



CONCEPT OF OSTEOSARCOPENIC OBESITY: A CLINICAL REVIEW

Samreen Farha¹, Mohammad Saad Ahmad Khan² and Sana Jameel³

¹P.G. Scholar, ²Assistant Professor, P.G Scholar

Department of Ilaj Bit Tadbeer, AKTCH, Aligarh Muslim University

³Department of Amaze Niswa wa Atfal, Ajmal Khan Tibbiya College, AMU, Aligarh, U.P.

Review Paper

Received: 20.11.2023

Revised: 22.11.2023

Accepted: 30.11.2023

ABSTRACT

"Osteosarcopenic obesity" is a clinical syndrome characterized by deficiencies in the skeletal system, adipose tissue, and bone structure and function. This illness, which is also known as "chronic stress and inflammation syndrome," develops early in childhood and can impact up to two thirds of western population by the age of 50 to 60. Chronic psychosocial stress, unhealthy habits including sedentary living, poor diet, unpredictable daily routines, and insufficient sleep, all of which act on a genetic and epigenetic susceptibility background, are significant pathogenic factors in the development of this widespread condition. Obesity affects bone and muscle growth in two ways: it can promote these gains through mechanical loading, but it can also be a producer of pro-inflammatory cytokines and other detrimental endocrine variables. Older persons may benefit more from routine daily activities and some other forms of exercise, which are essential for maintaining healthy weight and preventing bone and muscle loss. Combining efforts to increase diet and physical exercise may be beneficial for older persons with OSO syndrome, and such suggestions should be encouraged as part of community health initiatives.

No. of Pages: 7

References: 26

Keywords: Obesity, Osteosarcopenic Obesity, Chronic Stress, Adipose.

INTRODUCTION

Osteosarcopenic obesity (OSO), also known as "osteosarcopenic adiposity," is a disorder characterized by structural and functional abnormalities in a patient's bones, skeletal muscles, and adipose tissue¹. The first phrase is derived from three Greek words: osteo, which means bone, sarco, means flesh, and penia, means shortage. Obese older persons are said to have osteosarcopenia, and the term "osteosarcopenic obesity" emphasizes the significant role that adipose tissue plays in the aging processes that cause skeletal muscle and bone loss. OSO refers to three conditions characterized by a loss of body composition².

1. Osteopenia and osteoporosis are symptoms of bone health deterioration.

2. Sarcopenia, or a reduction in muscular strength and mass; and
3. Fat (adipose) tissue accumulation or its eventual redistribution and infiltration into muscle and bone. As a result, osteopenic obesity and sarcopenic obesity are components of OSO².

Osteopenia, sarcopenia and obesity

Osteoporosis is a metabolic bone condition characterized by reduced bone mass, faulty bone tissue, and osteal microarchitecture disturbance. Density of bones increases from birth to age and peaks in young adulthood, followed by gradual bone loss³. Furthermore, according to a Swedish National Patient Registry cohort study, lifestyle and nutritional behaviors including smoking, drinking, and a lack of activity are associated with an higher chance of

*Corresponding author: farha.samreen9@gmail.com

developing J-shaped fractures in the future⁴. An increased in osteoclast activity causes natural bone mass loss through resorption, whereas osteoblastic activity causes bone tissue to regenerate through the creation process. So, higher resorption and a lower rate of creation are both linked to bone loss. Weaker bones may be more susceptible to fractures as a result of osteoporosis⁵. Fragility fractures are a substantial cause of morbidity in the population, are accompanied by discomfort, and frequently result in unsatisfactory rehabilitation, especially when they occur in the distal radius, vertebrae, or hips. In addition, hip fractures are linked to higher mortality rates, which typically appear 3–6 months following a fracture⁶.

