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An illustration and modalities of *Khilṭ Dam* (blood)

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Abstract

Background: Buqrat (Hippocrates; 460-370 BC) is certified for the appliance of *Akhlāt Arba'a* in medicine. Jalinoos (Galen) put forth this theory and applied it in its patho-physiology. He also assumes *Arkān* based theory of the four *Akhlāt* (Humors); *Dam* (Blood), *Balgham* (Phlegm), *Ṣafrā* (Yellow bile) and *Saudā* (Black bile), and blood is the mixture of all four *Khilṭ* (Humour) in which every *Khilṭ* participate in different but definite manner.

Purpose: The attempt is to make the existence of *Khilṭ Dam* on the basis of current scientific scales.

Methodology: Classical Unani literature and the information of blood of past and recent advancement will be analyzed to reach the conclusion.

Conclusion: Blood of human is also as same as that of first human. The view and knowledge gets improvement with acceptably proven changes in their form with the advancement of time. The theory of *Akhlāt* and the description of them are scientific. If anything changes, it is the view to see the things.

Keywords: Unani, *Khilṭ Dam*, blood, Humours

Introduction

Buqrat (Hippocrates; 460-370 BC) is certified for the appliance of *Akhlāt Arba'a* in medicine and he also elaborated the concept comprehensively. He finally projected *Arkān* based theory of the four *Akhlāt* (Humors); *Dam* (Blood), *Balgham* (Phlegm), *Ṣafrā* (Yellow bile) and *Saudā* (Black bile). It is said that if the *kamiyat* (Quantity) and *kaifiyat* (Quality) of these four humours is in required division of a body to perform its specific functions, health occurs if not alertness in the state of the body. Galen stated that every animal and plants that is subjected to genesis and degradation and those bodies that are formed inside earth i.e. mineral all are made from *Arkān Arba'a*; *Nār* (fire), *Mā'* (water), *Rīḥ* (air) and *Arḍ* (earth) and these are primary remote *Arkān* and secondary proximate *Arkān* from which human body and all other blood containing are made, are *Akhlāt Arba'a* i.e. *Dam* (blood), *Ṣafrā* (yellow bile), *Saudā* (black bile) and *Balgham* (phlegm) ^[1, 2, 3]. After that all Unani scholars like *Abu Sahal Masihi*, *Ibne Sina* (Avicenna), *Ahmad Bin Tabri*, *Ibn Hubel Baghdadi*, *Ibne Rushd* (Averroes), *Razi* (Razes) followed this concept.

***Akhlāt Arba* (The Four Humors):** *Khilṭ* means the substance which is in mixture form. *Ibne Sina* assumes that *Khilṭ* is a liquid substance and made up of *Istīḥal Awwal* (first metabolism) of food. Human body is build up of *Akhlāt Arba* ^[3]. *Khilṭ* is a liquid body which is enclosed in the vessels and cavity of the body to provide *Badal Ma Tahallul* through conversion into *Jawhar A'dā'*. They provide nutrition to the *A'dā'* which have same *Mizāj* as of *Akhlāt*. *Dam* carries the *Ḥarārat Gharziyya* (innate energy) from *Qalb* (heart) to *A'dā'* (organs) ^[3, 4].

The *Khilṭ Dam* (Sanguineous Humour): In classical literature of Unani medicine, the characteristics of normal *Khilṭ Dam* is that it is red in colour, has no unpleasant odour, and has a very sweet taste. It is *Ḥār Raṭab* (Hot and Moist) in nature ^[2, 3, 5].

Presence of *Khilṭ Dam*

According to Location: *Khilṭ Dam* is found inside the vessels (*Urooq*).

According to Colour: All the fluids of the body which are red in colour are called as *Khilṭ-e-Ahmar*, *Khilṭ-e-Hamra*, or *Dam*.

According to Ruṭūbat Ūlā And Thāniya: *Khilṭ Dam* comes under the Rutubat-e-Ula.

According to the quality of Latafat and Kasafat: *Khilṭ Dam* or blood has both types of quality. Its *lateef* part which have the property of diffusing into *A'dā'* and when they combine with *Rūh* (O₂) they produce *Quwā* to perform various physiological functions in the body. *Kaseef* part perform the function of takwin and becomes part of the organs. They replace wear and tear and promote growth.

According to Tabayi (Normal) and Ghair Tabayi (Abnormal): When *Khilṭ Dam* is normal in its composition, and constituents, is called *Tabayi* or normal blood. But when the composition, constituents, or quality and quantity are altered due to any cause, its *Mizāj* and *Tarkeeb* altered. Hence, it is called *Ghair Tabayi* [6, 7].

