

HEALTH RISKS OF OVERWEIGHT & OBESITY - A COMPARATIVE STUDY BETWEEN THE PERSPECTIVE OF AYURVEDA AND MODERN MEDICINE

Dr. Sukalyan Ray¹, Dr Sumana Ray Paul², Dr. Amritaksha Ghosh³, Dr. Soumyadip Saha⁴

^{1st} Professor & H.O.D., Dept. of Roga Nidan Evum Vikriti Vigyan, Naiminath Ayurvedic Medical College, Hospital And Research Centre, Agra, Up, India. Email – vaidya.sukalyan.ray@gmail.com ORCID ID- 0000-0002-4580-3355

^{2nd} Lecturer, Dept. of Ayurved Samhita & Siddhanta, Institute of Post Graduate Ayurvedic Education and Research, Shyamadas Vaidya Sastra Pith Hospital, Kolkata, West Bengal. ORCID ID- 0009-0000-1557-3264

^{3rd} Post Graduate Scholar, Dept. of Roga Nidan Avum Vikriti Vigyan, Institute of Post Graduate Ayurvedic Education and Research, Shyamadas Vaidya Sastra Pith Hospital, Kolkata, West Bengal. Email - amritakshaghosh2000@gmail.com ORCID ID- 0009-0005-9728-6264

^{4th} Post Graduate Scholar, Dept. of Swasthavritta & Yoga, Faculty of Ayurveda, IMS, Banaras Hindu University, Varanasi, Uttar Pradesh, 221005. Email – saha.somu.0077@gmail.com ORCID ID- 0009-0005-9256-2725

Corresponding Author: Dr. Sukalyan Ray*
Email: vaidya.sukalyan.ray@gmail.com

ABSTRACT:

Overweight and obesity, which are defined as having body mass index (BMI) 25.0 - 29.9 kg/m² and > 30 kg/m² respectively, continue to be public health concerns across the globe. Over the past few decades, the instances of overweight and obesity have increased significantly worldwide. Overweight and obesity have demonstrated multiple health risks and health outcomes that are a matter of great concern. Some of these health risks may be the direct result of increased fat mass; others may be due to metabolic consequences of enlarged fat cells - which ultimately increase overall mortality of an obese individual. It is quite interesting to note that, right from the beginning of human intellectual understanding, overweight and obesity were considered as forbidden conditions for human health. *Charaka Samhita*, a central treatise of ancient Indian medicine, *Ayurveda*, written some two thousand and three hundred years ago, had discussed the various aspect of overweight and obesity like its clinical definition, causative factors and various health risks associated with it elaborately under the terminology '*Ati Sthaulya*'. This treatise not only mentioned eight distinct health risks associated with overweight and obesity like : *Ayurhars* (shortening of life span or increased morbidity), *Javoparodha* (lack of enthusiasm or loss of vitality), *Kricchra Vyavayata* (difficulty in sexual coitus), *Daurvalya* (generalised weakness), *Daurgandhya* (having foul body odour or emission of foul smell from body surface), *Swedabadha* (feeling of pain or trouble due to sweating), *Kshudatimatram* (feeling of excessive hunger or increased appetite) and *Pipasatiyoga* (feeling of excessive thirst), it also gave the separate pathophysiology for each of those health risks. Numerous scientific studies in past couple of decades have pointed towards multiple health risks associated with overweight and obesity which are quite similar to those what are mentioned in *Charaka Samhita* long ago. This similarity in observation between an ancient classical *Ayurvedic* text like *Charaka Samhita* and modern scientific studies proves the rational and scientific approach of our ancestors in exploring the truth. In today's era, the need of the hour is the synthesis of our age old traditional knowledge with recent modern scientific advancements. Every principles and explanations given in our traditional *Ayurvedic* texts should be studied in comparison with evidence backed scientific research and studies done in recent times. Only then these age old eternal knowledge of *Ayurveda* hidden in ancient scriptures will be accepted and acknowledged by modern scientific community, especially in western world. In this present study, authors have tried to validate the observations of *Charaka Samhita* regarding eight distinct health risks associated with overweight and obesity in light of recent scientific studies and understanding of modern science.

