

Effect of Ageing on Weight-Bearing Joints: Based on The Concept of Unani Medicine

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Cite this paper as: Md Khursid Alam Ansari, Azizur Rahman, Abid Ali Ansari, Shabistan Fatma Taiyabi, (2025) Effect of Ageing on Weight-Bearing Joints: Based on The Concept of Unani Medicine. *Journal of Neonatal Surgery*, 14 (32s), 7504-7508.

Accepted: 11-01-2025

Published: 21-01-2025

ABSTRACT

Ageing is a multi-causative meta-phenomenon that leads to progressive intrinsic deterioration of the homeodynamic capabilities of the body that challenge survival. According to the principle of Unani medicine, the cold-dry temperament of the elderly causes loss of structural integrity in organs, and a decrease in intensity of innate heat and amount of innate moisture leads to functional decline in organs over time. The structural deformity and functional decline are accomplished by gradually accumulating alien moisture. In humans, the temperament of adulthood is hot-dry (drier than the child but moister than the elderly), which is best suited for the optimal somatic and reproductive function; hence, this temperament is regarded as mu'tadil (equipoise). Whereas, the temperament of the elderly is cold-dry, which is worst for the function of life, causing structural deformity and functional decline in organs. Ageing imparts its effect on every organ, including weight-bearing joints. Joints are spacious, mobile, and weaker organs, which favor the accumulation of alien moisture. The organs that are more spacious and have greater mobility undergo earlier and severe degenerative changes due to ageing.

Keywords: Ageing, Senescence, Innate Moisture, Elderly, Articular cartilage

INTRODUCTION

Ageing is the universal truth for everyone, which is inevitable and irreversible. Ageing brings a detrimental change in almost every organ, which increases the susceptibility to disease and disability.¹ Most of the medical scholars, including Ibn Sina, believed that the health of the elderly is not a condition of disease because they considered only two states of the body- health and disease, but Galen classified the health of the elderly among the third state of the body, that is, neither health nor disease. Whatever the classification, it is a fact that the somatic and reproductive functions of the elderly are mediocre, and they are highly prone to disease and disability. The elderly are defined as those aged 60 years or above.^{2,3,4}

METHODOLOGY

The present study was literary. This study is grounded in explanatory, exploratory, and reconciliatory thoughts and doctrines. The scholarly materials were collected from various sources. The source of materials was the classical text of Unani medicine, manuscripts and their translations, for example Kulliyat -e- Qanoon, Canon of Medicine of Avicenna, Kamil us sanaat, Kulliyat-e-Nafisi, Kutab Al-Umda Fil Jarahat, Kitab Mukhtarat fil Tib, Kitab-fil-mizaj, Ainul-Hayat, Firdaus-ul-Hikmat, journals, proceedings, periodicals, thesis reports, dissertations, gazettes, etc., for this purpose the library of NIUM and relevant websites have been visited. The collected materials were analyzed and systematized in a comprehensive way to draw a meaningful conclusion.

LITERATURE REVIEW

Old Age: In the classical text of Unani medicine, old age is defined as the chronological age of 60 and above (from birth). The United Nations also refers to a person of 60 years or over as an older person.^{2,5}

Weight-Bearing Joints: The joint of the body that hold up and carry body mass to the ground in a standing position is called weight-bearing joints. Ankles, knees, and hips are primary weight-bearing joints. Joints of the feet, pelvis, lower back, and spine are weight-transmitting joints.⁶ Weight-bearing joints perform two functions: one of weight-bearing and the other of movement.⁷

