

# Journal of Diabetes Education

To Dispel Darkness Of Diabetes

DIET MANAGEMENT ►



◀ EXERCISE

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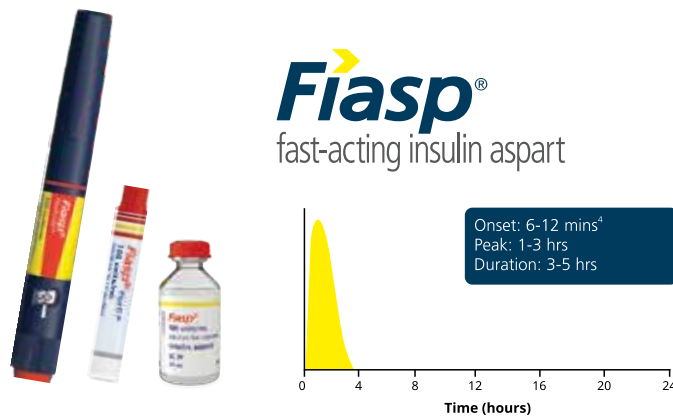
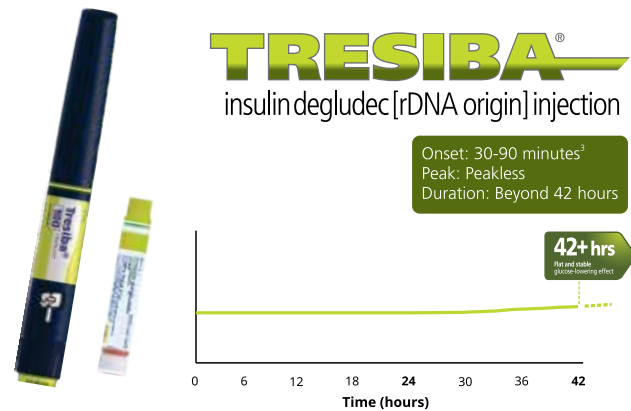
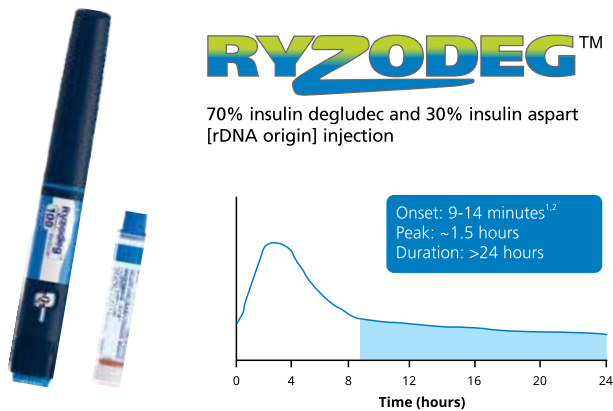


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# SARCOPENIA

## ITS MANAGEMENT & IMPACT ON HEALTH

Rima Ved\*

### WHAT IS SARCOPENIA?

The term 'Sarcopenia' was first proposed by Rosenberg in 1989 (Greek 'sarx' or flesh + 'penia' or loss), describing it as an age-related reduction in the muscle mass. Approximately, 60% of the body's protein stores are included in muscle mass and if deficient, causes lack of strength, increased chance of falls and reduced autonomy.

Clinical definitions of sarcopenia are still not available. Though, there are three papers published on this topic:

*The European Working Group on Sarcopenia in Older People (EWGSOP):*

EWGSOP defines sarcopenia as a syndrome of generalized and progressive decline in skeletal muscle tissue related to low muscle power or decreased physical performance. In addition, the EWGSOP newly identifies subcategories of sarcopenia as acute (lasting for <6 months) and chronic (lasting for > 6 months). Currently, this definition is the most widely used one.

*The European Society for Clinical Nutrition and Metabolism Special Interest Groups (ESPEN-SIG):*

The presence of low skeletal muscle mass and low muscle strength (which could be assessed by walking speed).

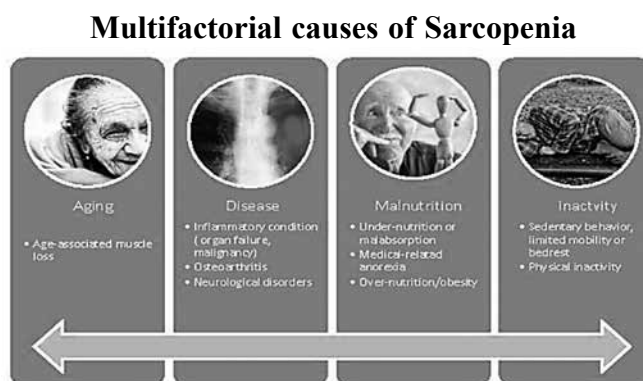
*The International Working Group on Sarcopenia (IWGS):*

The presence of low skeletal muscle mass and low muscle function (which could be assessed by walking speed) and that sarcopenia is associated with muscle mass loss alone or in co-existence with increased fat mass.

### CAUSES OF SARCOPENIA

Figure 1 below describes the factors that cause reduction in muscle quantity and quality such as primary (aging) and secondary (disease, inactivity and poor nutrition). When no cause other than ageing is detected, it is called primary sarcopenia. In many older persons, there are some other causes associated with the sarcopenia such as undernutrition or overnutrition, anorexia, inflammation, hypogonadism, lack of activity, hypovitaminosis D, loss of motor neurons, poor blood flow to the muscle, genetics and insulin resistance.

Figure 1



Source: Giovannini S et al, J Clin Med, 2021

### ASSESSING SARCOPENIA

**SARC-F Questionnaire:** It is a five-part survey, in which self-reporting is done by participants. Components of questionnaire include the following:

**Strength:** Difficulty faced in lifting or carrying 10 lbs. (0 = not facing any difficulty, 1 = some difficulty, and 2 = unable to do it).

**Assistance walking:** Difficulty faced in walking

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across a room and whether use of aids or help is needed to do this (0 = no difficulty, 1= some difficulty, and 2 = unable to do without using help or any aid or unable to do the task at all)

*Rise from a chair:* Difficulty faced when transferring from a chair or bed or if any aids or help was required doing so. (0 = not facing any difficulty, 1= some difficulty, and 2 = unable to do it without help).

*Climb stairs:* Difficulty faced climbing a flight of 10 steps (0 = no difficulty, 1= some, and 2 = a lot or unable to do).

*Falls:* Scores were as following:

2 - Respondents who reported falling four or more times in the past year.

1 - Respondents who reported falling 1–3 times in the past year.

0 – For not having any incidence of falls in the past year.

Sensitivity of this test tool ranges from 25.3 - 33.3 %, which could be a disadvantage as many sarcopenic patients could be missed out in the evaluation.

### Anthropometric measurements

These include, Body Mass Index (BMI), Mid-upper Arm Circumference (MUAC), triceps skin fold (TSF). It also includes derived equations such as mid upper arm muscle circumference (MAMC), where  $MAMC = MUAC - 3.14 \times TSF$

It is considered as low muscle mass if MAMC is less than 21.1 cm in men and 19.2 cm in women.

BMI is a diagnostic measure for malnutrition, but it does not differentiate between muscle mass and fat mass. Hence, it is not a suitable tool to predict muscle mass alone.

### Muscle strength and performance

This can be assessed by the following:

*Hand Grip:* Hand grip strength which is associated with a decreased nutritional status, is

recommended by EWGSOP for assessing muscle mass and diagnosing malnutrition.

As per Table 1, hand grip measurement should not be less than 85% of the expected value, which can be calculated by using a formula incorporating age, sex and BMI measurements.

**Table 1**

### Predictive equations of handgrip strength (kg) for adults aged 18 and over

Prediction equations	
Left hand	$(\text{Age} \times -0.16) + (\text{gender} \times 16.68) + (\text{BMI} \times 0.29) + 26.60$
Right hand	$(\text{Age} \times -0.18) + (\text{gender} \times 16.90) + (\text{BMI} \times 0.23) + 31.33$
Age: in years. Gender: male = 1, female = 0. BMI: body mass index as measured by weight in kg/height in m <sup>2</sup> .	

Source: Ackermans LLGC et al, Clin Nutr ESPEN, 2022

*Gait speed:* It is related to the health of the elderly. Walking requires energy and also use of organ systems such as the nervous, pulmonary, cardiac and circulatory system. A reduction in gait speed can mean reduction in function of these systems. The 4m usual walking speed test is a common gait speed test used to assess physical performance. EWGSOP2 recommends a cut-off point of 0.8 m/s as an indicator of severe sarcopenia.