KEY WORDS:

Overweight, obesity, health risks, *Ayurveda*, *Charaka Samhita*, *Meda*, *Ati Sthaulya*, *Ati Sthaulya Dosha*, *Ashtaninditiya Purusha*

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INTRODUCTION:

Obesity and overweight are defined as a systemic disease that shows excessive and abnormal accumulation of body fat leading to adverse health effects. Obesity imposes

devastating health and financial tolls on individuals and society. Despite significant efforts to increase awareness, the obesity epidemic continues at an alarming rate. According to the latest WHO global estimates, 2.5 billion

adults aged 18 years and older were overweight (43%), with nearly 890 million living with obesity (16%). The global age-standardized prevalence of obesity increased from 8.8% in 1990 to 18.5% in 2022 for women and from 4.8% to 14.0% for men. In 2022, there were an estimated 44% women and 43% men living with overweight globally¹. Women have higher overweight and obesity rates than men, indicating that women face a greater risk and burden of fat-related health problems². Directly and indirectly its prevalence is associated with the development of many other conditions often leading to disability and reduced standard of living as well as shorter span of life. Obesity and overweight has been considered as a potential harmful condition right from the inception of human civilization. One of the earliest principal texts of *Ayurveda*, *Charaka Samhita* (3rd century B.C.), believed to be authored by *Acharya Charaka*, has mentioned *Ati Sthula Purusha* i.e. obese persons as one of the eight types of persons in society having forbidden physical character, known as *Ashtaninditiya Purusha*³. Not only that, this text has considered *Ati Sthaulya* i.e. obesity as the most principal forbidden condition of human character due to its high health risks⁴. Due to its huge medical importance, *Acharya Charaka* has described the various aspect of obesity including specific definition, essential clinical features, eight principal causative factors, its pathogenesis and eight most important health risks associated with obesity.

Nowadays three measures of obesity are often used in epidemiological studies: body mass index (BMI), waist circumference (WC) and waist to hip circumference ratio (WHR), among which BMI is the most commonly used parameter. BMI is calculated as the ratio of weight in kilogram divided by height in meters square (kg/m²). The classes of BMI reported by the WHO are, 18.5-24.9 kg/m² for normal, 25.0 - 29.9 kg/m² for overweight and > 30 kg/m² for obesity⁵. Although over weight and obesity essentially refers to excess body fat but its measurement by BMI is somehow misnomer. Irrespective of the height, body weight is contributed by the weight of fatty tissues along with muscles. BMI doesn't distinguish muscle from fat. This can lead to a muscular person's BMI more than 25 kg/m² although he may not be necessarily overweight or obese. This concept can be traced in *Acharya Charaka*'s definition of obesity where he had considered excess deposition of both fatty tissue and muscles within body⁶, although in the pathogenesis he had given emphasis on excess deposition of *Meda Dhatu* i.e. body fat⁷. In this context, it is quite fascinating to note that, how *Acharya Charaka* had given the most up to date definition of a healthy person by including various anthropometric parameters like *Sama Mamsa Pramana* (person having proportionate musculature), *Sama Samhanana* (person having proportionate compactness); physiological parameters like *Drudhendriya* (proper functioning of all sensory and motor organs), *Sama Pakta* (having proper digestion), *Sama Mamsa Chaya* (proper nourishment of muscle tissues); pathological parameters like *Vikaram Na*

Balenabhibhuyate (having proper immunity so that diseases prevalence will be less) etc. - which indicates *Ayurveda*'s rational and most scientific approach towards medical science long ago⁸.

Modern scientists have considered various factors to be responsible for development of overweight and obesity, among which very interestingly some are identical with the causes of *Ati Sthaulya* mentioned by *Acharya Charaka*⁹ like eating more calories than one's need¹⁰ (*Ati Sampuranad*), eating too much saturated fat¹¹ (*Guru Shita Madhura Snigdha Upayogad*), lack of physical activity¹² (*Avyayamad & Avyavayad*), sleep disorders¹³ (*Diva Swapnad*), subjective well-being (SWB) & feeling of happiness¹⁴ (*Achintanad & Harsha Nityatvad*) and genetic causes involving single & multiple genes¹⁵ (*Bijaswabhavat*). This validates *Acharya Charaka*'s rational and scientific approach in analysis of pathophysiology of obesity.

Similarly *Acharya Charaka* had also mentioned eight different specific physiological conditions, known as *Ashta Dosha*, as consequence of overweight and obesity¹⁶. All the leading translators of *Charaka Samhita* in recent times have translated this term '*Ashta Dosha*' as 'eight defects' or 'eight faults' of obesity which, according to the present authors, is quite inconclusive from the perspective of medical science¹⁷. The term '*Dosha*' literally means 'anything which disturbs the body's normal functioning'. So, from that perspective it would be more appropriate if we consider this term, in accordance with modern medical terminology, as 'health risks of overweight and obesity'. These eight specific health risks of overweight and obesity as mentioned in *Charaka Samhita* are: *Ayuhrash* (shortening of life span or increased morbidity), *Javoparodha* (lack of enthusiasm or loss of vitality), *Kricchra Vyavayata* (difficulty in sexual coitus), *Daurvalya* (generalised weakness), *Daurgandhya* (having foul body odour or emission of foul smell from body surface), *Swedabadha* (feeling of pain or trouble due to sweating), *Kshudatimatram* (feeling of excessive hunger or increased appetite) and *Pipasatiyoga* (feeling of excessive thirst).