Weight-Bearing Mechanics: Primary weight-bearing joints provide a great degree of freedom for movement along with a weight-bearing mechanism. When two or more cartilage-surfaced bones in a joint meet and work together, it allows for bending, stretching, twisting, and turning easily. In most weight-bearing joints, a convex structure rotates within a concave socket, for example, the hip, shoulder, and wrist. The subchondral plates (which lie below the cartilage in joints) of concave joint members are significantly thicker than those of their convex partners. These structural differences give the advantage that the concave surface resists strong tensile forces and makes that side stiff, whereas the corresponding thin layer on the convex side allows it to be comparatively flexible, hence each side of the joints experiences the same loading forces, but the stress is different.^{6,8} Anatomical structures depend for their existence on the chemical constitution.⁵ Joints are evolved for mobility; hence, they are spacious and lubricated by a fluid to facilitate easy movement without wear and tear.⁹ As a by-product of metabolism, some waste products are produced; some of these are not expelled through the natural routes, hence they accumulate in the body where spaces are available. To minimize the hazardous effects of excess matter to the vital organs, nature pushes these waste materials towards the weaker organs. The joints have spaces and cavities; hence, the waste materials accumulate easily in the joints.¹⁰ Movements of joints stir and pull the matter. Movements also generate heat, and heat drags the fluids. Joints lack digestive faculty, unlike other organs. When matter accumulates in other organs, the digestive faculty acts on that and makes it able to excrete, but in joints, it does not happen, which favors the accumulation of waste products there. Hot-moist temperament helps in the digestion, but joints are made up of cartilage, tendon, nerve, and ligaments, all these are cold-moist that is unfavorable for digestion in the joints, so, due to weak digestion in joints, there is more formation of waste material which accumulates and further hampers the digestion as well as defects the elimination of waste; eventually, restrict the movements and weight-bearing property of joints.¹¹ Accumulated waste products of other organs, degraded molecules, and alien moisture in the joints/matrix, cause its toxic effects as well as structural deformity and stiffness. The joints are a compound organ comprised of simple organs. Simple organs involved in joint formation are bones, cartilage, tendons, ligaments, vessels, and nerves. The cold-dry temperament of the elderly primarily affects the simple organs, which reflect in the dis-temperament of joints.¹² Senescence-related changes in components of joints are as follows-

Bones: Due to cold-dry temperament and domination of the element earth, bones become fragile, increasing the risk of fracture and osteoporosis, as well as diminishing growth and differentiation, which leads to delayed healing.⁵

Cartilage: Cartilage loses flexibility and increases rigidity under the influence of dryness and dominance of elemental earth. Rigidity and fixity or ossification of cartilages prevent it from its shock-absorbing property and become the cause of pathological conditions like osteoarthritis.⁹

Tendons and Ligaments: With the advancement of age, tendons and ligaments lose their elasticity, and an increase in rigidity leads to weakness of the joint and restricted movement.¹³

Vessels: Coldness causes narrowing and dryness, a decrease in the elasticity of vessels, leading to improper transportation of nutrition and waste materials.¹³

Flesh: Rigidity and fixity increase due to dryness in temperament and domination of the element earth.¹⁴

Nerves: The signal conduction mechanism of the nerve is disturbed due to the cold-dry temperament of the elderly.^{15,16}

Synovial Fluids (Rutūbat Zulāliyya): They lubricate the joints and provide smooth movement. In the elderly, dry-cold temperament causes a decrease in the amount and an increase in viscosity of the synovial fluid, causing stiffness in joints and restricted movements.¹¹

In joints, wear and tear increases due to dryness in temperament, but growth and differentiation diminish due to the decrease in the amount of innate heat and moisture. The effects of ageing on different joints are mentioned below-

Sacroiliac Joint (SIJ): Throughout life, changes occur in this joint. In old age, a breakdown in ligament integrity around the SI joint leads to hypermobility. The instability and disability in joints occur due to degeneration of the regulating ligaments. Arthritis in this joint usually occurs, which is related to SIJ degeneration. SI joint pain is the biggest contributor to lower back pain, with female predominance.¹⁷ SIJ degeneration is characterized by joint space narrowing, sclerosis, erosion, and a decrease, which begins in the 20s and progresses with age.^{18,19} The cold-dry temperament of the elderly causes dryness in simple organs involved in joint formation, favors the accumulation of alien moisture, and narrows the vessels, causing poor nutritional supplements. Due to dryness, ligaments lose laxity, and dryness also causes a breach in continuity in joints, which reflects in joint pain. Normally, the SIJ absorbs the mechanical forces from the lower limbs across the pelvic girdle, provides

stability to the lower limb, and transmits body weight equally on both legs. In the elderly, the mental faculty becomes weak, which leads to a decrease in stability and poorly coordinated mobility of joints.⁹ The degenerative changes, along with poorly coordinated movement, cause unequal weight transmission.