*Short Physical Performance Battery (SPPB):* Score ranges from 0-12 points

2 or lower: sarcopenia, potential cachexia and mobility disability.

3-9: Possible sarcopenia.

10 or more: No sarcopenia.

Table 2 below describes cut off points as per time taken for completing the particular activity.

Table 2

## Short Physical Performance Battery (SPPB) as a frailty measure

Frailty Criterion	Definition
Usual Gait Speed	<p><i>Gait Speed Test:</i></p> <p>The individual attempts walk a 4-meter course at their usual speed</p> <ul style="list-style-type: none"> <li>▪ 0 points - unable to do the walk</li> <li>▪ 1 point - &gt; 8.70 sec</li> <li>▪ 2 points - 6.21 to 8.70 sec</li> <li>▪ 3 points - 4.82 to 6.20 sec</li> <li>▪ 4 points - &lt; 4.82 sec</li> </ul> <p>Equipment: walking course; stopwatch. Average of 2 attempts.</p>
Repeated Chair Stands	<p><i>Chair Stand Test:</i></p> <p>The individual attempts to rise from a chair five times without using their arms.</p> <ul style="list-style-type: none"> <li>▪ 0 points - if unable to complete 5 chair stands or completes stands in &gt;60 seconds</li> <li>▪ 1 point - chair stand time is 16.70 sec or more</li> <li>▪ 2 points - chair stand time is 13.70 to 16.69 sec or more</li> <li>▪ 3 points - chair stand time is 11.20 to 13.69 sec</li> <li>▪ 4 points - chair stand time is 11.19 sec or less</li> </ul> <p>Equipment: chair; stopwatch.</p>
Standing Balance	<p><i>Three balance tests</i> are performed and scored as follows:</p> <p><i>Side-by-side stand:</i></p> <p>The individual attempts to stand with feet together, side-by-side, for 10 seconds.</p> <ul style="list-style-type: none"> <li>▪ 1 point - held for 10 seconds</li> <li>▪ 0 points - not held for 10 seconds or not attempted</li> </ul> <p><i>Semi-tandem stand:</i></p> <p>The individual attempts to stand with the side of the heel of one foot touching the big toe of the other foot for 10 seconds.</p> <ul style="list-style-type: none"> <li>▪ 1 point - held for 10 seconds</li> <li>▪ 0 points - not held for 10 seconds or not attempted</li> </ul> <p><i>Tandem stand:</i></p> <p>The individual attempts to stand with the heel of one foot in front of and touching the toes of the other foot for about 10 seconds.</p> <ul style="list-style-type: none"> <li>▪ 2 points - held for 10 seconds</li> <li>▪ 1 point - held for 3 to 9.99 seconds</li> <li>▪ 0 points - held for &lt;3 seconds or not attempted</li> </ul> <p>Equipment: stopwatch.</p>

Source: <https://frailtyscience.org/>, 2020

### Combined tools screening

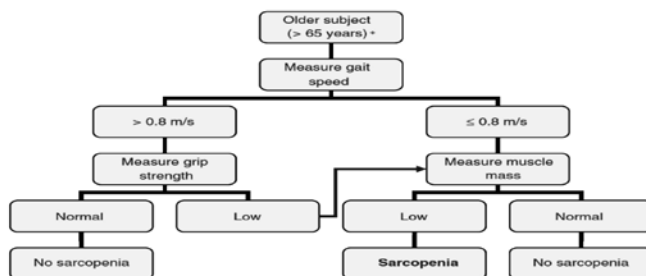
The Ishii screening tool is a model with three variables: age, grip strength and calf circumference.

It has a high sensitivity when compared to the SARC-F (75.5% for women and 84.9% for men), making it more suitable as a screening tool.

EWGGSOP has also come up with an algorithm for sarcopenia, as described in Figure 2 below. Along with the elderly (>65 years of age), the algorithm can also be used for young population at risk.

**Figure 2**

#### EWGSOP algorithm for sarcopenia case finding in older individuals



\* Comorbidity and individual circumstances that may explain each finding must be considered  
 \* This algorithm can also be applied to younger individuals at risk

Source: Ackermans LLGC et al, Clin Nutr ESPEN, 2022

### Computed tomography (CT)

CT imaging is the current gold standard to evaluate of muscle mass in sarcopenic, cachectic and frail patients.

CT images are used for evaluating body composition by differentiating between different tissues.

Limitations of this technique include high costs and limited availability of the equipment.

### DXA (dual energy X-ray absorptiometry)

Dual-energy X-ray absorptiometry (DXA) analysis of body composition includes bone mineral density (BMD), lean mass and fat mass.

Skeletal muscle mass is obtained by calculating lean mass. Appendicular lean mass (ALM) is the sum of lean mass of the arm is also referred to as appendicular skeletal muscle mass (ASMM). ASMM at present is most commonly used to assess sarcopenia.

Limitations of this technique include high costs and limited availability of the equipment.

### Bio-electrical impedance analysis

BIA is a non-invasive, fast and easy-to-use and also a highly used technique to estimate body composition.

The BIA method is validated and useful for determining body composition at a given point, but also includes monitoring the changes over a long period of time.

Advantage is that, BIA is a non-invasive, cheap, easy and fast method to evaluate body composition without any radiation exposure. Limitations arise when there is disproportion between body mass and conductivity which can result in errors.

To conclude, muscle mass can be determined by BIA, dual x-ray absorptiometry (DXA) or anthropometric measurements including MUAC, CC and triceps skinfold thickness. It is correlated to the EWGSOP definition of sarcopenia.

The EWGSOP hence suggests clinical distinction of sarcopenia in the following three stages as shown in Table 3:

*Pre-sarcopenia:* Low muscle mass not affecting either muscle strength or physical performance. This phase can only be identified by techniques that measure muscle mass accurately.

*Sarcopenia:* Low muscle mass and also, low muscle strength or physical performance.

*Severe Sarcopenia:* Meets all of the 3 criteria (low muscle mass, low muscle strength and low physical performance).

Table 3

**Definition of sarcopenia by European Working Group on Sarcopenia in Older People (EWGSOP2)**

Criteria	Test and Cut-off	Diagnosis
Low muscle strength by chair and grip strength	Grip strength (males <27kg) Grip strength (females <27kg) Chair standing >15 s for five rises	Probable sarcopenia
Low muscle quantity or quality	ASM (males) <20kg ASM (females) <20kg ASM / height <sup>2</sup> (males) < 7.0 kg/m <sup>2</sup> ASM / height <sup>2</sup> (females) < 5.5 kg/m <sup>2</sup>	Sarcopenia
Low muscle performance	Gait speed ≤ 0.8 m/s Short physical performance battery (SPPB) ≤ 0.8-point score Timed Up-and-Go Test ≥20s 400 m walk test, noncompletion or ≥ 6 min for completion	Severe Sarcopenia

Source: Giovannini S et al, J Clin Med, 2021

## SARCOPENIA AND OTHER COMORBIDITIES

### Sarcopenia and CVD

In a research study done by Kae Gao et al, amongst middle-aged and older Chinese adults it showed that both possible sarcopenia and established sarcopenia are associated with CVD. Nutritional imbalance, reduced physical activity, hormonal fluctuations are some mechanisms which are common between sarcopenia and CVD. With regards to heart failure, there is reduced muscle mass and strength observed in the patients. Patients with chronic heart failure were also seen to have myofibrillar degeneration and reduced muscle capillary density. Growth hormone levels tend to reduce in patients with heart failure, inhibiting skeletal muscle formation.

Also, in patients with heart failure there is an activation of the ubiquitin protease enzyme system that promotes breakdown of protein. This in turn leads to an imbalance between muscle production and destruction, leading to sarcopenia. Patients with heart failure also suffer

from nausea, adverse drug reactions, urinary problems, poor appetite which is also associated with sarcopenia

Atherosclerosis is a result of cellular inflammation. Inflammatory factors such as Tumor necrosis factor (TNF- $\alpha$ ) and interleukin-6 (IL-6) are catabolic factors, which increase protein catabolism leading to reduced muscle synthesis and increased muscle breakdown. High levels of HsCRP marker enzymes are associated with cardiovascular system, are also shown to reduce muscle strength. Hence, it can be seen that inflammation and oxidative stress are the common causes for sarcopenia and atherosclerosis.

### Insulin Resistance and Sarcopenia

The human skeletal muscle accounts for 40-50% of the lean body mass and is the main target organ where insulin acts.