Numerous scientific studies in past couple of decades have pointed towards multiple health risks associated with overweight and obesity which are quite similar to those what are mentioned in *Charaka Samhita* long ago. This similarity in observation between an ancient classical *Ayurvedic* text like *Charaka Samhita* and modern scientific studies again proves the rational and scientific approach of our ancestors in exploring the truth. Quite uniquely *Acharya Charaka* had explained the separate pathophysiology of each of these eight health risks associated with overweight and obesity which points his intricate approach towards the problem of obesity. A comparative study of such explanations of obesity associated health risks given by ancient scriptures in accordance with recent modern scientific advancements will open a new gateway in understanding the ancient wisdom hidden in thousand years of unexplored pages of scriptures. In this present study, the

authors have undertaken such an attempt of understanding the eight principal health risks of overweight and obesity as mentioned by *Charaka Samhita* and their possible validation in light of modern scientific understandings.

MATERIALS AND METHODS:

This study was conducted as a narrative and analytical review aimed at exploring the health risks associated with overweight and obesity from both *Ayurvedic* and modern perspectives. The central classical text of *Ayurveda*, *Charaka Samhita* was reviewed to extract relevant theoretical concepts related to *Ati Sthaulya* i.e. obesity and *Ashta Doshas* i.e. eight principal health risks associated with this condition. Modern sources were searched electronically using PubMed, Google Scholar, Scopus, ResearchGate, and official health reports, including WHO publications on overweight and obesity related health risks. The search strategy involved the use of combined keywords such as overweight, obesity, obesity related health risks, *Ayurveda*, *Ashtaninditiya Purusha*, *Ati Sthaulya*, *Meda Roga*, *Ati Sthaulya Dosha*. The literature published between 2000 and 2025 was primarily considered for inclusion. Relevant clinical studies, epidemiological findings, behavioural science papers, and experimental research documenting either the etiological mechanisms or consequences of overweight and obesity were included, while duplicate papers, non-scientific reports, and studies with insufficient methodological clarity were excluded. After initial screening of titles and abstracts, full-text articles meeting the inclusion criteria were evaluated in depth. The information was systematically extracted regarding the pathophysiology of different health risks of overweight and obesity. These contemporary findings were correlated with observations of *Charaka Samhita* to establish a conceptual mapping. As this is a review study utilising previously published literature, no ethical approval was required.

DISCUSSIONS:

A comparative discussion between the perspective of *Charaka Samhita* and modern science on pathophysiology of the eight principal health risks of overweight and obesity is given below:

1. Ayuhrash: The term *Ayuhrash* can be literally interpreted as shortening of life span, which can be compared with increased mortality. Increased mortality shortens one's possibility to live longer.

Acharya Charaka has explained the pathogenesis of *Ayuhrash* as: '*Tasya Hyatimatramedavino Meda Evopachiyate Na Tathetare Dhatavah, Tasmadsyayusho Hrasah*'¹⁸. This can be explained in the following way: in obese person there is excessive accumulation of *Meda Dhatu* within body. This abnormal and excessive accumulation of *Meda Dhatu* suppress the normal synthesis of other *Dhatus* like *Rasa* etc. which are equally important for the sustenance of body. Such disproportionate accumulation of *Meda Dhatu* and suppression of normal synthesis of other *Dhatus* breaks the normal homeostasis of the body (homeostasis can be interpreted as *Prakriti* as mentioned by *Acharya Charaka*

- '*(Dhatu) Samyam Prakriti Uchyate*'¹⁹. Such a breakdown of normal homeostasis within an obese body increases the mortality and leads to premature death in an obese individual.

How obesity contributes to increased mortality has been established by multiple recent studies worldwide. The relation between higher body mass index and all-cause mortality has been found in a recent study consisting of individual-participant-data meta-analysis of 239 prospective studies in four continents, which shows that the associations of both overweight and obesity with higher all-cause mortality were broadly consistent in four continents. In the BMI range over 25kg/m² (the upper limit of WHO's normal range), the relationship of BMI to mortality was strong and positive in every global region where the study was conducted²⁰. Another recent study involving 5400 patients demonstrated a lower 30-day mortality in critically ill patients with class II obesity and a higher 30-day mortality in underweight patients. This study highlighted the association between a higher BMI and longer ICU²¹. In another recent study, data were obtained from the CDC Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) multiple causes of death database, focusing on the underlying cause of death as obesity (ICD-10 codes E66.0 - E66.9) for young adults aged 18-39 years in United States. The study found, in between 1999 to 2023, there were 19,451 deaths with obesity as underlying cause of death (males 60.58%) in young adults of above age group²². In another similar study, obesity appears to lessen life expectancy markedly, especially among young adults²³.

