with salts. These salty substances are Sodium, Potassium, Calcium, Magnesium, Phosphorus,

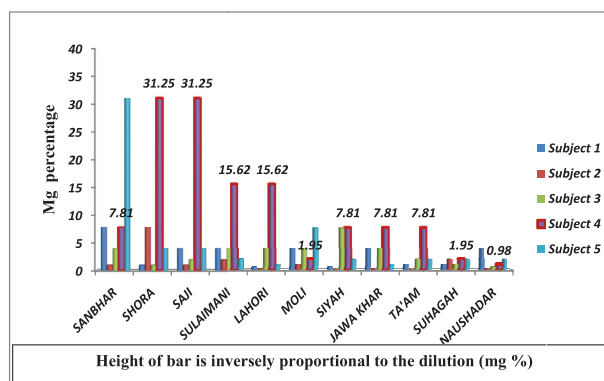


Fig 1: Minimum detection limit of saltiness of various salts (Namak) is 31.25 mg% (1gm/100 ml water) and maximum detection limit is 0.12 mg % by serial dilution method

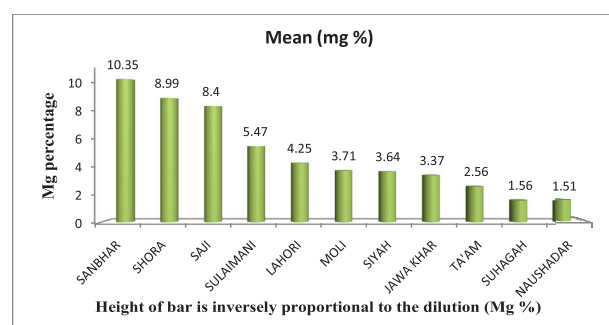


Fig 2: Minimum Mean detection limit of saltiness of various salts is 1.51 mg% (1gm/100ml water) and maximum Mean detection limit is 10.35 mg % by serial dilution method

etc. Sodium and Potassium dissolve in water while calcium and magnesium do not dissolve. These salty substances have their own specific function and play vital role for treatment of disease³⁴. Unani medicine considers *Maddah* (Matter) as the carrier of taste and its *Fael* (action) and temperament.³⁴ *Maddah* may be *Kaseef* (Dense), *Lateef* (Tenuous), and *Mutawassit* (Moderate); similarly, *Fael* may be interpolated as *Ha'ar* (Hot), *Barid* (Cold), and *Moatadil* (Intermediate). Bitter, acrid and sweet tastes are formed by dense substance with hot, cold and moderate temperament respectively. Similarly *Hirreef* (Pungent), *Hamiz* (Sour) and *Dasim* (Greasy) tastes formed by tenuous substance with hot, cold and moderate temperament, respectively. Substance in between dense and tenuous having hot, cold and moderate temperament form the *Maleh* (Salty), *Qabiz* (Astringent) and *Tafeh* (Tasteless) tastes, respectively³⁵. Regarding degree of *Mizaj* of taste it is stated that *Hirreef* (Pungent) taste is hotter than

Murr (Bitter) and *Maleh* (Salty) taste, similarly *Afis* (Acrid) taste colder than *Qabiz* (Astringent) and *Hamiz* (*Sour*) taste, respectively. The taste which is in between the hot and cold *Mizaj*, *Huloo* (Sweet) is hotter than *Dasim* (Greasy) and *Tafeh* (Tasteless). In dryness the *Murr* (Bitter) taste is drier than *Hirreef* (Pungent) and *Afis* (Acrid) taste, similarly, *Tafeh* (Tasteless) substance have more water than *Huloo* (Sweet) and *Dasim* (Greasy) taste substances. The taste which is in between dry and moist temperament, *Hamiz* (*Sour*) has less dryness than astringent and salty taste³⁵.