Pubic Symphysis (PS): Since the 1920s, the pubis has been one of the most commonly used skeletons for skeletal age estimation.²⁰ The pubic symphysis is an amphiarthrotic cartilaginous joint. This joint exhibit a series of age-related morphological degenerative changes. The bone mass decreases, and the dimension of the symphyseal surface increases with age. Due to the lack of significant joint space and limited range of mobility, this joint doesn't favor the accumulation of alien moisture. In the elderly, porosity and osteopenic degenerative changes occur due to dryness of temperament, causing the erosion of the symphyseal surface. The fibrocartilaginous disc of the joint may ossify due to the dominance of the earthly element. The degenerative disease of PS may cause groin pain due to instability of joints. The instability of PS may be enhanced by abnormal joint mechanics of the SIJ.¹¹

Hip Joint (HJ): The Hip joint is a ball-and-socket variety of synovial joints. The high mobility of this joint generates a considerable amount of heat, which draws the alien moisture. The dependent position favors the inflow of alien moisture. Wider joint space and anatomical peculiarity of ball and socket type favor the accumulation of alien moisture. The accumulated alien moisture is phlegmatic fluid (Hippocrates called mucoid fluid). This accumulated phlegmatic fluid causes moistening and loosening of the tendon and ligament. This looseness of the ligament and tendon makes the HJ weak and vulnerable to dislocation.²¹ Females are moister in temperament, which favors the production and accumulation of alien moisture; hence, they are more prone to HJ dislocation. The dryness and degenerative changes are more severe in HJ because the dryness of temperament is intensified by accumulated alien moisture. Dryness of temperament and dominating earthy matter in the elderly make the bones fragile. The femur connects the axial skeleton with the lower limb, which lies obliquely near HJ. The fragile femur is prone to fracture at the surgical neck due to the oblique weight transmission mechanism.⁹

Knee Joint (KJ): Knee joints are the largest, most complex weight-bearing joints. This joint is highly mobile and absorbs a huge amount of body weight pressure. Due to the greater mobility of the joint, any mechanical or pathological injury undergoes delayed healing. In the elderly, a cold-dry temperament causes more production of alien moisture. The mobility of joints generates heat and jolts the alien moisture. Heat also draws the alien moisture into the joint. A spacious joint cavity, coupled with a lack of digestive faculty, favors the accumulation of alien moisture. Accumulated alien moisture impedes the nutritional supply of joints, also producing dryness in synovial fluid and cartilages. The mobility of joints causes wear and tear. Nutritionally deprived joints of the elderly don't heal from the wear and tear of joints, causing inflammatory changes. Dryness of the joint causes a breach in the continuity of the simple organs involved in joint formation. The inflammatory changes and loss of continuity in simple organs cause joint pain. Due to the progressive cold-dry temperament of the elderly, cartilages lose flexibility, tendons and ligaments lose elasticity, and synovial fluid dries; these collectively cause stiffness and restricted movement in KJ.⁹

Tibiofibular Joint: The proximal tibiofibular joint (PTFJ) is a synovial joint. It has a slight gliding movement. It has an anatomical communication with the tibiofemoral joint; hence, it is considered the fourth compartment of the knee joint. The distal tibiofibular joint (DTFJ) is a syndesmosis. Both PTFJ and DTFJ lack significant joint space and have limited mobility; hence, these are free from the accumulation of alien moisture. But PTFJ is near the main compartment of the knee joint, hence there is a chance to be affected by the accumulated alien moisture of the knee joint. The cold-dry temperament and dominant earthy element will cause dryness and degenerative changes, but it would be mild and of late onset.^{13,22}