Mizāj (Temperament): The *Mizāj* of blood is hot and moist (*Har and Ratab*). The reason of being *Hār* is that: It is *Hār bil fa'il*, and *bil quwā*. The reason for being *Hār bil fa'il* is that the organs which are richly supplied by the blood are hot in comparison to those organs whose blood supply is low. This is due to the water content of blood which has three distinct properties that help the blood in keeping the body warm. These qualities are; high specific heat, high thermal conductivity, and high latent heat of evaporation. *The reason for being Hār bil quwā is that* it contains such chemical compounds which are potentially hot i.e., when they reach into the cells of the tissue, they oxidize to produce heat and energy. *The reason of being Raṭab is that;* it contains 91-92% of water, which becomes the cause of its moisture [6, 7].

Asbāb-e-Wajūd (Causes of existence) of Sanguinous Humour: *Material Cause* those parts of the solid and fluid aliment which are of equable temperament, comes from the diet. *Formal Cause* is exact and good digestion. *Efficient Cause* is required heat. *Final Cause* serves to nourish the body. *Khilṭ Dam* is the result of *Haḍm Kabidi* [3, 8].

Mechanism of Formation of Akhlāṭ: [2, 3, 8, 9] Food undergoes a definite amount of digestion during the act of mastication. The lining of the mouth is being continuous with that of the stomach, so, there is one continuous digestive surface. When masticated food comes in contact with it, a certain change at once takes place in it under persuade of the saliva, whose action, in virtue of the innate heat within it, is digestive. Therefore, when wheat is masticated it procures the maturation of furuncles and abscesses, but has no such effect when simply rubbed with water, or even if boiled with water. After reaching the masticated material into the stomach, true digestion goes on not so much by the heat of the stomach but by reason of the heat of the enveloping members namely the liver on the right, the spleen on the left. This is not warm in virtue of its own substance, but in virtue of its blood supply, the omentum in front whose fat easily retains heat and reflects it on to the stomach, and the heart above which warms the diaphragm and so, warms the stomach.

The first stage of digestion: yields the quintessence of the aliment, which, in many animals, becomes chyme by the help of admixture with the fluid which one has consumed. The chyme is just like to sodden barely. The part of this chyme that is thus diluted is drained from the stomach into the intestines, and enters into the roots of the mesenteric vessels

which are found all along the intestinal tract. Having entered in these channels the nutriment passes into the portal vein, enters the gateway of the liver, and then travels along finer and ever finer divisions until it reaches to the capillaries, which are the vital source of the vena cava emerging from the convexity of the liver. The passage of the nutriment through these very narrow channels could not take place were it not admixed with water consumed in excess of the authoritarian requirements of the body.

The second stage of digestion: By being disseminated over the whole liver in this way, the chyme is converted into chyle that is exposed to the digestive function of the whole organ, and the function of the liver is thus proficient most vigorously, energetically, and speedily. The change of nutriment into blood is now complete. The various products and by products of digestion up to this point are as follows: *In healthy digestion*, the blood itself, by-products; foam, the bilious (*Ṣafrā*) humour, a sort of precipitate the atrabilious (*Saudā*) humour. *In unhealthy digestion;* By products: An oxidation product, where digestion is carried too far, attenuated portion, morbid bilious humour, dense morbid portion as atrabilious humour, a product when digestion is not carried far enough that is serous humour. As long as it stays in the liver, the blood which the liver forms is more attenuated than it should be, because the wateriness is in excess. But when the blood leaves the liver, the excess of water is removed, for it is taken to the renal vessels, and so provides the kidneys with the quantity and quality of the blood best suited for their nutrition. The purified blood ascends into the superior vena cava, and its subsequent route is into smaller and smaller veins and finally into the finest hair like channels. Having reached these hairs like channels it sweats out through their orifices and bathes the tissues.

Third digestion: The blood undergoes a third digestion in the blood-vessels. The foods of tissues carried by the blood, and the tissue wastes discharged into it, undergo treatment inside it, which is only proficient if certain salts and acid bases are present; otherwise conversion of such substances into available form fails to occur; and deposition in various tissues, fascia, and joints, and even in the vessel walls (e.g. atheroma) and nerve sheaths occur with ill effect. These harmful substances may be thought of as composed of particles too large to permeate the (invisible) pores of the tissue boundaries referred to, and the pathological condition of obstructions.