Insulin resistance (IR) refers to the decreased responsiveness of the target skeletal muscle to utilise insulin and lead to impaired glucose metabolism throughout the body. Insulin resistance can lead to sarcopenia inducing muscle depletion due to decreased protein synthesis

and increased protein catabolism in the skeletal muscle; Increased expression of the FoxO gene family, which causes breakdown of skeletal muscle either directly or by increasing protein degradation and Auto phagocytosis of skeletal muscle cells.

Also, Advanced Glycation End Products (AGE's) are formed due to non-enzymatic reactions between glucose and amino groups in proteins, nucleic acids. AGE is positively associated with insulin resistance and obesity. Increased protein cross-linking within the muscle interferes with the contracting ability of the muscle (occurs due to AGE's) and also increases inflammation and oxidative stress.

### **Sarcopenia and Diabetes**

In a study conducted amongst 65-year-old Korean men with Type 2 Diabetes Mellitus (T2DM), a high HbA1c ( $\geq 8.5\%$ ) was linked with reduced physical performance due to low quality of limb muscles. Glucose and muscle homeostasis is negatively affected in a diabetic individual as T2DM is associated with chronic, low grade systemic inflammation. The inflammatory markers which are seen elevated are Interleukin-6 (IL-6), tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and C-reactive protein (CRP) which in turn lead to adiposity and insulin resistance.

In obesity, IMAT is an ectopic fat depot associated with poor metabolic and muscle health outcomes. Obese and T2DM individuals have greater amounts of thigh IMAT compared to non-obese and lean individuals and IMAT is associated with insulin sensitivity, as per a cross-sectional analysis of the Look AHEAD study, overweight and obese men and women with T2DM had greater IMAT at higher levels of total-body adiposity when compared with non-diabetic overweight and obese controls. Also, IMAT consists of non-contractile tissue like fat which infiltrates into the skeletal muscle fibres affecting elastic properties which can further lead to sarcopenia.

## **PREVENTION AND MANAGEMENT OF SARCOPENIA**

### **Nutrition**

Dietary protein provide amino acids that are needed for the synthesis of muscle protein. In addition, it is possible that protein intake should be combined with exercise to prevent sarcopenia. Association between sarcopenia and protein is such that lower protein intakes are related to a loss of lean mass and also to a reduced grip strength. Protein intake and physical activity are the main anabolic stimuli for muscle protein synthesis. Aging causes loss of various anabolic signals to muscle that are present in young people. Such “anabolic resistance” is associated with the development of sarcopenia

Recommendations for optimal dietary protein intake daily is 1.0 - 1.2 g/kg body weight with an optimal repartition over each daily meal to prevent sarcopenia. A dietary plan should include 25 to 30 g of high-quality protein per day as dietary protein recommendations for the prevention of sarcopenia.

The type of protein is also crucial for muscle mass retention. Whey protein, which is quickly digested and absorbed, promotes development of muscle mass better than casein, which is slowly digested and absorbed. Leucine, which is present at high concentrations in whey protein, is known to play a key role in augmenting the muscle protein synthetic response to food intake. It has beneficial effects on the increase in lean body mass among elderly individuals with sarcopenia.

As per research study conducted by Devries MC et al, 65–75-year aged women who consumed a high protein diet containing more than 4g of leucine had a greater increase in myofibrillar protein synthesis than those who consumed an isocaloric mixed protein beverage containing 1.3g of leucine. Dietary protein derived from animal-based sources has more anabolic effect than that derived from plant-based source. This can be due to difference in protein type and content, especially the relatively low leucine content in plant-derived proteins.

***Nutritional interventions for different life stages***

Sarcopenia can occur earlier in life along with a variety of health conditions. Both genetic and environmental factors during all life stages can lead to a decline of muscle mass and strength which is commonly seen with aging. Nutrition, thus is an important determinant of health in all age groups, beginning from pregnancy, infancy, childhood till elderly.

During pregnancy, micronutrient requirements increase more than energy requirements as there is a higher requirement for foetal development. The WHO recommends the supplementation of both iron (30–60 mg/day) and folic acid (400 mcg/day) during pregnancy for the prevention of maternal anemia, preterm birth and low birth weight. Folate supplementation is important for neurodevelopment of foetus. Vitamin D deficiency during pregnancy has been linked to osteopenia in new-borns and reduced bone density in childhood. The recommended intake for female and male adolescents for calcium is 1,300 mg/day and 600 IU/day for vitamin D.

Nutrition recommendations for infants and young children should aim at achieving weight as per the standards. There were differences observed in body composition between breastfed (BF) infants and formula-fed (FF) infants. The WHO recommends exclusive breastfeeding till the infant completes 6 months of age. A research study by Robinson et al, showed an association between exclusive breastfeeding and higher grip strength in older life. It showed that exclusive breastfeeding resulted in an increased fat mass (subcutaneous fat) at 6 months compared to those who were not exclusively BF. It could be assumed that the higher fat mass in BF infants during the first 6 months can be a protective and useful factor during the periods of weaning.

A research study by Sabia et al. showed that an unhealthy lifestyle during teenage and adulthood (ie., less consumption of fruit and vegetables, physical inactivity, smoking and alcohol consumption) is related to slower gait speed almost 17 years later. Another study by Stenholm et al, documented that the excess body weight in

adulthood leads to a decline in muscle strength in old age.

**Exercise**

Resistance and endurance training exercises have an impact on sarcopenia. Strength training also improves free testosterone levels and resistance training improves growth hormone levels for both men and women. A multicomponent exercise program including moderate intensity resistance training and balance exercises has been shown to increase muscle mass and walking speed in sarcopenic elderly women.

Recommendation for sarcopenic older people suggests an intervention program including both endurance and resistance exercises. Endurance can consist of 30–60 min/day of moderate-intensity exercise for at least 5 days/ week to 20–30 min/day of high-intensity exercise for at least 3 days/week, with no more than two consecutive rest days. Resistance training should be performed two or more alternate days per week.

Different physical exercise modalities induce different physiologic adaptations and target different components of frailty. A multicomponent exercise program which includes endurance, resistance, coordination, balance and flexibility exercises has been currently recommended for pre-frail and frail elders to improve muscular strength, gait speed, balance and physical performance.

Taking advantage of musculoskeletal peak through adequate nutrition and physical activity at a young age and maintain it through adulthood. This is a good strategy to counteract the rate of its decline observed in older life.

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# OBESITY AND ITS COMPLICATIONS

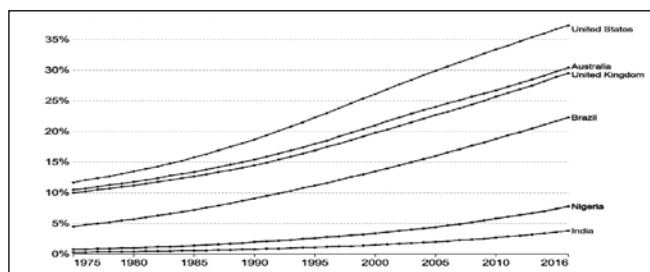
Apurba Krishna Chowdhury\*

## Introduction and Problem Statement

Obesity is a growing global health concern in the 21st century, affecting millions of people worldwide. According to the World Health Organization (WHO) estimates, the number of cases has increased threefold since 1975 as shown in Figure 1 below.

**Figure 1**

**Share of adults that are obese, 1975 to 2016**



Source: WHO, Global Health Observatory, 2022

Recent data states that in 2016 more than 1.9 billion adults, 18 years and older were overweight. Of these, over 650 million were obese. This is equivalent to 39% of adults aged 18 years and over being overweight and 13% were obese. Thirty-nine million children under the age of five were found overweight or obese in 2020 and over 340 million children and adolescents aged 5-19 were found overweight or obese in 2016.

In the past, obesity was an issue to be seen mainly in high-income nations. It is now emerging in low and middle-income nations across all socioeconomic levels and geographic areas.

## Obesity and BMI

Body mass index (BMI), which is determined from an individual's body weight and height is the main metric used to determine obesity. A BMI score of 30 or above is considered obese, which is strongly associated with numerous diseases and disorders including hyperlipidemia, hypertension, diabetes mellitus, coronary heart disease, atherosclerosis, cerebrovascular disease and colorectal cancer and an overall high mortality rate.

Although, BMI is the most widely used measure of obesity, it has specific fundamental flaws. Broadly, BMI is used to determine whether a person is overweight or obese but it does not actually measure body fat. Ethnicity, age, gender and muscle mass are other variables that can alter the BMI scoring. A person having a high muscle mass may occasionally have a high BMI and can still be classified healthy. To determine a person's general health status, other evaluations such as waist circumference and body composition analysis may be required.