Obesity and increased body mass contributes into increased mortality in multiple ways. Obesity is associated with an increased risk of diseases and death, particularly from cardio vascular diseases (CVD) and cancer. The risk of premature death arise from the increased mass of adipose tissue and the products produced by the increased number and size of adipocytes in obese individuals. Psychosocial dysfunction, obstructive sleep apnoea syndromes (OSA) and osteoarthritis (OA) can be a direct result of increased fat mass. Other diseases associated with obesity results from the metabolic consequences of large fat cells. Diabetes mellitus (DM), gallbladder stones, hypertension, altered liver functions, coronary artery disease, cerebrovascular disease, cancers and infertility can all be traced in part to the increased secretion of inflammatory and coagulation molecules from adipocytes. Thus obesity increases overall mortality through its above stated comorbidities²⁴.

2. Javoparodha: The term *Javoparodha* can be interpreted as lack of enthusiasm or loss of vitality. Modern science defines vitality as, "the specific psychological experience of possessing enthusiasm and spirit"²⁵. In another definition, vitality has been defined as the combination of zest, enthusiasm, vigour and energy²⁶.

Acharya Charaka has explained the pathogenesis of *Javoparodha* as: '*Shaithilyat Soukumaryadguruvaccha Medaso Javoparodhah*'²⁷. This can be explained in the

following way: as because *Meda* possesses qualities like *Shaithilya* (sluggishness), *Sukumaratva* (delicacy) and *Gurutva* (heaviness), in obesity excessive accumulation of *Meda* within body makes a body more heavy and delicate, which ultimately results into sluggishness of normal body functions. This leads to loss of spontaneity and enthusiasm in performing regular day to day work by an obese person - a phenomenon termed as *Javoparodha*. How obesity contributes to loss of overall vitality in any individual has been established by multiple studies worldwide in last decade. A recent large prospective study found that, women who gained body weight over a four year period demonstrated decreases in physical functioning and levels of vitality²⁸. Another study found that, obese individuals have lower health related quality of life (HRQL) for physical function comparing to non-obese persons. This study also recorded higher prevalence of falls and ambulatory stumbling in obese persons having low HRQL²⁹. Another study found poor vitality as a potential risk indicator for weight gain and development of obesity, especially in women³⁰. Similarly, high waist circumference (an indices of obesity) in old women is found to be associated with both poor physical performance and activities of daily living (ADL) disability³¹.

Obesity in terms of its comorbidities contributes to loss of vitality. Excess deposition of subcutaneous fat and adipose tissue creates excessive pressure on different weight bearing joints which in turns reduce mobility. Obesity associated with metabolic syndrome is associated with cardio vascular diseases. Obesity is also associated with cardiomyopathy which reduce the cardiac functionality, which in turn hampers the blood circulation to brain which reduce the brain functions, often resulting into loss of vitality and occurrence of syncope. Severe obesity is also related with obesity hypoventilation syndrome (OHS) which results into impaired lung functions. Excess deposition of fat over the chest wall reduces chest movements. Pulmonary function test (PFT) in obese individuals often show diminished ERV, FRC and TLC. These altogether reduce oxygen supply to tissues and brain, which contribute into loss of vitality. Often obesity is related with mental depression. Also obesity is often associated with body dissatisfactions (BD) which is defined as the discrepancy between the real and individuals' idealized body image. Decreased physical activities in obese patients make them depressed, socially isolated which results into reduced productivity and economic repercussions. These altogether contribute into lack of enthusiasm, vigour, sense of positivity and spirit in an obese person - a condition we can term as loss of vitality^{32,33}.

3. Kricchra Vyavayata: The literary meaning of *Kricchra Vyavayata* is difficulty in sexual coitus. This can be interpreted as impaired sexual life, where sexual satisfaction can be achieved with great difficulty.