Sarcopenia is defined in the literal meaning from the Greek for "poverty of the flesh" and is the normal, aging-related process of the loss of LM (lean mass). Adult skeletal muscle changes, such as fibres atrophy, type II muscle fibres loss, type I muscle fibres clustering, a reduction in fast motor units, lipid infiltration, and neuromuscular abnormalities, may all contribute to the development of sarcopenia. As a result, Rosenberg first made reference to sarcopenia in the literature more than 25 years ago. Sarcopenia is a complex geriatric syndrome. In contrast to other causes of LM loss including microgravity exposure, wasting, cachexia, and other chronic illnesses or muscle diseases, sarcopenia is considered to be a chronic condition. Sarcopenia is associated with weakened muscles, impaired bodily functions, and a higher risk of death⁷.

Obesity is characterized as an abnormal or significant buildup of fat that has a detrimental effect on health. According to the World Health Organization, central obesity is defined as having a waist circumference of >102 cm for males and 88 cm for women and a body mass index (BMI) 30 kg/m². Over the past three decades, prevalence has rapidly increased throughout the world, mostly as a result of a combination of genetic susceptibility and intentional lifestyle changes, such as sedentary habits and high calorie intake⁸.

Unani Concept

Obesity is referred to as farbahi, a Persian word, in early Arabic literature. Obesity generates continuous imtalai kaifat (increase in vasopressure), which induces vasoconstriction of arteries and, ultimately, decreases hararate gharizia. In comparison to the lean, an obese person has more balgham (phlegm) and less

dam (blood), leads to the minor variation in the body's mizaj. Khilte balgham which is Balgham primary component, and being barid ratab in temperament khilte balgham, raises the body & baroodat and ratoobat levels, making the individual's mizaj barid-ratab predominantly⁹.

Obesity being an abnormality results in Cardiovascular disease, Diabetes mellitus, HTN, and osteoporosis etc. According to Unani Physicians as the age progresses the inherent heat and innate moisture decrease steadily, resulting in weakening the Tabiyat (physique), slowing down physical function, and decreasing the formation of Akhlat saleh (normal humours)¹⁰. Another thing that happens with progressing age is Osteoporosis (takhalkhul-e-izam). it occurs due to change in asbab-e-sitta zaruriya like people on diet which is qalil ul taghzia, raddi alkaimus according to buqrat. As per ibn-e-sina people who are of balade maghrabi, female gender increasing age certain drugs like musakkin-i-Alam, excessive sleep, chronic diseases are major contributory factors for takhalkhul-e-izam.¹¹

Osteoporosis (takhalkhul-e-izam) is the marz-e-murakkab of izam in which su-e-mizaj, su-e-tarkeeb, and tafarruq-e-ittesal occur concurrently but gradually, resulting in takhalkhul and zof leaving them susceptible to kasar (fracture). Majority of the unani physicians accepts the fact it is su-e-mizaj haar ratab sada that happens during osteoporosis. Alteration in asbab-e-sitta zarooriya by Living in hawa-e-jayyad al jawahar, eating ghiza-e-kaseer-al-taghzia jayyad-al-kaimus, keeping the tabayi level of hakat-wa-sukun badani moatadil riyazat, moderate sleep, etc. Calcium supplements like mufrad drugs sadaf, marwareed, gaudanti, hajrul yahud, murakkabat qurse sadaf, khameera marwareed etc are the various ways by which the disease can be to prevented¹². To summarize, in unani systems of medicines factors like weakening of tabiyat formation of akhlat-e-khaleez, takhulkhal and farbahi are contributory to takhulkhal-e- izam-o-zubool bawajah farbahi.

Diagnostic criteria

Osteopenia or osteoporosis, sarcopenia, and obesity, or impairments in bone, muscle, and fat, are the diagnostic criteria for OSO. Because of the novelty of this disease, we suggest the following diagnostic standards:¹³

1. Having osteoporosis or osteopenia. when bone mineral density is between 1 and 2.5 SD or more

below the predicted range, or both, osteopenia or osteoporosis is diagnosed. According to the NHANES III reference database, the IOF, ESCEO, ISCD, WHO, and NOF have all recommended using dual-energy X-ray absorptiometry (DXA) for measurements of the femoral neck and/or lumbar spine (L1-L4) in women between the ages of 20 and 29.