The growing prevalence of obesity is also a major contributor to non-communicable chronic diseases (NCDs) including 44% of diabetes, 23% of ischemic heart disease and 7-41% of certain cancers. This is due to the high-energy value of modern diets, which are often rich in fatty-foods and refined carbohydrates. Figure 2 below shows different BMI and obesity classification as per WHO.

\* From Jhajjar Power LTD, Jhajjar, Haryana.  
Email id: drake2010@gmail.com

**Figure 2****BMI and Obesity classification as per WHO**

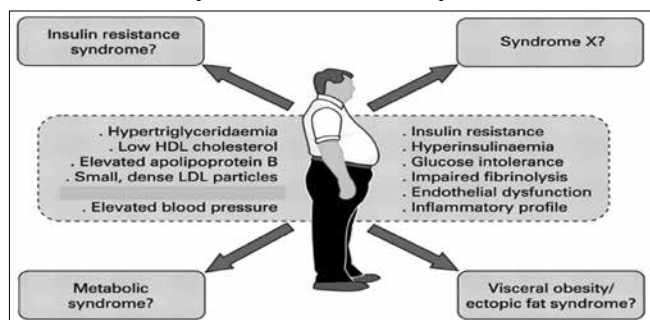
Status	WHO criteria BMI cut-off	"Asian criteria" BMI cut-off
Underweight	<18.5	<18.5
Normal range	18.5 – 24.9	18.5 – 22.9
Overweight	25.0 – 29.9	23.0 – 24.9
Pre-Obese		25-29.9
Obese	>30	>30
Obese (Class I)	30.0 – 40	30-40
Obese (Class II)	40.1 – 50	40.1-50
Obese (Class III)	>50	>50

Source: WHO, Global Health Observatory, 2022

In comparison to diets high in carbohydrate and proteins, consuming a high-fat diet has a lesser thermogenic effect which lowers energy expenditure. High-fat diets that also contain a lot of refined carbohydrates frequently lead to weight gain and visceral adiposity which encourages the onset of obesity-related diseases such as diabetes and cardiovascular disease. Increased dietary lipid consumption also contributes to a rise in total caloric intake.

**Obesity and Metabolic Syndrome**

The number of patients who have metabolic issues related to obesity is escalating with the incidence of obesity. As per Figure 3, metabolic syndrome is linked to a number of health issues, such as cardiovascular disease, Type 2 diabetes and other chronic illnesses. It is triggered by a number of factors such as insulin resistance, high cholesterol levels and high blood pressure.

**Figure 3****Obesity and metabolic syndrome**

Source: Fox KA, Després J; Heart; 2009

Insulin resistance is thought to be the underlying cause of metabolic syndrome and it can result in disruptions of metabolism. A multifaceted strategy is necessary for the effective management of metabolic syndrome including dietary adjustments, treatment of underlying medical disorders and occasionally the use of drugs and surgical procedures.

Globally, childhood obesity has recently become a serious issue. Estimates indicate that 10% of school-age children (ages 5 to 17) are currently considered obese. In addition to having a major multi-organ impact, childhood obesity can cause insulin resistance, dysglycemia, fatty liver disease, hypertension and dyslipidaemia.

**Cause and Pathophysiology**

Obesity is caused by a failure to balance caloric intake with energy utilization. Scientific studies point towards a multifactorial origin such as high-caloric diets, food addiction or depression. There are numerous mechanisms leading to the complications of obesity. Two of the more prominent are inflammation and the gut microbiome.

**Inflammation**

Obesity is correlated with a state of chronic low-level inflammation as a result of the metabolic cells responding to excess nutrients in the body. This inflammation has been linked to the emergence of immunometabolic disorders and affects a number of organs including the liver, brain, pancreas and adipose tissue. The development of the metabolic syndrome and other connected health issues, such as cardiovascular disease and Type 2 diabetes is believed to be influenced by this chronic inflammatory condition. A multifaceted strategy that addresses both the root causes and symptoms of this condition is necessary for the effective therapy of obesity and metabolic syndrome.

Adipose tissue contains a substantial amount of immune cells and obesity related activation of the inflammatory response in these cells which affects their number and function. It results in inflammation and an immunologically

dysregulated state. This is considered to be the primary mechanism connecting obesity to its numerous metabolic and vascular problems. The deregulation of the immune system associated with obesity is thought to have a significant role in the development of the metabolic syndrome.

Methods to target the underlying mechanism is necessary for effective management. It is likely to entail a change in diet and exercise habits as well as a prescription of immunosuppressive medications and lifestyle adjustments to minimise inflammation.

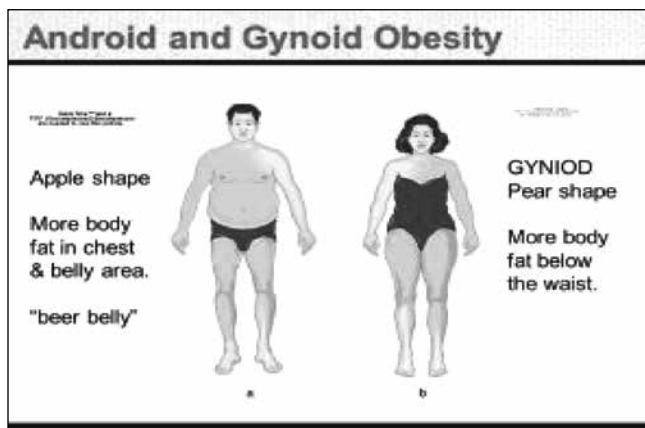
### Gut microbiome

In recent years, there has been an upsurge in interest in the role of the microbiome in the pathogenesis of obesity. Through a variety of signalling mechanisms, gut microorganisms can affect host metabolism and have an impact on insulin resistance, fat deposition and inflammation. According to research, the microbiome undergoes major alterations as a result of obesity. Improved insulin sensitivity and microbial diversity have been seen in experiments where a lean person's microbiota was transplanted into an obese individual. These findings emphasise the role of the microbiome in the emergence of difficulties associated with obesity and imply that targeting the microbiome may be a potential approach in the management and prevention of these disorders. To completely comprehend the intricate connection between the microbiota and health issues associated to obesity, further studies are necessary.

### Body Fat Distribution and Health Risk

Body fat distribution is considered a strong metabolic and cardiovascular risk factor. The underlying mechanisms that determine inter-individual differences in body fat distribution are complex and still a matter of research. Although evidence indicates that sex hormones, glucocorticoids, genetic make-up and epigenetic mechanisms are the main contributing factors which influence where the excessive calories would be stored.

**Figure 4**  
**Android and Gynoid Obesity**



Source: Min, Y., Ma, X., Sankaran, K. et al. *Nat Commun*, 2019

As seen in Figure 4, fat distribution is of two types: some people may be apple-shaped (android) and carry most of their excess body fat around the stomach. Others may be pear-shaped (gynoid) and carry most of their excess body fat around the hips, buttocks and thighs.

A higher risk of cardiovascular illnesses, metabolic disorders and other health issues is linked to central obesity. This is due to the metabolic activity of the abdomen fat which contributes to insulin resistance, inflammation and other conditions that can be harmful to health. Waist circumference assessment offers a quick and affordable technique to evaluate central obesity and results in health hazards.

Waist circumference plays a significant role in predicting adult risk for obesity and cardiovascular disease. A waist circumference of over 40 inches ( $\geq 90$  cm) for males and 35 inches ( $\geq 80$  cm) for females is regarded as a risk factor for the classification of metabolic syndrome according to the NCEP ATP III definition.

### Health Effects of Obesity

Obesity can result in a number of issues such as heart disease, stroke, Type 2 diabetes, sleep apnea and several malignancies. The development of these problems can result from changes in the levels of hormones and other substances in the body brought on by the increasing amount of fat that is deposited. Too

much body fat may cause inflammation and insulin resistance both of which hasten the onset of specific diseases. Obesity may also shorten life-expectancy and raise the risk of high blood pressure and cardiovascular disease. The major disorders resulting from obesity have been illustrated below in Figure 5.

