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A REVIEW ON MEDICINAL ASPECT OF ALUM IN *UNANI* MEDICINE AND SCIENTIFIC STUDIES

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ABSTRACT

Alum is a mineral origin drug of Unani medicine which is used in the treatment of various diseases because of its astringent, analgesic, haemostatic, desiccative, expulsive for foetus and placenta, antipyretic, detergent, corrosive, expectorant, emetic and irritant property. Different *in vitro*, *in vivo* and clinical studies has been done with significant results on its antibacterial, haemostatic, healing property, anti-obesity, larvicidal activity, etc. but these studies are not sufficient to cover its vast therapeutic indications as mentioned in Unani literature . This review paper is an attempt to explore the information on medicinal potential of alum in Unani medicine as well as scientific studies to draw attention for further research so as work on untouched properties.

KEYWORDS: Alum, traditional, Unani, scientific study.

INTRODUCTION

The word ‘alumen’ occurs in Pliny’s Natural History. Pliny informs us that ‘alumen’ was found naturally in the earth. He calls it ‘salsugoterrae’.[1] Potash alum (Potassium Aluminium Sulphate) is an inorganic salt.[2] It is colorless, transparent, odorless, crystalline masses or granular powder with a sweetish astringent taste. When heated it melts and at about 200º loses its water of crystallization with the formation of the anhydrous salt. It is soluble as 1 part in 7.5 parts of water, 1 in 0.3 of boiling water, and 1 in 3 of glycerol. A 10% solution in water has a pH of 3 to 3.5. A 6.35% solution is iso-osmotic with serum.[3] Alum (either

aluminium ammonium sulphate or aluminium potassium sulphate) works by the astringent action of protein precipitation at the cell surface and superficial interstitial spaces. This leads to decreased capillary permeability, contraction of intercellular space, vasoconstriction, hardening of the capillary endothelium and a reduction in oedema, inflammation and exudates. Alum is used in cases of gingivitis, in management of mucositis and oral ulcers.[4] It is used to purify drinking water in many developing countries, including Bangladesh. Recently, the effectiveness of alum in decontaminating household water has been reported.[5] Alum is also widely used in rural areas of Nigeria for the treatment of pediatric cough (personal communication). Study reported that one of the ingredients for the cure of cough was alum. Suspension of alum precipitated diphtheria toxoid and had a much higher immunogenicity than the fluid toxoid. Alum promotes a strong humoral response to diphtheria, tetanus and hepatitis B vaccines and is widely used in bacterial vaccines.[6] Alum employed in the treatment of lead colic and as an emetic in the treatment of poisoning. A 1% to 4% solution is used as mouthwash or gargle in stomatitis and pharyngitis. Alum is either as a solid or as a solution may be used as touching with crystal of alum may treat a haemostatic for superficial abrasions, cuts and ulcers on the lips.[3] This review paper is an attempt to explore the information on medicinal potential of alum in Unani medicine as well as scientific studies.

Molecular formula: $K_2SO_4.Al_2(SO_4)_3.24H_2O$[3,4,6]

Vernaculars: English: Alum,[7,8, 9] Sulphate of Alumina and Potash, Sulphate of Aluminium and Ammonium, Aluminous Sulphate.[9] **Arabic:** *Zaj abyaz*,[7,8,10,11] *Shibe yamani*.[7,8] **Persian:** *Zak safed*,[7,8,10] *Zamah*. **Bangali:** Phatphadi, Phatkiri. **Marathi:** Phatki.[7,8] **Sindhi:** Patki.[8] **Urdu:** Phitkari. **Hindi:** Phitkari.[11] **Tamil:** Patikaram, Padikharam, Shinacarum. **Telgu:** Pattikaramu. **Kannada:** Phatikara. **Sanskrit:** Sphatikari, Surashtraja, Kamakshi,[9] Venmali.[12]