The average *Mizaj* (Temperament) of the salty drugs was found to be hot in II degree and dry in III degree. None of the salty drugs was observed with *Mizaj* of *Barid* and *Ratab* (Temperament of Cold and Moist). The most common *Afa'al* (actions) mentioned for salt tasting drugs is *Hazim* (Digestive) and *Kasir riyah* (Carminative) and *Mushtahi* (Appetizer) among all actions of salt tasting drugs. In Unani system of medicine salt is described in the heading of spices³³. Salt the second most important constituent in our daily diet, salt is found in combination of different elements, such as Carbon, Calcium, Phosphorus, Potassium, Sodium, Chlorine, Magnesium and Iron¹⁸.

The present study aimed to develop objective method for measuring relative saltiness of salt tasting drugs of Unani medicine, as the taste is an indicator for assessing *Mizaj* of a drug. The study assessed the relative saltiness of the drugs in comparison to *Namak -e-Taam* (Common salt) which served as a comparator for predicting *Mizaj* of drugs of this taste. In this study the salt tasting drugs were observed for saltiness value, and a fair correlation was seen for saltiness value and *Darjat -e-Mizaj* (degree of *Mizaj*). It was observed that the salt tasting drugs having the higher degree of *mizaj* (temperament) displayed higher saltiness value and drug having lower degree of *mizaj* displayed lesser saltiness value.

The correlation and regression was carried out between *Mizaj Ha'ar*, *Mizaj Yabis* and detection limit of the salt taste through serial dilution method. It was found that there was moderate correlation between *Mizaj Ha'ar* and detection limit ($r = 0.47$, $Mizaj Ha'ar = 2.026 + 0.0161 \times \text{Detection Limit}$). Thus, salt detected at higher dilution has got higher degree of *Darja-e-Mizaj Ha'ar*. The *Kafiyaat Munfaila* (passive quality) of *yaboosat* (dryness)

showed no correlation with the detection limit employing that *Yaboosat* of the salt is independent of the detection limit ($r = 0.04$, $Mizaj Dry = 2.488 - 0.0068 \times \text{Detection Limit}$). These observations signify a fairly high positive correlation between the dilution and the two *Mizaji Kafiyaat*. Correlation with *Darjat-e-Mizaj* was important so as to reach to the approximation for dosage of drugs. Present study also evaluated the correlation coefficient between the salt detection limit and the *Darjat-e-Mizaj*. It was found that there was direct correlation between the taste detection limit and the *Darjat- e-Mizaj*. As per the observation of the study it can be inferred that higher detection limits for saltiness of a drug meant that it had a higher *Darjat- e-Mizaj*. The present study on selected salts/salty drug used in Unani medicine is a preliminary study for assessing one of the sub constituent of indicators of *Mizaj* assessment through taste. The method can be a valid one as the same has been already studied in food sciences³⁶. This study extrapolated the same method for ranking the salt taste of drugs by observing relative taste detection limit. Only the natural salts were studied in the present work. Other drugs with salty taste were not included in the study. On one hand, the study provided for precision, on the other hand stressed the need for further exploration of salt containing Unani drugs, particularly of plant origin in respect of their other constituents. Like salty taste other study are also published on other taste such as exploring the bitter drug as blood purifying³⁷ but this study on salty tasting Unani drugs is a preliminary exploration. Further studies are needed with similar and other sophisticated methods. Present study may serve as a template for similar future studies.

Conclusion

Saltiness value of common Unani salts was estimated, the salt threshold was found to have high correlation with the *Daraje- e- Mizaj* of the drugs. Present study set a measure for relative saltiness of salt tasting drugs which may in future be used for precise assessment of *Daraje- e- Mizaj* of the drugs used in Unani medicine.

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Author(s) Contribution

MSA, GS and H designed and conceptualized the

work. GS and H were idea owner of the work, MSA conducted the work and collected the data GS and H supervised the work and analyzed the data. GS also helped in experimental studies data analysis. GS, MSA and H drafted the manuscript. GA and H revised it critically. Editing and approval of final draft was done by GS. All authors agree to be accountable for all aspects of the work

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