**Figure 5**

**Obesity resulting in major disorders**



Source: Kyrrou I, Randeva HS, Tsigos C, et al. *Endotext*: 2018

**OBESITY MAJOR HEALTH COMPLICATIONS**

**Diabetes**

Diabetes mellitus (DM) is a chronic disorder that affects the metabolism of carbohydrates, proteins and fats. There are two main subcategories of DM: Type 1 and Type 2 diabetes. Type 2 diabetes is the result of insulin resistance and/or low insulin production by pancreatic  $\beta$ -cells. The risk of developing Type 2 diabetes is seven times higher for an obese person and three times higher for an overweight individual compared to a person with normal weight. Research has proven a connection between body weight and insulin resistance. The ineffective action of insulin on the organ-systems is known as insulin resistance. As a result, there is a higher chance of developing Type 2 diabetes and elevated blood glucose levels.

When normal glucose tolerance worsens and fasting hyperglycemia emerges as a result of the increased hepatic gluconeogenesis, pre-diabetes progresses to diabetes. Furthermore, obesity also leads to an increase comorbidities associated with Type 2 diabetes such as high blood pressure and abnormal cholesterol levels. Maintaining a healthy weight, eating a balanced diet and regular

physical activity is crucial in preventing or managing Type 2 diabetes.

**Cardio-vascular diseases**

Obesity is associated with an increased risk of heart diseases like hypertension, coronary artery disease, left ventricular hypertrophy, left atrial enlargement and congestive heart failure (CHF).

Fat deposits in the arteries cause inflammation and increase the risk of plaque formation, leading to narrowed arteries and reduced blood flow to the heart. This in turn, can increase the risk of angina or heart attack.

**Hypertension**

Hypertension is a significant risk factor for cardiovascular disease and is correlated with obesity. As the body needs to supply more oxygen and nutrients to the increased amount of adipose tissue, the heart must pump more blood via the arteries which elevates blood pressure. According to studies, Body Mass Index (BMI) and both systolic and diastolic blood pressure have a linear connection. The Framingham Heart Study shows that excess weight is the main contributor to hypertension in 78% of men and 65% of women. Losing weight and keeping the BMI 25 kg/m<sup>2</sup> are two methods of lowering risk of developing hypertension. Blood pressure of obese people classified as normotensive is higher than it would be at a lower weight. Weight loss results in a reduction in blood pressure.

**Cerebrovascular and Neurological diseases**

Obesity is linked to an increased risk of stroke in both men and women. Vascular risk factors such as hypertension, dyslipidemia and diabetes are all associated with increased risk of dementia and Alzheimer's disease. Although, a raised BMI contributes to each of these factors, the independent relationship between obesity and dementia is a little more complex. A review article brought out an independent association between high BMI and risk of dementia.

**Immune system**

An immune system that might be dysregulated due to obesity can be evident as early as in

childhood. It is linked to an increased risk of contracting infections of many diverse kinds including skin, nosocomial, urinary tract and at the surgical site. Additionally, obese people do not respond as well to vaccinations and have been found to have had a higher mortality risk seen during the H1N1 influenza pandemic. It has been hypothesised that obesity and autoimmune disease have increased at the same rate in the past few decades. Obesity is strongly linked to an increased risk of multiple sclerosis, psoriasis, psoriatic arthritis and rheumatoid arthritis.

### Osteoarthritis

As per the Centre for Disease Control, osteoarthritis is the most generic form of arthritis. Some people call it degenerative joint disease or 'wear and tear arthritis'. Being overweight or obese can increase the risk of developing osteoarthritis and worsen symptoms. This is because the additional weight of the body places stress on the joints, particularly the hips and knees causing them to wear out faster. Also, obese individuals may have a tougher time recovering from joint replacement surgery and are placed at a higher risk of its complications.

## RESPIRATORY DISEASES

### Sleep Apnoea

Obesity is a contributing factor towards exacerbating obstructive sleep apnea which can result in irregular heartbeats, high blood pressure and decreased oxygen levels as well as other cardiovascular complications.

### Asthma

The prevalence of asthma is increased in overweight subjects and obese people and accounts for 75% of the emergency department visits due to asthma.

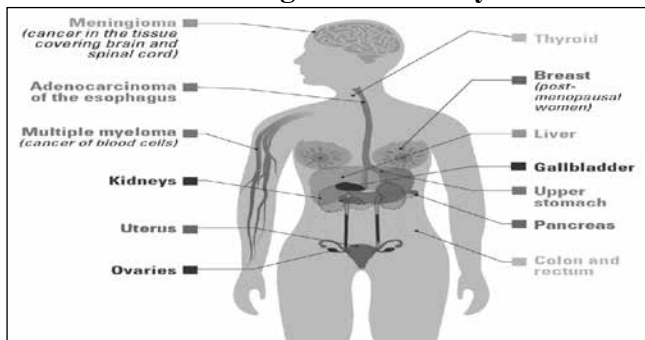
### Cancers

As per Figure 6, obesity can increase the risk of several types of cancer including the colon, uterus, breast, gallbladder in women and colon cancer in men. Studies suggest that obesity-associated inflammation can contribute to the progression of cancer in a tissue-specific

manner due to interplay between different signalling events.

**Figure 6**

### Thirteen cancers are associated with overweight and obesity



Source: Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, 2022

### Psychological Effects

Adults who are obese are frequently subjected to stigma and societal condemnation, which may have a detrimental effect on a person's physical and mental health. Poor self-esteem, depression and body image dissatisfaction may result from prejudices and discriminatory attitudes towards overweight and obese people. This may also encourage unhealthy habits and lessen the motivation to lose weight.

Furthermore, weight prejudices in medical settings might lead to less effective care and treatment. To encourage a good body image and support people in their health and well-being, it is critical to identify and address weight bias in society and in the healthcare field. It has been observed that depression is more frequently seen in young and female obese individuals. Weight loss is associated with an improved mood. Obese or overweight adolescents are more likely to engage in a risk behaviour pattern such as substance abuse, sexual behaviour and violence. In children, obesity may lead to negative effects on mental health such as low self-esteem, body dissatisfaction and depression. This may impact academic performance. It is crucial to address childhood obesity and promote healthy lifestyle habits to prevent its deleterious impact on physical and mental health.

## GASTROINTESTINAL EFFECTS

### GERD-related complications

Obesity has a strong correlation with GERD symptoms like erosive esophagitis and oesophageal adenocarcinoma. The risk increases progressively with increasing weight, hepatobiliary disease and non-alcoholic fatty liver disease (NAFLD). NAFLD is increasing in prevalence in developed countries and is one of the most common causes of cryptogenic cirrhosis. It is closely related to the metabolic syndrome, of which obesity is a key element. Simple steatosis, steatohepatitis and cirrhosis are all on the NAFLD disease spectrum, along with all of the accompanying consequences. A recent large study revealed that achieving a 5% weight reduction through lifestyle changes was associated with an improvement and even normalisation of liver enzymes in people with abnormal liver function tests. Patients with NAFLD, especially those with steatosis, respond favourably to weight loss. Interestingly, the waist-hip ratio is an independent predictor of advanced fibrosis at liver biopsy.

### Gynaecological and Obstetric complications

During pregnancy, obesity is associated with an increased risk of complications like gestational diabetes, pre-eclampsia, macrosomia, shoulder dystocia, higher caesarean section rates and infections. Maternal obesity may also be an independent risk factor for neural tube defects and fetal mortality. Polycystic ovarian syndrome (PCOS) is the most prevalent endocrine condition in women of reproductive age. It is characterised by a chronic anovulatory cycles, polycystic ovaries and hyperandrogenism. Insulin resistance plays a critical role in its pathophysiology and is associated with obesity. With weight loss, people suffering from PCOS experience favourable results and recover.

### Fertility

In men, obesity is associated with a reduced sperm count and increased rates of erectile dysfunction. In women, it also leads to reduced fertility, poorer outcomes after fertility treatment

and more pregnancy loss. Polycystic Ovarian Syndrome (PCOS) is the primary cause of female infertility, with the risk increasing in proportion with the obesity.

### Surgical and Anaesthetic complications

When evaluating the relationship between pulmonary changes and obesity, data seems inconsistent. Several studies reported no difference in the rate of pulmonary problems as per BMI scores. Failure to distinguish between obesity and other concomitant illnesses may be one reason for the difficulties in diagnosing it.