Source: Chiefly found with peroxide of iron in Silajit or in Alum earths of Nepal or prepared from the alum shales in the Punjab, Rajputana, Bihar and Cutch states.[9]

***Mahiyat* (Description in Unani literature)**

It is a famous drug of mineral origin.[10,13,14] It is found in the form of crystals resembling to salt but lesser in weight.[7,10] It has so many types but for medicinal purpose only three types are commonly used.[15] First one is yellowish white transparent with heavy weight and

produces irritation and astringent taste while coming in contact with tongue.[15,16] The second variety is found in the form of round pieces, having sour taste and causes numbness of tongue. The third variety is soft and brittle in nature produces moist feeling on touching and has bad odour.[16]

***Mizaj* (Temperament):** Hot and dry[8,13,17,18]

***Af'al* (Actions):** *Qabiz* (astringent),[7,8,14,16,19] *Mussakkin* (analgesic), *Habissuddam* (haemostatic/styptic),[16,17,18] *Mujaffif* (desiccative),[7,8,14] *Mukhrije janeen wa mashema* (expulsive for foetus and placenta), *Daf'e humma* (antipyretic),[7,8] *Jali* (detergent), *Akkal* (corrosive), *Munaffise balgham* (expectorant),[8] *Muqai* (emetic),[7] Mudir, Dafe naubat (antipyretic), *Muhaiyyaj wa Musahhaj* (irritant).[17]

***Miqdare khurak* (dosage):** *250 mg to 500 mg,*[7,8,17]*1gm*[13]

***Muzir* (adverse effect):** Lungs, stomach and intestine.[7,8,10,12,13]

***Musleh* (corrective):** Milk and Oils,[7,8,12,13] *Sheerae berge lonia.*[20]

***Badal* (substitute):** *Naushader* (ammonium chloride),[8,12,13] Salt,[12,13] *Kafe dariya*[10]

***Murakkabat* (compound formulations):** *Safoofe istehaza, Sunoone mukhrije ratoobat*[11]

Therapeutic uses mentioned in Unani medicine

It can be used orally or locally but its oral use is not very much recommended by the Unani physicians.[16]

Dental problems: Alum water solution is used as gargle to treat mouth ulcers, bleeding gums, inflammatory conditions of gums and teeth and also in excessive salivation.[16,17] Along with *roghane gul* and vinegar it is used to treat gum ulcers.[19] Gargling with decoction of black pepper and alum or by locally applying these two in powdered form removes toothache, strengthens the gums and fixes loose teeth. Decoction of alum 11gm and *mocharas* (semul gum) 6gm in half litre of water is used as a gargle to reduce toothache and also strengthen the teeth. Applying alum with honey or vinegar or by gargling with alum in honey water is effective in halitosis and stomatitis. It can also be used as a toothpowder to relieve toothache. Decoction of alum and *chambeli* should be used as gargle in stomatitis. Powdered alum and *mazoo* (galls) is sprinkled over mouth ulcers with benefit. 2 part alum and 1 part salt is used as tooth powder to strengthen the teeth.[16]

Eye diseases: It can be used in conjunctivitis and keratitis.[10,12,16] Eye wash with its solution is used in burning eye and also in pus discharge from eye. Thickening of eyelid and blepharitis is cured by use of alum with honey.[10,16] Grind alum with *mazoo* (galls) and *sumaq* (sumach) can be applied in case of watering of eye and it also reduces red eye. Local application of dessicated alum in key lime juice is used in eye pain. Equal quantity of alum, opium and *rasaut* (berberry extract) pounded in water is applied round the ear to relief eye pain in children.[16] Appling few drops of 250mg alum pounded in 30ml rose water (distilled) reduces red eye and excess waste production.[7,16,17]