2. Mass of muscles and function loss associated with impairment.
3. BMI ≥ 30 kg/m².¹³

Prevalence

Since the OSO syndrome is a recently recognized ailment and the diagnostic criteria are still being improved, it is currently unknown how many or what proportion of persons have the combined sickness. However, statistics on its constituent parts are readily available. One in two American women could suffer a fracture in their bone, and at least 54 million Americans presently have osteoporosis or osteopenia. Moreover, between 5% and 13% of individuals 65 or older. 80 years old with sarcopenia^{14,15}. Ironically, osteoporotic fractures like hip fractures in elderly people speed up the onset of sarcopenia, which decreases general physical strength and increases the possibility of fractures and falls. Therefore, there is a direct connection between these two diseases. Obesity, once thought to be protective of bone and muscle mass, is now associated with degradation of bone and muscle, especially with age. This is true even though a recent study suggested the existence of OSO syndrome in a younger-age overweight adult, causing changes in the body composition that are comparable to those seen in elderly populations¹⁶. In a previous study, obese women who were osteopenic performed much worse physically than obese-only women (those who did not have considerable bone or muscle loss), indicating that bone is important to the functioning of the body¹⁷.

It had been believed that individuals who were overweight or obese were shielded from age-related changes loss of strength, muscle mass and even mobility because they had more total body mass, which included muscular mass¹⁸. Sarcopenic obesity, like osteopenic obesity, is now becoming more widely recognized. New research, however, raises the possibility that an older adult who is overweight or obese may not be able to maintain overall performance despite having more lean mass due to having a higher overall body weight. Highly fat

deposition and fat infiltration into muscles, which leads to decreased muscular mass, quality, and functionality as well as possible increased frailty, are the main causes of sarcopenic obesity. Increased body fat percentage, especially when it's coupled with aging's loss of lean mass, is particularly bad for women's bones. So, compared to older women presenting with obesity alone, older people with osteosarcopenic obesity had a considerably greater risk of mobility deterioration, as seen by reduced grip strength, slower walking speed, and poorer balance^{17,19}. The chance of falls and the resulting fractures increases when functional performance is impaired. Effective preventive measures to postpone or even stop OSO are therefore strongly advised.

The prevalence of obesity will not be further explored in this review. The diffusion of fat into bone marrow and muscle with aging, or with other chronic conditions, is important to emphasize since it most likely replaces bone and muscle cells and decreases the function of each tissue. Therefore, it is crucial to focus on "hidden fat," which may be challenging to detect, in addition to obesity as characterized by standard measurements (BMI, percent of body fat).

Pathophysiology and pathogenesis

In order to prevent atrophy and to grow or restore volume and strength, bone, muscle, and related tissues (such as tendons, ligaments) require weight-bearing. Strong muscles reduce the incidence of fractures by maintaining better balance, minimizing falls, and partially absorbing/dissipating pressures associated with falls, in addition to serving as an endocrine organ for bone mass preservation.

These tissues also create hormones that alter the other tissues' metabolism and activities in addition to how they respond to endocrine stimulation. It is well recognized that bone, muscle, and adipose tissues interact with one another and support homeostasis through hormonal and perhaps neurological crosstalk. All three tissues can be simultaneously impacted by changes to this interaction.

Additionally, adipose tissue frequently takes the role of atrophied muscle and bone. Patients with osteosarcopenia have significant fat infiltration into their muscles and bone marrow, which suggests that lipotoxicity and local inflammation may play a role in age-related osteosarcopenia. The interaction between muscle, bone, and fat the connective tissues three most prevalent constituents is hence made more difficult²⁰.

Management

Although environmental influences, genetic predisposition, pharmaceutical therapy, chronic diseases, and genetic predisposition are important in the genesis of OSO, factors affecting lifestyle such as eating habits and physical activity are also important.