Fourth digestion: When the nutriment has reached the various members, giving each its appropriate element, a fourth digestion takes place [2, 3, 8, 9].

Composition/Constituents of Khilṭ Dam (Blood): *Khilṭ Dam* is a mixture of all Akhlāṭ, all *Akhlāṭ* participate into its composition. It is considered the heterogenous in its composition, so it is not *mutashabiha-al-ajza*. It is *mutashabiha-al-imitzaj* that it is hot and moist. In medical literature related to blood often start with hemo or hemato (haemo and haemato) that is arise from the Greek word *αἷμα (haima)* for blood [10]. In terms of anatomy and histology, blood is considered a specialized form of connective tissue, given its origin in the bones and the presence of potential molecular fibers in the form of fibrinogen.

Kamiyat al-Dam (Quantity of Blood): Blood accounts for 7% of the human body weight, with an average density around 1060 kg/m³, very close to pure water's density of 1000 kg/m³. The average adult has a blood volume of roughly 5 liters, which is composed of plasma and several kinds of cells. These blood cells that are also called corpuscles or formed elements consist of red blood cells, RBCs (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes). Volume of the red blood cells constitutes about 45% of whole blood, the plasma about 54.3%, and white cells about 0.7% [10].

Cellular Component of Blood: Erythrocytes (Kurayāt Ḥamrā’): There are 4.7- 6.1 million (male), 4.2 to 5.4 million (female) red blood cells contain the blood's hemoglobin and distribute oxygen. The red blood cells together with endothelial vessel cells and other cells are also marked by glycol proteins that define the different blood types. The fraction of blood occupied by red blood cells is referred to as the haematocrit, and is normally about 45%. The combined surface area of all red blood cells of the human body would be roughly 2,000 times as great as the body's exterior surface [11, 12].

Leucocytes (Kurayāt Bayḍa’): White blood cells are part of the body immune system. They destroy and remove old or aberrant cells and cellular debris, as well as attack infectious agents (pathogens) and foreign substances. There are five main types of white blood cells. Neutrophils, the most numerous types, these cells help to protect the body against infections by killing and ingesting bacteria and fungi and by ingesting foreign debris. Lymphocytes consist of three main types: T cells or T lymphocytes and natural killer cells, both help protect against viral infections and can detect and destroy some cancer cells, and B cells or B lymphocytes, which develop into cells that produce antibodies. Monocytes ingest dead or damaged cells and help defend against many infectious organisms. Eosinophils kill parasites, destroy cancer cells, and are involved in allergic responses. Basophils also participate in allergic responses.

Thrombocytes/Platelets (Aqrās al-Dam): They take part in blood clotting. Fibrin from the coagulation cascade creates a mesh over the platelet plug [11, 12, 13].

Plasma: About 55% of blood is plasma; it is a fluid that is the blood's liquid medium, which by itself is straw yellow in color. The blood plasma volume is 2.7–3.0 liters (2.8–3.2 quarts) in an average human. It is essentially an aqueous solution containing 92% water, 8% blood plasma proteins, and trace amounts of other materials. Normally it holds the blood cells in whole blood in suspension; this makes plasma the extra cellular matrix of blood cells. It is mostly water (up to 95% by volume), and contains dissolved proteins (6–8%) i.e. serum albumins, globulins, and fibrinogen, glucose, clotting factors, electrolytes, like Na⁺, Ca²⁺, Mg²⁺, HCO₃⁻, Cl⁻, etc, hormones, carbon dioxide, and oxygen. It also serves as the protein reserve of the human body. It plays a vital role in an intravascular osmotic effect that keeps electrolytes in balanced form and protects and other blood the body from infection disorders. Plasma circulates dissolved nutrients, such as glucose, amino acids, and fatty acids dissolved in the blood or bound to plasma proteins, and removes waste products, such as carbon dioxide, urea, and lactic acid [10, 11, 12].

Af’āl/Functions: The basic and primary function of *Khilṭ Dam* is concerned with growth (*Tanmiya*) and nutrition (*Taghdhiya*). Rest all necessary functions has been described with description of blood above.

Determination of Influence of Khilṭ Dam (Blood): *Ibne Sina* (980-1037 AD) in his famous book *Al-Qanoon-fil-Tibb* mentioned ten parameters that are applied and used universally in the assessment of temperament. They are known as *AJNĀS ASH’RĀ* [3, 8]. *Sanguine* individuals have following characters with respect to specific parameter that are as following:

(1) **Malmas (Touch):** The parameters of assessment in *Malmas* are hotness, coldness, softness and hardness. The hotness and moistness of the skin is a sign of sanguine temperament.