### Chronic Kidney Disease

The obesity epidemic has been associated with an increase in the prevalence of chronic kidney disease. It is unclear whether obesity is a risk factor which is independent of diabetes and hypertension. Among NHANES III participants, the risk of either incident end-stage renal disease or kidney-related death was independently associated with a BMI of  $>35 \text{ kg/m}^2$ , with a relative risk of 2.3 among those who were morbidly obese compared with normal weight persons. The risk did not increase for those classified as overweight or obese. "In the Framingham study, patients who were obese at baseline were more likely to have a decrease in estimated glomerular filtration rate (GFR). Through multivariate analysis, increased baseline BMI was significantly associated with progression to chronic kidney disease, with an odds ratio of 1.23 for each standard deviation. Remarkably, even minor weight loss may preserve renal function. In a study of 24 Type 1 and Type 2 diabetics with nephropathy, a reduction in BMI from 33 to 26  $\text{kg/m}^2$  was associated with a decrease in proteinuria from 1.3 to 0.623g per 24 h and an improvement in GFR from 66 to 81  $\text{ml/min/1.73m}^2$ .

### Conclusion

Obesity is a growing global health concern that affects individuals in all levels of society. In the recent decades, the prevalence of obesity has drastically expanded worldwide. This implies a significant and escalating financial and health

burden. The effect of this is evident as people are becoming morbidly obese at a younger age. Although its causes are poorly understood, it is thought to be a complex interplay of genetic, metabolic, behavioural factors with specific environmental variables being a contributing factor.

Additionally, genetic factors do play a role, as a small number may have a genetic predisposition to insulin resistance and metabolic syndrome. It is important to address both these factors in the prevention and management of obesity.

The high caloric value of modern diets combined with the increased consumption of refined-carbohydrates may significantly leads to obesity related conditions. Strategies aimed at promoting healthier diets and lifestyle choices need to be developed. Urgent action is required to deal with the obesity crisis so it does not cripple the economy.

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# CARE OF ELDERLY WITH DIABETES

## SPECIAL CONSIDERATIONS, CHALLENGES, EDUCATION

Sudhir Kumar\*

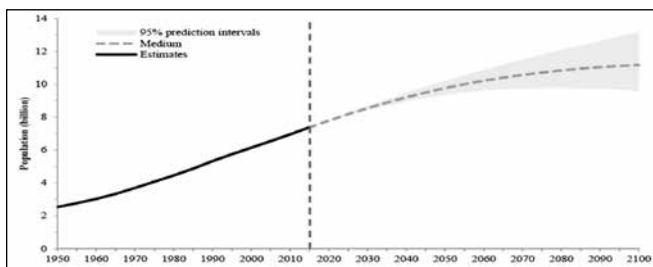
### Diabetes in the Elderly is an entirely different mode

Ageing is a natural process rather than a phenomena or occurrence that affects all things on Earth. Despite its universality, ageing is often the most neglected issue by all who view older individuals as disempowered and non-resourceful people. In both the fields of economics and sociology, elderly are not categorized as a class or status group. Furthermore, old age is considered a distinct life stage, separated chronologically into the last part of human time with old age itself being clearly identifiable and demarcated, as a sharp third-stage division of the life cycle.

The last century saw ageing as a global concern and today it is a challenge worldwide. Population ageing is an inevitable and irreversible demographic reality. As per Figure 1, there is a rapid increase in the population in both developing and developed countries. It is felt to a great extent in less developed countries as it creates a greater demand on health care systems. The developed countries also are experiencing an increasing number in the ageing population, hence it has become increasingly important to provide special care for the elderly.

Figure 1

**Population of the world: estimates 1950-2015 and medium variant projection with 95 percent prediction intervals, 2015-2100**

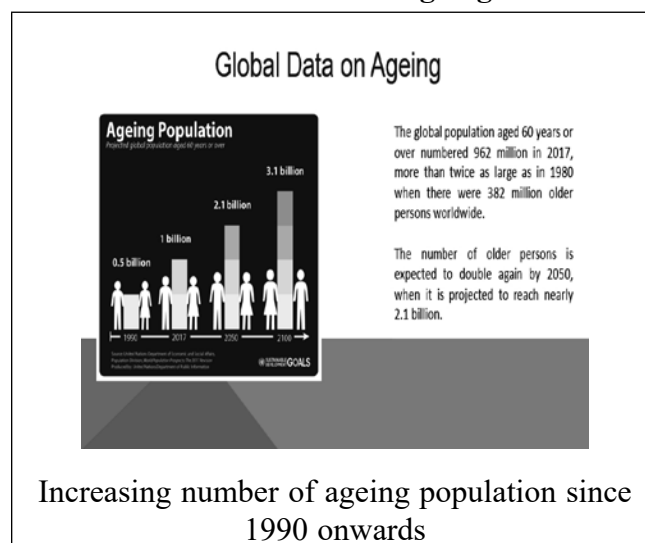


Source: United Nations, Department of Economic and Social Affairs, 2017

As per Figure 2, it was projected that by the year 2020, the population of individuals aged  $\geq 60$  years would exceed the number of children  $<5$  years of age. Additionally, it is estimated that by 2050, the majority of older individuals (up to 80%) will reside in low- and middle-income countries. As per Figure 3 below, elder patients with diabetes are commonly increasing in clinical practice due to the aging.

Figure 2

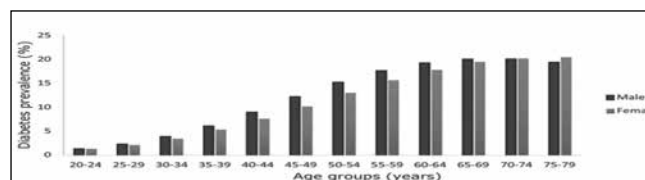
**Global Data on Ageing**



Source: Saeedi et al, 2011 Diabetes Research in Clinical Practice, 2019

Figure 3

**Diabetes prevalence by age and sex in 2019**



Source: American Diabetes Association, 2021

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### Challenges faced in management of the Elderly

When patients have no additional comorbidities, no signs of frailty, have a good functional reserve and no vascular problems, then managing diabetes in older adults can be rather simple and straightforward.

Diabetes in elderly individuals can be insidious, which ultimately delays diagnosis due to its atypical presentation. The classic diabetic symptoms like polyuria and polydipsia may not be present in elderly persons. Dehydration, disorientation, incontinence and consequences including neuropathy or nephropathy may instead manifest as symptoms of diabetes.

Also, as the population ages, diabetes, its comorbidities and cognitive impairment occur more commonly together. This makes care tougher leading to significant consequences. The treatment of an elderly person with diabetes, is further significantly impacted by the emergence of cognitive impairment. It is possible that diabetes and dementia are linked pathologically. Those with Alzheimer's disease, which can also be considered as Type 3 diabetes due to increased cerebral insulin resistance being one of the central features causing this metabolic-cognitive syndrome of the brain.

In the same way, any limitation in carrying out routine activities of daily living such as eating, walking, bathing, dressing and grooming as well as Instrumental Activities of Daily Living (IADLs) such as housework, driving, cooking and shopping is impacted and there can be serious consequences in their health.

Improper glucose management, with or without medications is linked to an increased risk of hypoglycemia in elderly patients. Intensive glycemic control poses a particularly high risk of hypoglycemic episodes in older adults. It may lead to severe consequences such as falls, traumatic fractures, worsening of co-existing medical conditions thus leading to adverse cardiovascular events and impaired cognition and function.

Additionally, hyperglycemia may have unfavorable physiological effects such as osmotic

diuresis leading to dehydration, impaired vision and decreased cognitive function. Whereas, on the other hand, with stricter glycemic control, the risk of hypoglycemia may increase.

Furthermore, the aging process affects all organs in the body including the kidneys. Renal function declines gradually with age with changes starting as early as in the third decade of life and progressing gradually. This is regardless of the presence or absence of concomitant comorbidities which otherwise accelerate the rate and severity of renal function decline. Functional age-related changes in renal function is characterized by a steady reduction in glomerular filtration rate (GFR). Appropriate management of diabetes in older adults should take into account these age-related changes and comorbidities that may impact kidney function adversely.

Special consideration is required in elderly patients having a higher likelihood of mortality due to cardiovascular events as compared to developing end-stage renal disease (ESRD). Numerous risk factors including medication and the associated medical condition increases the risk of hypoglycemia in this vulnerable group.

Hypoglycemia in elderly may increase the risk of falls and fall-related fractures. This phenomenon is recognized as the most prevalent and dreadful "geriatric giant," necessitating education of elderly patients on maintaining modest blood glucose levels to avoid such serious episodes. It must be explicitly explained to the patient through mutual discussion. Furthermore, all issues pertaining to safety and monitoring of the therapy for better glycemic control, including glycemic variability measures must be conveyed clearly to patients with knowledge of the timely action to be implemented to avert such accidents.