Nutrition

A multidisciplinary team of medical professionals, nutritionists, and physical therapists, together with lifestyle interventions (nutrition and exercise), will probably be used to treat OSO. Due to chronic illnesses, poor oral health, diminishing appetite, and changes in smell and taste, elderly people find it challenging to maintain a balanced diet²¹. Reduced nutrition absorption is another effect of aging^{4,21}. Dietary maintenance of bone health and body composition is essential. According to a current study, women with OSO syndrome have a lesser daily consumption of vitamin D and calcium (from food and supplements) than women who are simply osteopenic, sarcopenic, or obese²². This suggests that maintaining an adequate intake of vitamin D and calcium may have health benefits. Additionally, people with OSO syndrome have been found to have lower serum vitamin D concentrations²³. Inadequate protein intake in older people can contribute to muscle loss. A new guidance specifies that the OSO population needs a diet that is rich in protein (1.4-71 1.6g/kg/day) to maintain quality of muscle and mass. The T-score and bone mineral density of the right femoral neck were both positively correlated with total protein intake, according to a recent study on postmenopausal women. Because a protein-rich diet is associated with high urinary calcium excretion, which may alter bone mineral density, it is essential to balance it with calcium and vitamin D.

A reduction in calorie and protein consumption, an overabundance of carbohydrates with a high glycaemic index, and a deficiency in n-3 polyunsaturated fatty acids can all contribute to OSO. The hypothesis that a poor diet promotes OSO was confirmed in humans where a continuous high-saturated-fat and sugar diet resulted in obesity and the degradation of bone and muscle. OSO may be made worse by excesses of salt, phosphorus, and the majority of the B vitamins, as well as by deficiencies in calcium, magnesium, potassium, vitamins B6, B12, A, D, E, and K, and folate.

However, a more modern idea known as nutrient ratios may be able to better explain how general

nutritional excesses and deficiencies affect both OSO and general health.

For good reason, higher protein intakes are recommended in all OSO management guidelines because they are healthy for both bone and muscle, as well as overall health. Increased protein and vitamin D intake are considered to be crucial therapies for the aging South Korean population to stop OSO. Although a higher dietary carbohydrate quality, including more fiber and fewer simple sugars and/or high glycaemic index meals, is advised, there are no specified needs for total carbohydrate for OSO. Similarly, there is no recommended daily allowance of total fat; however, consuming more of the n-3 polyunsaturated fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), at a rate of more than 1 g/day, is advised. Thus, it is advised to consume more than 1 g per day of the important fatty acid -linolenic acid. The main vitamin that should be ingested in larger amounts is vitamin D; its importance for the health of bones, muscles, and fats is well-established, while the most important minerals are calcium, magnesium, and potassium. As part of an overall healthy eating pattern.

Exercise and combined intervention

Exercise is necessary for the OSO syndrome primarily to maintain or enhance BMD, muscle strength and quality, balance, and reduces obesity and inflammation with age. This is valid even for routine or somewhat intense activities. Due to its direct loading effect on skeletal muscle, aerobic activity is the major physiological stimulus for bone anabolism. Daily exercise alters the skeletal muscle's metabolic activity, which affects its endocrine function and the way all of the body's organs, including the bone, react to homeostasis. The effects of various forms of exercise on bone or muscle vary. As a result, not every activity is successful. OSO can be made better. Exercises that are aerobic and low-impact, like walking or cycling, have been shown to be advantageous. Despite being good for metabolism, they had little impact on BMD¹³.

Although aerobic and resistance training are essential for treating sarcopenic obesity, other factors such as frequency, intensity, duration, and kind of exercise (aerobic, resistance, or both) should also be taken into account. If weight loss together with a combination of aerobic and resistance training helps sarcopenic obese people maintain their physical independence, longitudinal studies should confirm this. Such

studies may target senior citizens who have access to fitness center membership advantages in local communities. Examining aquatic therapy or tai chi alone or in combination with other forms of exercise may be helpful for treating patients with sarcopenic obesity. Progressive resistance exercise combined with pharmacotherapy, such as testosterone supplementation, enhanced changes in body composition, including decreased fat mass and increased lean mass. However, a thorough and deeper examination is necessary to determine whether physical exercise should be paired with novel and promising treatments⁷.