(2) **Lahm wa Shahm (Muscles and Fat):** The flesh indicates heat. It means excess of muscles present in hot and moist temperament. According to *Ibne Sina* well muscular development denotes moist and hot temperament. If the body is fleshy and the amount of fat is not much, the temperament is hot and moist.

(3) **Ash’ar (Hairs of the Body):** Coarse hairs are generally found in the people of hot temperament. Straight and coarse hairs are pattern of hot moist.

(4) **Laun-e-Badan (Body Complexion):** *Tabri* states that the real cause of body colour is the dominance of a particular humor (*Khilṭ*) and its diversion towards the skin at the time of formation of embryo. If there is dominance of red colour of the body suggests dominance of *dam*. Redness of body is a symptom of heat and blood. One thing should always be kept in mind that climate and zones affects skin and hair colour, so one should not expect a Negro is to have fair skin colour.

(5) **Haiyat-e-A’ḍā’ (Physique):** Broader chest, prominence of veins and joints, well developed muscles, rapid and strong pulse, larger extremities and height; all are indicatives of *Sanguine* temperament.

(6) **Kaifi’at-e-Infi’al (Responsiveness of Organs):** Quality of reaction is the quality of the body being affected quickly or slowly by the fourfold states of hotness, coldness, moistness or dryness. Quickness of the body in reacting to a certain state is the preponderance of that state in the body. Hence if the temperament of an organ is hot and moist in itself it will give a considerable response when the external environment becomes moist and hotter.

(7) **Naum wa Yaqza (Sleep and Wakefulness):** Excess wakefulness is indicative of increased heat and dryness and thus denotes a hot and dry temperament, but if there is some moistness in temperament it would be near about mu’tadil.

(8) **Af’al-ul-A’ḍā’ (Functions of Organs):** Normal functions means all those actions which take place as demanded by the physiology whether these are physical actions or psychic and animal actions. Confusion of actions is an evidence of hotness. Persons of hot temperament have rapid body activities, strong voice, talkative nature and their movements are excessive and strong.

(9) Fuzlat-e-Badan (Excreta of the Body): Acrid and strong smell and deep colour of excreta indicate that the body is hot. Similarly excess sweating is also due to increased body metabolic rates, which signifies body hotness.

(10) Infi'alat-e-Nafsania (Psychic Reactions): The sign of heat pertaining to the action and reaction of psyche are intensity of anger, depth of sadness and sorrow, acuteness of perception and memory, too much initiative, lack of scruples, over trust, optimism, callousness, vigilance, manliness and active habits. The nature of dreams have also been given due consideration in this process. It is described that dreams of fire, incidence pertaining to heat, red color, and sunbath and bone fire all suggestive of hot temperament [3, 8].

Discussion

With the above referenced knowledge of *Khilṭ Dam* in both era i.e., classical and modern, it can be say that;

Colour: *Khilṭ Dam* is that humour of the body which is red in colour, due to the presence of heme part of hemoglobin, which when reacts with oxygen gives such spectrum which is red in colour. This red spectrum overlaps on the all constituent of the *Khilṭ Dam*. Hemoglobin is the chief determinant of the color of blood in vertebrates. Each molecule has four heme groups, and their interaction with various molecules alters the exact color. In vertebrates and other hemoglobin using creatures, arterial blood and capillary blood are bright red, as oxygen imparts a strong red color to the heme group. Deoxygenated blood is a darker shade of red; this is present in veins, and can be seen during blood donation and when venous blood samples are taken. This is because the spectrum of light absorbed by hemoglobin differs between the oxygenated and deoxygenated states [14].

Location: *Khilṭ Dam* is found as; *According to Colour:* All the fluids of the body which are red in colour are called as blood. *According to Location;* blood is found inside the vessels (Urooq). *According to Ruṭūbat Ūlā and Thāniya;* blood comes under the *Ruṭūbat Ūlā* (Primary Fluid).

Constituents: The word *Khilṭ* itself signifies that the thing which has the word *Khilṭ* as its prefix, is a mixture of more than two or more things. So when we are saying *Khilṭ Dam*, its mean that it has other constituents also in its existence.