Acharya Charaka has explained the pathogenesis of *Kricchra Vyavayata* as: '*Shukraavahutwan Medasavrita Margatwaccha Kricchra Vyavayata*'³⁴. This can be explained in the following way: excessive formation of

Meda Dhatu leads to accumulation of *Meda* within various channels. This leads to obstruction of the nourishment pathways of all the other *Dhatus*. As a result, *Shukra Dhatu* cannot get proper nourishment and remains in a feeble condition within body. Thus it can be said that, accumulation of *Meda* within channels leads to obstruction of channels, which leads to both qualitative and quantitative reduction of *Shukra Dhatu*. *Shukra Dhatu* is responsible for maintenance of our sexual health as well as reproductive system. Qualitative and quantitative reduction of *Shukra Dhatu* leads to impairment within reproductive system and disarrangement of sexual homeostasis, as result of which obese persons face difficulty in sexual performance and also lack the quality of sexual life - a condition termed as *Kricchra Vyavayata*.

Several studies have found that obesity is associated with impairment in sexual functioning. Many studies found that, obesity have a detrimental impact on sexual functioning³⁵. In the majority of studies of men with obesity, obesity has been found to be associated with mild to moderate symptoms of erectile dysfunctions, as assessed by the International Index of Erectile Function (IIEF)³⁶. The relationship between obesity and sexual dysfunction appears to be particularly true for individuals with greater adiposity. In a recent study, it has been found that, 60% of women included in the study who sought bariatric surgery reported sexual dysfunction³⁷. This is one of the first reports to show impaired sexual functioning in women prior to bariatric surgery. Another study found that, men presenting for bariatric surgery reported impaired sexual functioning across several relevant domains³⁸. The specific nature of relationship between BMI and sexual dysfunction is unclear. One study indicated that, concerns about physical appearance and body image may negatively impact sexual desire and activity³⁹. A recent review of literature on the relationship between obesity and sexual functioning concluded that, there are three different pathways exist between the two conditions: direct effects of adipose tissue on sexual response, the impact of obesity related comorbidities on sexual desire and functioning; and the influence of relevant psychological variables⁴⁰. Excess body weight has negative effects on a number of hormones that contribute to sexual behaviour and reproductive potential. Adipose tissue is the site of sex steroid aromatization in which androgens are converted to oestrogens. This conversion leads to androgen deficiency which may influence erectile dysfunctions. In obese women, sex hormone binding globulin (SHBG) levels are reduced, which results in an increases clearance of free sex steroids including testosterone, dihydrotestosterone and androstenediol. As a result, a compensatory mechanism is got activated which results in a hyperandrogenemic state and may have negative effect on menstruation and ovarian function. Several adipokines are believed to be related to oxidative stress which can have detrimental effects on sperm functions and overall fertility in both men and women. Impairment in sexual functioning are associated with a number of

obesity related comorbidities including hypertension, type II DM and depression⁴¹. Thus obesity alone or coupled with its comorbidities contributes to impairment of sexual function in both men and women.

4. Daurvalya: The term *Daurvalya* can be interpreted as generalised weakness or especially weakness of skeletal muscles.

Acharya Charaka has explained the pathogenesis of *Daurvalya* as: '*Daurvalyam Asamatwaddhatunam*'⁴² - which can be explained as following: due to disproportionate synthesis of *Dhatu* (body tissue) *Daurvalya* i.e. generalised weakness of body occurs. For proper strength of body, the qualitative and quantitative index of all the seven *Dhatu*s should be maintained properly. *Sharira Vala* is primarily maintained by *Oja* which is the nectar of all the seven *Dhatu*s. If any one *Dhatu* gets synthesized and accumulated disproportionately within body and all the other *Dhatu*s remain in diminished condition, the sum-total nectar will be reduced leading to development of weakness⁴³. Also, every *Dhatu* has its own designated functions in body like providing nourishment (*Rasa Dhatu*), maintenance of vitality (*Rakta Dhatu*), providing compactness of body (*Mamsa Dhatu*), building the skeletal structure of body (*Asthi Dhatu*), filling of bones and to make them more strong (*Majja Dhatu*), maintenance of reproduction and sexual pleasure (*Shukra Dhatu*) etc. So, in obesity, when there is excessive accumulation of *Meda Dhatu* only and deprivation of synthesis of all the other *Dhatu*s, the net result will be loss of body strength and deterioration of body stability - leading to generalised weakness of body.