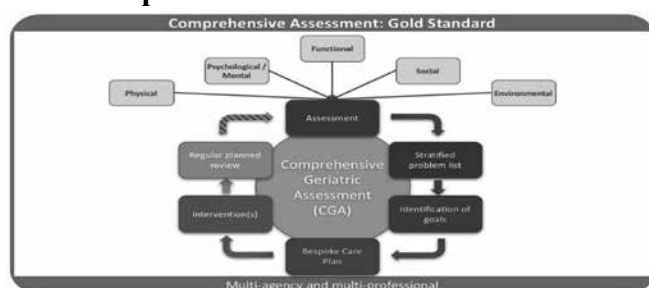
Diabetes mellitus is a chronic condition that requires good cognitive function to execute self-care tasks, achieve good glycemic control and avoid acute and long-term diabetes-related complications. However, memory and executive function impairments associated with dementia can lead to noncompliance with prescribed regimens, erratic eating patterns and increased risk of weight loss and malnutrition.

### Assessment and Evaluation of the Elderly

A comprehensive, regular clinical and laboratory evaluations are recommended for older adults with diabetes which include metabolic control and screening for complications. Several assessment tools may be used to evaluate the current status of elderly diabetes patients, with the Standardized Assessment of Elderly People (STEP) serving as an appropriate starting point. This tool can identify relevant differences in self-reported health problems between persons with diabetes and without diabetes as per Figure 4.

**Figure 4**

#### Comprehensive Geriatric Assessment



Source: Ellis G et al, Cochrane Database Syst Rev.2017

One example of a self-management application designed specifically for older adults with Type 2 diabetes mellitus is ASSISTwell. Implementation of self-assessment digital tools, such as the INSPIRE ICOPE-CARE (ICOPE MONITOR) and the ICOPEBOT conversational robot, can be used to manage various life situations and improve, maintain or slow any decline in intrinsic capacity. This can be done by assessing and longitudinally monitoring six core domains of intrinsic capacity: locomotion, vitality, vision, hearing, cognition and psychology. This differs from other approaches by being framed as a dynamic continuum with monitoring the second half of a person's life course to provide insight into the efficacy and effectiveness of the clinical actions.

Comprehensive Geriatric Assessment (CGA) includes eight domains of assessment such as comprehensive older age assessment (COAA), geriatric evaluation management and treatment (GEMT), Electronic Frailty Index (EFI), Berg Balance Scale, the activities of daily living (ADL), instrumental activities of daily

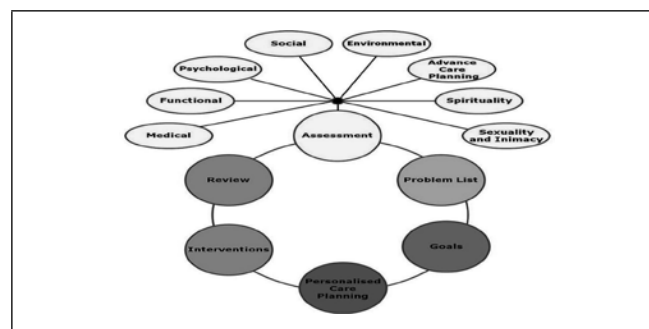
living (IADL), Katz Index of Independence in Activities of Daily Living, Lawton Instrumental Activities of Daily Living Scale, Barthel index for activities of daily living (ADL) and the Charlson Comorbidity Index (CCI). Also strength, assistance with walking, rising from chair, climbing stairs and Falls (SARC-F), 25-item Resilience Scale (RS), HALFT scale, 5-level EQ-5D (EQ-5D-5L), EQ visual analog scale (EQ-VAS), Pittsburgh Fatigability Scale and the Life-H Daily Habit assessment test are amongst those used.

Other established evidence-based measures that are useful in this population include intrinsic capacity (IC) correlated with walking speed, resilience score and MMSE score and negatively correlated with frailty, SARC-F score, IADL score and the GDS score for physical and mental fatigue. The IC score was not associated with body composition variables such as fat-free mass, body fat percentage or visceral fat area. Higher IC was associated with better quality of life. The area under the curve of the receiver operating characteristic (AUC-ROC) for the ICOPE screening tool versus Fried phenotype, FRAIL, ADL disability, IADL disability can also be considered as useful tools of measurements.

The Geriatric Nutritional Risk Index (GNRI) is used to assess and evaluate nutritional status and desired weight in geriatric patients as a simple tool, along with WHO BMI and Edmonton Obesity Scoring Scale (EOSS). Figure 5 shows the process of CGA.

**Figure 5**

#### The processes of Comprehensive Geriatric Assessment



Source: Ellis G et al, Cochrane Database Syst Rev. 2017

Education

The co-occurrence of diabetes and frailty is increasingly common in older adults. Frailty is linked to a diminished quality of life, falls, disability, hospitalization, a range of other negative outcomes and also mortality, making it essential to consider the unique needs of frail elderly individuals on a customized basis with special attention to their physical and mental health status.

In contemporary times, educators should be familiar with gerontechnology gadgets, internet of things, wearable-technology, remote health monitoring, AGP and CGM with alarms in case the SMBG measurement is not feasible. This is to avoid serious states of extreme glycemic dysregulations. Usually, wearable medical alert devices, habit formation in wearable trackers and AI, patient decision support systems with clinical decision support systems, app-based (Android, iOS, Windows, Ubuntu etc.) different mobile and desk-computing based multitasking systems, brain-computer interface devices for perception, learning and motor control devices assist patients with dementia.

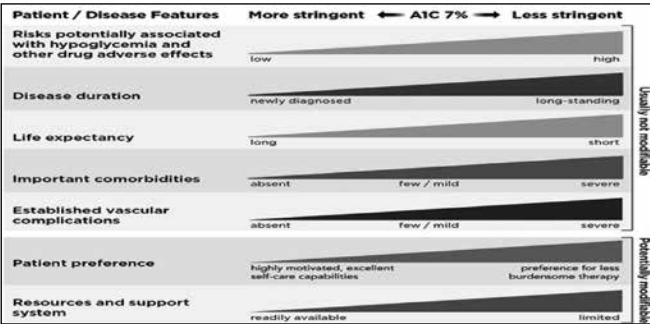
The 8 A’s of the geriatric diet prescription is Accuracy, Appropriateness, Accessible, Acceptability, Attractiveness, Achievability, Affordability, Absorbability as factors to be kept in mind while imparting education.

The individualization of the glycemic target suggested by the American Diabetes Association (ADA) guidelines for elderly individuals with diabetes should be individualized based on their overall health status, life expectancy and personal preferences. For instance, for the healthy older adults with a life expectancy of 10 years or more, the recommended glycemic targets are: HbA1c less than 7.5%, fasting plasma glucose (FPG) of 90-130 mg/dL and postprandial glucose (PPG) of less than 180 mg/dL.

As per Figure 6, for older adults with complex or comorbid conditions or a limited life expectancy, glycemic targets should be based on a shared decision-making process between the patient and healthcare provider. In this case,

the following factors should be considered: risk of hypoglycemia, presence of microvascular and macrovascular complications, life expectancy and comorbid conditions, functional status and cognitive function, patient preferences and goals of care.

Figure 6  
Approach to individualization of glycemic targets



Source: American Diabetes Association, 2022

It is important to balance the benefits of glycemic control with the potential risks of hypoglycemia and its consequences to optimize their quality of life. Correction of modifiable risk factors should be given utmost priority for example, prolonged fasting, erratic eating and dietary errors, alcohol intake, smoking cessation etc. Patient heterogeneity must be taken into consideration by clinicians as well as diabetes educators for older adults with diabetes while setting and prioritizing treatment goals. There is a need of glucose evaluation as frequently as needed, periodic assessment of geriatric co-morbidities and diabetes complications. The diabetic educator must be concerned about talking openly with relatives keeping it patient-centric to develop a healthy eating plan and monitoring of blood glucose levels to ensure the recommended target range is achieved.

Therapy related to any small muscle (fine motor) issues is necessary through planning of rehabilitative exercises that match the level of activity so that it can be worked into the patient’s daily routines. The individual should be well informed about the benefits of exercise to be motivated to be more active. The elderly with diabetes and their caregiver should receive

adequate diabetes education on risk factors for foot ulcers, amputation and prevention strategies.

The need of prescribing education in homecare or ambulatory settings must be done while also educating the family-members with the help of concerned physicians and diabetes educators. Education on the behavioral and symptoms management and non-drug therapies and non-pharmacological measures should also need to be imparted. Patients should also be educated to keep a daily log of their activities, on foot care, travelling and other issues of special consideration.