Bariatric Surgery

Weight and metabolic outcomes are improved, and mortality is decreased, via bariatric surgery. This could be used as a treatment for osteosarcopenic obesity in older adults (65 years) in properly chosen patients. Except for one study that looked at how sarcopenic obesity affected the outcomes of gastric bypass and sleeve gastrectomy, its safety and effectiveness in sarcopenic obesity are unknown. Bariatric surgery causes a loss of fat mass, changes gut hormones, and can worsen sarcopenia and osteoporosis brought on by weight loss. Before recommending this intervention, carefully planned investigations are required⁷.

Management in Unani System of Medicine

The management can be classified into three group:

Ilaj bil Ghiza (Dietotherapy)

Ilaj bit Tadbeer (Regimenal Therapy)

Ilaj bil Dawa (Pharmacotherapy)

Ilaj bil Ghiza (Dietotherapy)

Less nutritional intake is proportionate to Quwwat (power), which should not be compromised; rigorous avoidance of excessive sweets, fried meals, and fatty foods; use of hot water; and careful use of vinegar and other foods processed in vinegar. Qaleel-ut-Taghzia and Kaseerul Kaimoos diets (low in nutrients but high in fibre). Fasting and diets with a Har Yabis Mizaj (hot and dry temperament) should be promoted.

Ilaj bit Tadbeer (Regimenal Therapy)

Tareeq (diaphoresis)

Hammam yabis before meal

Kasrat-e-is'hal (excess purgation)

Mus'hil (purgation) and Mudir (diuretic)

Hard work and sleeping on hard bed

Dalk with haar and Muhallil Roghaniyat such as Roghan Qust, Roghan Soya, Roghan Shibbat^{9,25}.

Ilaj Bit Dawa (Pharmacotherapy)

Advia Mufrida (Single Unani Drugs)

Commonly used drugs are Luk Maghsul (Coccus lacca), Lehsun (*Allium sativum*), Zanjabeel (*Zingiber officinale* Roscoe.), Filfil Siyah (*Piper nigrum*), Zeera (*Carum carvi*), Anisoon (*Pimpinella anisum*), Badiyan (*Foeniculum vulgare*), Tukhm Karafs (*Apium graveolens*), Marzanjosh (*Oliganum vulgare*), Tukhme Suddab (*Ruta graveolens*), Kalonji (*Nigella sativa*), Khardal (*Brasica nigra*), Haleela Siyaaah (*Terminala chebula*), Sandarus (*Trachylobium hornemannianum*), Sirka (*Vinegar*)^{9,26}.

Advia Murakkabah (Compound Unani Formulation)

Compound drug include Safoof Mohazzil, Arq-e-Zeera, Arq-e-Badiyan, Iyaraj Faiqra, Jawarish Falafili, Jawarish Kamoni, Majoon Baladuri, Majoon Kamooni, Anqarooya, Dawa-ul-Luk, Itrifal Saghir, Dawa-ul kurkum, Amroosiya, Asnasiya, Habb-e-Sandarus^{9,26}.

Conclusion

The multifactorial disorder known as OSO syndrome involves aging-related changes in body composition, such as loss of bone and muscle in addition to increased or redistributed adiposity. A combination of factors, including inadequate nutrition, inactivity, low-grade chronic inflammation, aggravation in the presence of certain chronic diseases, and the metabolic after effects of all these factors over time, contribute to this complex condition. The onset of OSO syndrome and the risk of falling can both be delayed by exercise and a balanced diet. In place of traditional exercise (aerobic and resistance training), low-intensity activities like Tai chi, Yoga, Pilates, and other similar activities, as well as whole-body vibration, can be used to prevent and cure OSO syndrome in older people. It is advised that practitioners take the patients' chronic illnesses and limitations into account so that training can be customized to their level of strength and fitness. To ensure a healthy diet, the OSO population's daily protein, calcium, and vitamin D intake needs to be monitored.

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1Department of Nutrition, Food and Exercise Sciences, Florida State University, Tallahassee, Florida; 6 pjafarinasabian@fsu.edu 7
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