Many recent studies found that, obesity contributes significantly in muscular weakness, especially the skeletal one. One study confirmed that, the combination of obesity and low muscle mass is associated with impaired physical functions and generalised weakness in patients with osteoarthritis⁴⁴. The age related loss of skeletal muscle mass and function has been termed as sarcopenia. Sarcopenia has been shown to increase the risk of developing functional limitations and generalised skeletal muscle weakness. Researchers found that, obesity contributes to sarcopenia through decreased physical activities, chronic systemic inflammation and neuropathic changes leading to motor neuron death and denervation of muscle fibres^{45, 46}. A rationale for the exacerbation of sarcopenia brought about by obesity may be the increased mechanical stress to the musculo-skeletal system through carrying the inert mass of high levels of adipose tissue evident in obesity. In addition, adipose tissue is known to act as an endocrine organ, secreting numerous hormones and inflammatory cytokines, hence enhancing biochemical stress. Obese individuals store chronically high levels of adipose tissue, which causes an increase in circulating pro-inflammatory cytokines like TNF- α , IL-1 α , IL-6 and C-reactive protein, which play a crucial role in cell signalling in the response to both acute and chronic systemic inflammation and can have a detrimental impact on skeletal muscle by stimulating muscle protein

degradation, causing muscle wasting/atrophy and reducing muscle protein synthesis. The initiation of muscle wasting/atrophy is modulated via multiple mechanisms such as activation of the ubiquitin - proteasome pathway, which has been found to be effected via TNF- α . Chronically high levels of TNF- α initiates protein degradation and decreased protein synthesis with net effect being skeletal muscle atrophy. The decrease in protein synthesis can also be related to a reduction in anabolic hormones that would otherwise promote repair and regeneration of skeletal muscles. Obesity contributes in the reduction of insulin like growth factor-1 (IGF-1), a promoter of protein synthesis and muscle hypertrophy. The inhibition of IGF-1 is thought to be initiated by the TNF- α mediated activation of Jun N-terminal kinase (JNK). Activation of JNK has also been shown to play a role in the development of insulin resistance and metabolic syndrome through diet induced obesity⁴⁷. Altogether they contribute in muscular dystrophy and muscle weakness.

Obese individuals have reduced maximum muscle strength relative to body mass in their anti-gravity muscles compared to non-obese persons⁴⁸. This effect on an obese individual is shown to increase the risk of developing osteoarthritis⁴⁹ and potentially cause muscle weakness and functional limitations especially in elderly persons⁵⁰.

5. Daurgandhya: The term '*Daurgandhya*' means having foul body odour or emission of foul smell from body surface.

Acharya Charaka has explained the pathogenesis of *Daurgandhya* as: '*Daurgandhyam Medodoshan Medasah Swabhavat Swedantvaccha*'⁵¹. This can be explained in way like this: in obese person, *Meda Dhatu* gets in altered condition which leads to formation of foul smell in it. *Acharya Chakrapani* opined that, by nature *Meda Dhatu* possess a foul smell like *Ama* i.e. undigested food material. So, when this *Meda* which is by its own nature possesses foul smell becomes more vitiated, the native smell of it becomes fouler in nature. Also, *Meda Dhatu* possess its own property of excretion of sweat which is again foul smelled in nature, according to *Acharya Chakrapani*⁵². That's why, in an obese person, when there is excessive accumulation of vitiated *Meda Dhatu* within body and profuse sweating from it occurs, together they lead to production of foul smell from body surface - a condition termed as *Daurgandhya*.

In modern medicine this condition of having foul body odour is known as bromhidrosis, also known as osmidrosis or ozochrotia. Sweat is generally odourless but increased sweating (hyperhidrosis) creates a favourable condition for different bacteria living on skin surface. Excess sweat, combined with the presence of skin folds, creates a warm and moist environment, devoid of airflow and direct sunlight. Such condition provides an ideal atmosphere for overgrowth of bacteria, especially certain species like *Corynebacterium spp.* and *Staphylococcus spp.* Such organisms generally break down the original odourless secretions from apocrine and eccrine sweat glands into volatile, foul-smelling short-

chain fatty acids and ammonia - causing foul body odour. Obese individuals generally find hard to maintain hygiene in areas with thick skin folds like axilla, groin, under the breast, buttock etc. which provides more chance of bacterial overgrowth in those areas leading to more foul body odour.

6. Swedabadha: The term 'Abadha' literally means trouble, pain or sorrow⁵³. So, term 'Swedabadha' refers to a feeling of pain or trouble due to sweating. The way *Acharya Charaka* has explained its pathophysiology, it is quite evident from that, in this context the term refers to a feeling of pain or trouble due to excessive sweating (known as hyperhidrosis).