As per the classical literature of *Khilṭ Dam*, *Ṣafrā*, *Balgham* and *Saudā* are present in the *Khilṭ Dam* in a definite and required quality and quantity. But if we talk about the modern knowledge *Khilṭ Dam* (blood) has broadly two parts one is plasma and second is cellular components. Plasma contains dissolved proteins (6–8%) i.e. serum albumins, globulins, and fibrinogen, glucose, clotting factors, electrolytes, like Na^+ , Ca^{2+} , Mg^{2+} , HCO_3^- , Cl^- , etc, hormones, carbon dioxide, and oxygen, whereas cellular component comprises of RBCs, WBCs, and platelets.

Mizāj (temperament) of Khilṭ Dam: It is hot and moist, instead of presence of other *Khilṭ*, *Ṣafrā*, *Balgham*, and *Saudā* that differ in temperament. But the hotness and moistness of dam is of such extent that results in impacting its temperament on all other *Khilṭ* present in it. But today it can be seen by the biophysical and biochemical parameters. So, pH of blood as it has a set range which shows the normalcy of blood, reading below and above the range signifies change in its *kamiyat* and *kaiḥiyat*, and hence alteration in its specific

and required temperament. The normal range is 7.35 to 7.45. Blood that has a pH below 7.35 is too acidic, whereas blood pH above 7.45 is too basic [14].

Practical Approach to Diagnose Mizāj Damwi (Sanguine Temperament): Tentatively to draw up correlations between modern biochemical data and the humours as above described would not be quite a useless exercise. From the description, it is clear that any given sample of blood contains: all four normal humours: As regards the sanguineous humour; RBCs, WBCs, Platelets, glucose and the salts concerned in maintaining the acid base equilibrium. As regards the phlegmatic (*Balgham*) humour serum globulins, serum albumin, and neutral fat. As regards the bilious (*Ṣafrā*) humour bile pigments, cholesterol, and perhaps lecithin and volatile fatty acid. As regards the atrabillious (*Saudā*) humour neutral sulphur, nitrogen compounds when in collidal form, certain muciods. A certain proportion of immature humours; that is, under oxidised digestive products, excrementitious humours, tissue wastes; the by-products of complete oxidation; non protein nitrogen group (urea, ammonia, creatinine, etc) [8]. In diseased states, it may also contain certain depraved humours, including over oxidised products, putrefactive substances of various kinds, products of bacterial growth, various auto intoxications, diamines, etc.

Note: Unani terminologies are written in the above text according to the book “Standard Unani Medical Terminology” published by Central Council of Research in Unani Medicine, New Delhi. [15].

Hypothetical Determinants of Damwi Mizāj (Sanguine temperament) On the Basis of Literature Available:
Hematocrit value: This is the ratio of the volume of red cells to the volume of whole blood. Normal range for hematocrit is different between the sexes and is approximately 45% to 52% for men and 37% to 48% for women.

Haemoglobin concentration: The normal range of hemoglobin for men it is 13.5 to 17.5 grams per deciliter, for women it is 12.0 to 15.5 grams per deciliter.

RBCs count: According to the Leukemia & Lymphoma Society: The normal RBC range for men is 4.7 to 6.1 million cells per micro liter (mcL). The normal RBC range for women who aren't pregnant is 4.2 to 5.4 million mcL. The normal RBCs range for children is 4.0 to 5.5 million mcL.

WBCs count: The normal number of WBCs in the blood is 4,500 to 11,000 WBC per micro liter (4.5 to $11.0 \times 10^9/L$).

Platelet count: A normal platelet count ranges from 150,000 to 450,000 platelets per micro liter of blood.

Glucose level: The American diabetic association recommends a post-meal glucose level of less than 10 mmol/L (180 mg/dL) and a fasting plasma glucose of 3.9 to 7.2 mmol/L (70–130 mg/dL).

Note: The above parameters are the reflection of *Damwi Mizāj*. If we divide the normal ranges of these parameters in four parts, the top most division would fall in *Damwi Temperament*. So, practical should be done to check this hypothesis either it is true or false.

Conclusion

Since the existence of human, its anatomy and physiology is same. So blood of human is also as same as that of first human. The view and knowledge gets improvement with acceptably proven changes in their form with the advancement of time. Similarly the components of blood with time become clearer. The theory of *Akhlāt*, and the description of them is scientific. If anything changes, it is the view to see the things.

Future prospects

The practical application and studies must be done to check out the hypothetical aspects that are based on literature available on the blood to find out the digital and biochemically and biophysically tested results. And other body humours should be analyzed like this.

Conflicts of interest: Nil.

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