Respiratory diseases: Keeping over the tongue powdered alum in the dose of 10 grains prevent asthma attack. Keeping alum below the pillow of a sleeping person prevent snore. In case of cough dessicated alum should be given in the dose of 1/2gm to 1gm thrice in a day. Dessicated alum and *misri* (crystallised sugar) in equal quantity in powdered form is used orally in the dose of 6gm to treat asthma. Paste made by mixing powdered alum and *murmaki* (myrrh) in equal quantity in honey is applied into the ear with cotton to relief otalgia.[16] It is also used in pertussis and diphtheria especially in children.[7,16,17]

Gastrointestinary diseases: Oral use of alum removes nausea and vomiting, act as stomach and liver tonic.[16] It can be used in chronic diarrhoea due to its astringent property.[7,16,17] Oral use of 1gm alum stops diarrhoea. In case of chronic diarrhoea oral use of alum with opium is helpful. Because of its local haemostatic property it can be given in gastrointestinal bleeding.[16,17] Enema with decoction of alum and bark of *babool* (Acacia) stops diarrhoea. It is very effective in dysentery especially in those cases where mucosa has become weak and loose.[16] Its decoction is used for perineal wash in haemorrhoids and rectal prolapse even powdered alum can be sprinkled over the anal region for the same purpose.[7] Douching with alum solution in rectum act as wormicide. In case of rectal prolapse douching with its solution is beneficial or a gauze soaked with its solution can be kept their for same benefit.[16] In aphthae and thrush, spongy gums and other affections of the mouth powdered alum with honey can be used with benefit.[9]

Genitourinary diseases: Douching with alum water solution is effective in gonorrhoeal ulcers, leucorrhoea, pruritus vulvae, abnormal uterine bleeding and lax perineum.[7,16,17] In the treatment of pruritus vulvae in paediatric girls, alum in the form of lotion (conc. 3gm in 30 ml of water) can be used. Small piece of gauze dipped in this lotion is kept over the vulvae to reduce itching. 1gm alum with 250gm sweet curd effective in gonorrhoea and the way of

taking is first in small amount of curd mix alum and eat, followed by left curd should be taken. Tampooning with its water solution is very effective in uterine prolapse. Oral use of alum 1gm followed by drinking of milk is effective way to treat chronic gonorrhoea. Mixture made from alum and *geru* (red chalk) in equal quantity and *misri* (crystallised sugar) in double quantity is used in the dose of 7 gm with milk to treat gonorrhoea.[16] Tampooning with alum solution made in *gandna* (Allum ampeloprasum) water is effective in uterine bleeding.[12,16] For expulsion of placenta and abortus decoction of alum can be used orally or locally in the form of tampooning.[7] Local application decreases scrotal pain. Keeping alum plug before intercourse act as contraceptive and also causes abortion.[16] Alum plugs combined with glycerine or alum douches may be used in leucorrhoea. In post partum haemorrhage or menorrhagia, sterilized cotton plugs saturated with alum powder or sterilized alum lotion immediately stop the bleeding.[9] It can also be used in amenorrhoea due to its emmenogouge property.[17]

Skin diseases: Powdered alum is sprinkled in treating infected wounds and bleeding from abrasions or cuts. It removes abnormal tissue growth. Sprinkled dessicated alum powder removes necrosed tissue from the wound and improves healing.[7,16,17] It is often sprinkled over indolent ulcers, especially chronic umbilical ulcers of infants. A lotion made of alum and borax 600mg each and 8 ounces of water is useful in weeping eczema. Alum powder mixed with talc and zinc oxide is a good remedy for sweating feet.[9] Powdered alum mixed in soaked *zaft* in water is effective in dandruff and lice in hair. Lice can also be removed by taking head wash with water in which alum has been dissolved and it can also be used for bath to prevent body odour. Alum dissolved in water prevents skin cracks in winter, acne vulgaris and *aurame balghamia* (phlegmatic swellings). For wet itching alum solution in hot water will be effective. Alum with *aseeurraayi* is used in leukoderma and vitilligo. Alum with wax is used to treat paronychia. In case of white spots on the nails hands should be washed with alum solution. Alum in combination with salt removes excess tissue growth. Roasted alum with honey is applied over the burning area with benefit. Grind alum, *abrak* (mica/talc), geru (red chalk) and *khatmi* (marsh mellow) in vinegar can be applied over hand to prevent from burn.[16] It is useful for alopecia and itching.[12,19] Its solution in coriander water is used as emmolient to treat pruritus.[10]