According to *Acharya Charaka*, 'Medasah Shleshma Samsargad Vishyanditwad Vahutwad Gurutwad Vyayamasahatwaccha Swedabadhah'⁵⁴. The whole pathogenesis can be described in the following way: *Meda* and *Shleshma* are homologous in nature, that's why *Meda* possesses the property of *Vishyandan* i.e. liquefaction. Aided with this property, *Meda* has a natural tendency to excrete more liquid out of it, which is known as *Sweda* i.e. sweat. Due to excessive accumulation of *Meda Dhatu* within body, an obese person becomes heavy and incapable of performing physical exercise. That's why, an obese person usually suffers from excessive sweating which makes his life miserable. This whole situation of misery of an obese person, produced by excessive sweating has been termed as *Swedabadha*.

Modern science has accepted the fact that, hyperhidrosis is such a condition that significantly impairs patients' quality of life⁵⁵. A recent study involving 2.77 million Israeli adolescents found that, obesity is associated with hyperhidrosis among adolescents, while more cases of hyperhidrosis were found in individuals with grade II obesity (BMI $\geq 35 \text{ kg/m}^2$), where male participants were slightly more affected than females⁵⁶. A group of researchers observed that, overweight and obesity are among the main conditions related to hyperhidrosis, probably due the reduced heat loss caused by the thick subcutaneous adipose tissue layer, which may lead to compensatory response characterised by the excessive production of sweat⁵⁷.

Obesity contributes to hyperhidrosis in multiple ways. More accumulation of subcutaneous fat and adipose tissues generates more heat through metabolism, which requires more sweat to be produced for cooling of body. A thick layer of subcutaneous fat acts as insulation, trapping heat and preventing efficient cooling, prompting more sweat. Again, due to excess body weight, the basic metabolic rate increases for performing daily tasks, increasing internal temperature and subsequent sweating. With excess fat deposition within body and an increased BMI, the heart has to pump more blood for regulation of normal homeostasis within body, raising body temperature and triggering sweating. The body struggles to reduce the temperature effectively, leading to sweating from mild exertion that wouldn't affect a leaner person⁵⁸.

7. Kshudatimatram: The term 'Kshudatimatram' refers to feeling of excessive hunger or increased appetite.

Acharya Charaka has given a dynamic picture of pathogenesis for *Kshudatimatram* like: 'Tikshnagnitwat Prabhutakoshtha Vayutvaccha Kshudatimatram'⁵⁹, which can be explained as: presence of excessively vitiated *Vayu* within *Koshtha* (abdomen) leads to *Tikshnagni* (excessively ignited digestive fire) which is the root cause of excessive hunger. In the following verse *Acharya* has given a more elaborate pathogenesis of excessive hunger found in obese persons: 'Medasaavritamargatwadvayuh Koshthe Visheshatah / Charan Samdhukshayatyagnimaharam Shoshayatyapi / Tasmad Sa Shighram Jarayatyaharam Chatikamkshati'⁶⁰ i.e. when body's different circulatory channels get obstructed by excessive deposition of *Meda* within them, then the free movement of *Vayu* within those channels also gets blocked, as result of which *Vayu* gets trapped within abdomen. Getting trapped within abdomen, this *Vayu* becomes excessively vitiated and this vitiated *Vayu* further ignite *Agni* i.e. digestive fire more viciously. Ignited by vitiated *Vayu*, this *Agni* causes rapid digestion and absorption of ingested foods which makes stomach empty in quick successions, as result of which an obese person feels excessive hunger and craving for food.

A recent study has found differences in appetite related behaviours, including higher disinhibition and perceived hunger and lower confidence in avoiding over-eating in older adults with obesity compared with those with normal weight⁶¹. Researchers have observed increased insulin resistance, high levels of leptin and reduced adiponectin accompanied with disinhibition eating in obese women⁶². Another conceptual study concluded that, obesity involves dysregulated hunger and satiety via central, peripheral and neuro-hormonal mechanisms⁶³.

A critical aspect of obesity development involves dysregulation of hunger and satiety mechanism, which disrupt energy homeostasis. Hunger, controlled by a complex interplay between peripheral signals (such as hormones) and central nervous system pathways, becomes heightened or dysregulated in obesity, contributing to over eating and weight gain. The underlying pathophysiology of increased appetite in obesity involves alterations in key hormones like ghrelin, leptin and insulin, as well as the neural circuits governing appetite, particularly in the hypothalamus and mesolimbic reward system⁶⁴. Leptin and ghrelin are two key hormones that play opposing roles in the regulation of appetite and energy balance. Ghrelin stimulates appetite and food intake, following binding to receptors and the subsequent activation of orexigenic neurons in the arcuate nucleus. Leptin, conversely has been demonstrated to suppress appetite and reduce food intake. This occurs through inhibition of ghrelin activated neurons, while simultaneously activating those that promote satiety and increase energy expenditure. A lack of biological response despite elevated leptin levels, which is known as leptin resistance is observed in individuals with excess body weight. Simultaneously high sensitivity towards ghrelin has also been observed