Ankle (Talocrural) Joint: This is a hinge variety of synovial joints. It is a very strong joint. Plantarflexion and dorsiflexion are the main movements of this joint. There is limited movement on this joint; hence, the accumulation of alien moisture is minimal. Age-associated degenerative changes due to cold-dry temperament are delayed and less severe compared to the knee and hip joints. In the elderly, the decrease in elasticity and increase in rigidity of ligaments cause a decline in strength, stability, and eversion range of motion in the ankle joint.²³

Joints of the Foot: There are five categories- Intertarsal, transmetatarsal, intermetatarsal, metatarsophalangeal, and interphalangeal joints are in the foot. These joints are connected by a complex ligamentous structure.⁸ These joints have a very narrow range of mobility. These joints have a thick cushion inferiorly, which protects the joints from the mechanical force exerted by the ground in the weight-bearing mechanism. The three main arches in the foot maintain the shape of the foot and smooth transmission of body weight to the ground. These arches also provide a vacuum space, which acts as a shock absorber.²⁴ These joints don't favor the accumulation of alien moisture; hence, age-associated degenerative changes are delayed and minimal in the foot. In the elderly, a cold-dry temperament causes loss of cushion pad of the sole, leading to a change in arches, which results in a flatter foot.²¹

DISCUSSION

Effect of Ageing on Weight-Bearing Joints

The joints are compound organs composed of simple organs. The normal structure and function of joints are maintained by the coordinated activity of different vital organs and faculties, with the simple organs involved in joint formation. Normally,

the vegetative faculty secures nourishment, the vital faculty supplies nutrition, pnuma, innate heat, and keeps vitality intact, whereas neural functions are performed by the nervous faculty.²⁵ Any functional derangements of vital organs and faculties affect the function of joints. In the elderly, the functions of organs and faculties deteriorate due to their cold-dry temperament, poor nutritional supplements, and decreasing amount of innate moisture.²⁶ These structural and functional changes in vital organs and faculties also hurt simple organs. Any change in the chemical constitution and temperament of simple organs affects the joint.⁵ The Joints are mainly evolved for mobility; hence, these structures are spacious and lubricated with synovial fluids to facilitate easy, smooth, permitted movements. Unlike other organs, joints lack digestive faculty. These anatomical and functional peculiarities of joints make them prone to the accumulation of alien moisture (metabolic waste products). Joints lack digestive faculty and are unable to excrete the accumulated alien moisture.¹¹ This alien moisture causes damage to joints and restricts their normal function. The weight-bearing joints have a dual function: movement and weight transmission. Joints are made up of bones, cartilage, nerves, tendons, ligaments, vessels, membranes, flesh, and lubricating fluids. Coordinated and contributed to the function of simple organs, making joints able to perform their required function.⁸ The temperament of the elderly is cold-dry. Hence, this temperament increases the dryness in simple organs; under this effect, bones become drier and fragile, cartilages lose flexibility, and tendons and ligaments also lose elasticity.⁵ As the amount of synovial fluid decreases, the spinal intervertebral disc becomes thinner due to dryness. Dryness decreases muscle mass and increases rigidity. Under the effect of the coldness of temperament, nerve impulse conduction becomes slow.¹³ The vessels become narrow and less flexible, resulting in improper transport of nutrients and waste. In the elderly, multiple factors adversely affect the simple organs, leading to functional deterioration and joint derangement. These changes can be summarized as a decrease in strength, increased stiffness, and a reduction in fluid content, leading to poorly coordinated restricted movement as well as a disturbance in the weight-bearing property. It increases the risk of falls, fractures, and age-associated degenerative diseases like osteoarthritis and osteoporosis.^{1,11,22}

CONCLUSION: It is concluded that ageing is a programmed phenomenon that results from the extinction of innate moisture and cold-dry temperament. Ageing imparts its effect on every organ, including weight-bearing joints. Joints are spacious, mobile, and weaker organs that favor the accumulation of alien moisture. The organs that are more spacious and have greater mobility undergo earlier and severe degenerative changes due to ageing.

FUNDING: This work is the completed at NIUM, Bengaluru.

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