ENT (Ear Nose Throat) diseases: Powdered alum as snuff is used to stop epistaxis.[7,9,10,16,17] Ear ulcers can be treated effectively by keeping a small piece of gauze

dipped in alum and honey mixture in the ear and this will also help in removing waste from ear. Alum with *aseeurrayi* can be applied round the ears to prevent pus discharge. Alum cooked in olive oil is helpful in deafness when dropped into the ear.[16] Gargling with alum is effective in tonsillitis and pharyngitis.[7,16,17] In inflammation round the ear, a paste made of alum and gypsum equal parts and *gile-armani* (Armenium Bole) is applied; in otorrhoea it may be dropped into the ear. A gauze wet with alum lotion is plugged in the nose in case of epistaxis.[9]

Kidney and bladder diseases: Alum1g to 2g and sugar 3g to 6g respectively with 250ml of milk can be used to treat kidney and bladder ulcers and also kidney and bladder stones.[10,12,16]

Miscellaneous: It is used in water purification. Oral use in the dose of 240mg or 255mg is effective in fever especially in case of children.[16] It is widely used in relapsing fever.[7,17] Before rising of temperature alum and *sonth* (ginger) in the dose of 60mg by keeping inside the *batasha* is given to prevent rise in temperature.[16] It is one of the drug for palpitation. It is used locally over the breast to prevent hypertrophy. Local application of dessicated alum helps in removing toxin in scorpion bite.[14] 7masha alum pounded in water is used in snake bite. It is given with milk in traumatic shock. After falling of umbilical cord, if there is formation of abscess then burnt alum is applied locally for treatment. In case of laxity of tissue or organ, powdered alum mixed with ghee can be applied. It also removes iron rust.[16]

Advance researches

Antibacterial effect

An in vitro study on efficacy and safety of Potassium Aluminum Tetraoxosulphate (vi) (Alum) in the treatment of tuberculosis was carried out using the proportion method. The results showed that at the highest concentration of 0.003g/ml, Mycobacterium tuberculosis was resistant to the alum extract while the standard drug (streptomycin) inhibited the growth of Mycobacterium tuberculosis at the same concentration. The histological analysis of the various organs showed normal morphology and no inflammation was seen. Statistical analysis of the weight of the experimental animals compared with those of the controls showed no significant weight difference and no mortality was recorded throughout the experimental process. The histological studies suggest that alum was relatively safe for mammalian consumption at the concentration used, but was ineffective against Mycobacterium tuberculosis.[6] The effects of alum [KAl(SO4)2] on free-living and copepod-associated Vibrio cholerae O1 and O139 were investigated by using plate counts and