in obese persons. Such situation leads to abnormal increase in appetite in people with obesity⁶⁵. Along with this pathway, high insulin resistance in obesity leads to constantly elevated non-esterified fatty acids (NEFAs), which can send a false signal of energy deficit, prompting more eating. The brain's reward system, particularly the mesolimbic pathway involving dopamine, plays an important role in the regulation of appetite. This system responds to the hedonic (pleasure related) aspects of food, which can override homeostatic signals and lead to eating for pleasure rather than for energy needs. In obesity, this mesolimbic pathway becomes hyperactive leading to more eating for pleasure.

The persistent hunger and impaired satiety observed in obesity are also influenced by genetic, environmental and behavioural factors. Beyond the physiological drivers, psychological elements such as emotional eating and stress play essential roles in increased hunger in obesity leading to exacerbation of the whole situation⁶⁶.

8. *Pipasatiyoga*: The term '*Pipasatiyoga*' means feeling of excessive thirst.

Acharya Charaka has described same pathogenesis for *Pipasatiyoga* like *Kshudatimatram* as described earlier. That is to say, due to excessive ignition of *Agni* within *Koshtha* as stated earlier, the gross temperature within body gets raised leading to dehydration and dryness of mouth. In such condition, an obese person usually suffers from excessive thirst.

Excessive thirst is generally contributed by lack of hydration in body. A recent study has found, significant association of under-hydration with increased prevalence of obesity, high waist circumference with multiple other conditions in U.S. population aged 51-70 years⁶⁷. Another study has found significant relationship between obese children and under-hydration in comparison with normal weight ones⁶⁸. A more recent study reveals that, severity of obesity promotes greater dehydration in children. This study also confirmed that, high sodium excretion in obese children indicates an excessive salt intake, along with a low potassium intake, which is a significant predictor of dehydration, regardless of the total water intake⁶⁹.

Under-hydration in obesity can be explained in multiple ways. Altered body water distribution in obesity contributes in under-hydration. Fat tissue contains very less water, so when obesity increases fat mass within body, total body water per kg body weight decreases leading to under-hydration, especially in cellular level leading to metabolic impairment. As we have discussed previously, obesity leads to chronic low grade inflammation within skeletal muscles, such inflammatory state increase capillary permeability as result of which more fluid leaks into interstitial spaces of tissue leading to under-hydration within cell. In case of advance obesity, if insulin resistance occurs, such insulin resistance leads to altered renal sodium handling, which causes less water reabsorption from distal tubules which increases urine output and cause more fluid loss within body. Also, as we have discussed earlier, obesity in a gross increase total body surface area along with BMI

and heat production from accumulated fatty tissue also increases - such a condition leads to more water loss through sweating. Also, some studies have suggested that, obesity associated dysbiosis impairs short chain fatty acid production and reduce colonic sodium and water reabsorption - a condition leads to under-hydration of body. All these causes creates a combined situation when body runs under shortage of water leading to dryness of mouth, ultimately resulting in feeling of thirst.

CONCLUSION:

In today's era, the need of the hour is the synthesis of our age old traditional knowledge with recent modern scientific advancements. Every principles and explanations given in our traditional *Ayurvedic* texts should be studied in comparison with evidence backed scientific research and studies done in recent times. Only then these age old eternal knowledge of *Ayurveda* hidden in ancient scriptures will be accepted and acknowledged by modern scientific community, especially in western world. As our most ancient scripture *Rigveda* tells us that, truth is one but wise speak about it differently, the same physiological events and pathological changes in human body have been studied and explained from different perspectives, based on different principles and level of understandings by different branches of medical science like *Ayurveda* and modern medicine. But as these all are true in their own way, as they are practically verified, both by the *Ayurvedic* scholars in ancient times and modern scientists & researchers in recent times, we should now study these biological events in comparison with the both ancient and recent perspectives. *Ati Sthaulya* i.e. obesity has been regarded as one of the principal life style disorder from ancient ages and termed as one of the most forbidden condition of human body due to its various complications and co-morbidities. In this present article the authors have presented a comparative study between the ancient *Ayurvedic* explanations, especially given in *Charaka Samhita* and recent scientific findings as well as advance understandings regarding *Ati Sthaulya Doshas* i.e. complications of obesity. Thus this present study will definitely contribute in the process of harmonizing between the ancient *Ayurvedic* knowledge and modern scientific understandings in coming days and will help modern researchers to understand and acknowledge the eternal knowledge of *Ayurveda* more proficiently.

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