immunofluorescence direct viable counting (DVC). Growth of alum treated cells in 0.5%. Instant Ocean seawater was inhibited i.e., no growth was obtained on Luria-Bertani(LB) agar or thiosulfate-citrate-bile salt-sucrose (TCBS) agar. However, a significant number of the inhibited cells maintained viability, as measured by DVC. In comparison, a significant number of V.Cholera organisms associated with zooplankton, most of which were crustacean copepods,were viable but non culturable,with only a small number of cells retaining cultur ability on LB and TCBS agar. Both DVC and viable plate counts (CFU) were significantly greater for V. cholerae O1 and O139 associated with zooplankton than for V. cholerae in water alone,i.e.,without copepods. It is concluded that alum is an effective coagulant but not an effective killing agent for V. cholerae and that association with copepods offers protection for V. cholerae O1 and O139 against alum and chlorine treatments.[5] Antimicrobial activity of crude extract from two commonly used medicinally materials, alum and clove were evaluated against four microorganisms over different concentration (10, 20, 30, 40 and 50) w/v %. Minimum inhibitory concentration (MIC) and the diameter of inhibition zone were determined by in vitro bioassay using agar well diffusion method against S. aureus, S. epidermidis, E. coli, Klebsiella pneumonia. The two medicinal materials exhibited antibacterial activity and inhibition growth of gram positive and gram negative bacteria isolated from different sites of infection. The inhibition effect of these extracts compared with standard antibiotics cefotaxime.[21] Another study was done to test the antimicrobial activity of alum on seven bacterial isolates: Proteus sp., Pseudomonas sp1., Pseudomonas sp2., Streptococcus sp., E. coli and Staphylococcus aureus1, Staphylococcus aureus2. The results showed alum in concentrations (5 and 10) gm/100 ml sterilized by a Millipore filter and gauze was affected against most bacterial isolates while alum in concentration 2.5 gm/ 100 ml not showed any inhibited affect against all selective bacterial isolates. The best mean of Minimal Inhibition Concentration for the alum sterilized by the a Millipore filter was in (100 & 200) mg/cm3 the MIC was (19,15 and 11) respectively while low (MIC) was in concentrations 25 mg/cm3 the MIC was (3), the high MIC for alum sterilized by gauze was in concentration (100 and 200) mg/ cm3 the MIC was (15,12 and 9) respectively, while low (MIC) of alum sterilized by gauze was in concentration (50 and 25) mg/cm3 the MIC was (4,2 and 1) respectively. The high mean of inhibited activity of alum against bacterial isolates when it sterilized by a Millipore filter while low mean of inhibited activity when it sterilized by gauze. Alum which sterilized by a millipore filter have high inhibited activity towards most selective bacterial isolates and showed high activity against Streptococcus sp. compared with antibiotics (Ampicillin, Tobramicin and Ceftriaxone) while alum which sterilized by

gauze have high activity against Staphylococcus aureus1 comparison with Antibiotics (Ampicillin, Tobramicin and Ceftriaxone).[22] Antimicrobial activity of propolis, alum and plant aqueous extracts at 50% concentration by well-diffusion method was characterized by inhibition zones. At this concentration, the maximum inhibition zone diameters 35mm, 40 mm were found in Salvadora persica and alum, respectively, for propolis the inhibition zone was 30 mm, while green tea and clove give the same inhibition zone 20 mm, the minimum inhibition zone 10 mm was found in black tea.[23] The diameter of swarming was decreased by increasing the concentration of alum.[24]

The anticariogenic effect of alum was evaluated in the study by measuring the salivary S mutans levels of children at baseline, after 3 weeks, and 6 weeks of using alum containing mouth rinses and the result showed statistically significant reductions in S mutans levels in children.[25] In another study children using saturated saline rinse and alum rinse showed statistically significant reductions in salivary S. mutans counts after 10 days and also after 21 days. After 21 days, the saturated saline rinse and alum rinse groups showed statistically significant differences over the placebo rinse group. Again, the alum rinse group showed a statistically significant difference over the saturated saline rinse group.[26] Antibacterial effect of alum increases with its concentration from 50 to 10000 PPM but still weaker than 0.1% chlorhexidine gluconate. Only concentrations of 5000 and 10000 PPM showed negative adherence of Mutans streptococci to the tooth surface.[4]

Haemostatic effect

A prospective trial of 45 consecutive patients was carried out, in which tonsillectomy was performed using aluminium potassium sulfate (>99% pure) as haemostatic agent on one side and gauze pack on the other side. Application of aluminium potassium sulfate in the tonsillar fossae reduced the operation time by 28.6%, the operative blood loss by 19.7% and the number of ties used by 33.3% in regard to control side. All these results were statistically significant.[27] Continuous vesical irrigation with 1 per cent alum solution was performed without anesthesia in 9 patients in whom massive bladder hemorrhage persisted despite evacuation of clots and normal saline irrigation for at least 24 hours. Hematuria ceased promptly in all patients, although the effect was transient in 3. No side effect was observed. Biopsy of the tumor subsequent to alum irrigation showed no alteration in the histological characteristics. Biopsy of the normal-appearing bladder mucosa also showed no evidence of epithelial damage.[28] Five patients with malignant hemopathies, including four treated by

bone marrow transplantation, developed cyclophosphamide-induced hemorrhagic cystitis that failed to respond to the usual treatments. Each was treated by continuous irrigation of the bladder with potassium alum. Hematuria ceased in three patients followed up for 5 to 10 months.[29] The efficacy of intravesical alum irrigation was analyzed after application to 9 patients with continuous and severe bladder hemorrhage. Causes of bleeding were radiation cystitis in 4 patients, vesical invasion by cervical cancer in 3, bladder cancer in 1 and cyclophosphamide-induced cystitis in 1. Though alum treatment was initially effective for control of massive bladder hemorrhage in all patients, it eventually failed to suppress a subsequent hemorrhage in 2 patients (78% success rate).[30] Intravesical 1% alum irrigation for intractable haematuria can be used with no spinal or general anaesthesia or elaborate radiological procedures, is generally safe, effective and well tolerated, and is suitable as a first-line treatment.[31]

Antiplatelet effect

One study was done to investigate the in vivo effect of alum on platelet aggregation and bleeding time in rabbits. The collagen-induced platelet aggregation of platelet-rich plasma samples from 14 healthy rabbits was measured turbidometrically using a platelet aggregometer, before and 1 hour after intravenous injection of alum. Collagen-induced platelet aggregation was significantly reduced after alum injection. Bleeding time from an ear puncture in 8 rabbits was also significantly prolonged after intravenous alum injection. These results suggest that the use of alum as an oral antiplatelet drug could be explored further, taking into account possible side-effects especially in renal compromised patients.[32]

Larvicidal effect

Larvicidal potential of potash alum was investigated to control mosquito larvae i.e. A. stephensi under laboratory conditions. The LC50 and LC90 value of alum were tested against various instars of mosquito larvae following 24 hours of exposure. No mortality was observed in the control groups over the course of experiment. Potash alum was also found to be effective against all instar larvae. The LC50 and LC90 among various larvae ranged between 2.1 to 48.74 ppm and 15.78 to 93.11 ppm, respectively.[33]

Healing effect

Fifty two patients were included in a randomized double-blind placebo controlled study. 28 female, 24 male, ages range 20-40 years. Patients with recurrent aphthous ulceration (RAU) were separated in to 5 groups, and these were treated with 1, 3, 5, 7 % of alum suspension,

and placebo, applied topically four times daily, for five days treatment. Patients response to treatment was determined by; clinical evaluation of subjective treatment response, duration of lesion healing. Statistical analysis of the effect on healing time of the three concentrations of the potash alum (3, 5, 7) had a significant reduction in the time required for complete healing of the ulcer compared with placebo group.[3]

Anti-obesity effect

In Wistar rats fed on high fat diet (HFD), oral intake of potash alum exhibited significant reduction in body weight, food intake, serum triglycerides (TGs), total cholesterol (TCs) and high density lipoproteins (HDL) whereas simultaneously increased the dry weight of feces, total lipids in feces, compared to HFD fed control.[34]

Spermicidal effect

Viability and motility of alum vary with different concentration of potash alum. In case of 15% concentration the death time was 51.9% sec in case of 10% it was 87.2 sec and in case of 5% it was 122.1sec.[35]

CONCLUSION

In classical literature of Unani medicine alum used widely for the treatment of various ailments, but scientifically few of them was screened out. Thus the scientific studies should be conducted to investigate the unexploited potential of alum.

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