### Conclusion

When it comes to elderly persons with diabetes, the diabetes care should be individualized, taking into account a range of factors such as comorbidities, medications, cognitive abilities, home-care situation and life expectancy. While optimum glycemic control is important, it may be less of a priority in frail elderly patients who require a focus on avoiding malnutrition and hypoglycemia and achieving the best possible quality of life.

Personalized multifaceted intervention strategies that utilize technology solutions may assist to ensure medication adherence. In fact, artificial intelligence under supervision may be used to address various problems in diabetes care, including clinical diagnosis, monitoring, developing treatment plans and designing drugs.

For elderly with Type 2 diabetes mellitus, a comprehensive evaluation of medical comorbidities and age-related conditions such as physical or cognitive impairment, financial or personal issues is crucial. Glycemic targets may need to be adjusted in older patients to reduce the risk of hypoglycemia and healthcare professionals must educate patients and their caregivers on managing cognitive dysfunction, hypoglycemic unawareness and medical comorbidities. A goal-based treatment algorithm

can be followed when stepping up medical therapy persons to ensure correct outcomes for elderly persons with diabetes.

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## QUESTION AND ANSWERS

**Q: Why is 3 am (2-4 am) blood sugar monitoring advised?**

**A:** People with diabetes, particularly those with Type 1 diabetes, get up between 2 to 4 am due to some uneasiness or excessive sweating. On checking they find their blood glucose <70 mg/dl, a low blood sugar level. Many of them have no symptoms. After this trough, there is a surge of blood sugar in the morning due to two reasons, Somogyi effect or Dawn phenomenon.

*Dawn Phenomena:* It is due to intense gluconeogenesis in the liver primarily due to lack of insulin and surge of contra-insulin hormones. The liver releases extra glucose in the bloodstream due to a surge in growth hormone, cortisol and catecholamines. It generally occurs in the morning at around 3 to 4 am onwards. While these events are occurring, the diabetes medication dose taken a day prior has also started to wear off which accentuates this phenomenon. In summary, the Dawn phenomenon is a physiological accentuation of hypoglycemia from 2-4 am followed by a physiological hyperglycemia. This conforms to the body's basic glucose rhythm in all individuals, but is markedly accentuated in a person with Type 1 diabetes or occasionally a person with long-standing Type 2 diabetes.

*Somogyi effect:* The Somogyi effect is also called "rebound hyperglycemia". This occurs when the blood sugar level drops too low, usually from 2-4 am. To rescue from an

extremely low sugar level, the body releases hormones that force the liver to release stored glycogen and stabilise the amount of glucose in the body. In diabetes, the liver releases extra glucose which is again a function of insulinopenia and increased contra-insulin hormones.

To determine the major difference between the two, one needs to note that the Somogyi effect is due to hypoglycemia which is followed by hyperglycemia. To check for the Somogyi effect, one has to check blood sugar levels at bedtime and after waking up. If the blood sugar level is low at night then it is due to the Somogyi effect. In case it is normal or high it can be due to the Dawn phenomenon. Somogyi effect can also occur at any time of the day when hypoglycemia occurs; thus it is post-hypoglycemic hyperglycemia.

Once the cause of the spike in the blood sugar level is determined, one needs to take measures to control them. For the Dawn phenomenon, a change in the timing or the type of diabetes medications may need revision; lighter breakfast may be preferable and an increase in the morning dose of medication may be advisable. For the Somogyi effect, a decrease in the dose of diabetes medications at night may be required or adding bedtime carb-rich snack may be required. It is also notable that glucose lowering effect of exercise may be an added factor.

**JJ**

# RECIPES

## BROCCOLI CARROT CUTLETS WITH OATS



### INGREDIENTS

#### For Cutlets

100 gm florets of Broccoli  
50 gm Carrots  
100 gm rolled Oats  
1 finely chopped green Chili  
10 gm Flax seeds  
1 tsp Oil

#### Spices

1 tsp roasted Cumin powder  
½ tsp red Chili powder  
½ tsp Chaat masala  
1 tbsp Red chilli flakes  
Salt to taste

### METHOD FOR CUTLETS

Bring water to boil with a little salt. Add the washed and cleaned broccoli florets. Let it remain in water for 2-3 minutes. Drain the water completely and pat it dry.

Mince boiled broccoli along with chopped carrots in a food processor .

In a bowl, mix together minced broccoli, carrots with oats and add the chopped green chilli and spices. Mix all ingredients well.

Keep the prepared mixture in the refrigerator for 30 minutes (covered).

After 30 minutes take out the prepared cutlet mixture. Make cutlets by hand by flattening mixture to palm size. Coat them with flax seeds.

Heat a little oil in the pan and place cutlets in it. Shallow fry till both sides are golden brown and crisp. One serving is three medium cutlets.

### Provides 2 servings

### Nutritional information per serving

Energy (Kcal)	Carbohydrate (gm)	Protein (gms)	Fats (gms)	Fibre (gm)	Glycemic Index
155	35	5	7	7	Low

### Special features

A healthy snack

A recipe rich in fibre

## BELL PEPPER AVOCADO QUINOA SALAD



### FOR THE SALAD

50 gm uncooked Quinoa  
 ½ firm but still ripe sliced Avocado  
 50 gm red, yellow and green bell pepper  
 50 gm steamed Corn  
 50 gm finely diced red Onion  
 50 gm shredded low fat Paneer  
 Few coriander leaves

### FOR THE DRESSING

Few coriander leaves  
 1 tsp extra virgin Olive oil  
 2 tsp fresh Lime juice  
 Salt as per taste  
 1 tsp freshly ground black Pepper

### METHOD

First, cook the Quinoa. Add water and Quinoa to a medium pot and place over a high heat flame. Bring the mixture to a boil, then cover and

reduce heat to low and let it cook for exactly 15 minutes. After 15 minutes, remove the pot from the flame and fluff the Quinoa with a fork. Then cover and allow the Quinoa to sit for 10 minutes. While the Quinoa is cooking, make the dressing by adding coriander, olive oil, lime juice, salt and pepper to a blender. Blend until smooth. Set aside.

Once the Quinoa is cooked, take it to a large bowl. Add in the avocado, blueberries, corn, red onion, paneer and coriander leaves.

Pour dressing all over the Quinoa salad and toss to combine. Garnish with extra coriander.

### Provides 2 servings

### Nutritional information per serving

Energy (Kcal)	Carbohydrate (gm)	Protein (gms)	Fats (gms)	Fibre (gm)	Glycemic Index
335	41	12	14	7	Low

### Special features

A healthy recipe for main meals: lunch or dinner  
 A recipe rich in fibre

**JJ**

## HOW KNOWLEDGEABLE ARE YOU?

1. For the diagnosis of diabetes, the best strategy would be:
  - A. Fasting blood sugar estimation
  - B. 2 hr post meal blood glucose
  - C. Random blood glucose plus HbA1c
  - D. 2 hr post- 75 gm glucose blood glucose
2. What is the ideal time to screen a pregnant woman for DM?
  - A. Beginning of 2nd trimester
  - B. beginning of 3rd trimester
  - C. near Full term
  - D. At the time of first antenatal visit
3. Who needs the minimum self-blood glucose monitoring?
  - A. T2DM undergoing CABG
  - B. Pregnant person with diabetes
  - C. T2DM controlled on lifestyle measures
  - D. T1DM engaged in sports activities
4. In a T2DM patient who is rapidly losing weight on metformin and has HbA1c of 9%, the correct approach is to start?
  - A. SGLT2i
  - B. DPP4i
  - C. Basal insulin
  - D. Pioglitazone
5. The most common site of infections in person with diabetes are:
  - A. Lung
  - B. Liver
  - C. Skin
  - D. Urinary Tract
6. For early diagnosis of coronary artery disease, a person with diabetes should have annually the following tests besides clinical evaluation?
  - A. ECG and if required 2D Echo Heart
  - B. Myocardial perfusion scan
  - C. Stress test
  - D. CT Coronary Angiography
7. Good footwear for a person with diabetes must:
  - A. Have a Heel Counter
  - B. Must be made of calf leather
  - C. Must be of canvas
  - D. Must be somewhat loose
8. The target blood pressure in T2DM with hypertension is:
  - A. <140/90
  - B. < 130/90
  - C. <120/80
  - D. <110/75
9. For early detection of kidney disease, a person with diabetes should be screened annually by doing?
  - A. Serum creatinine and urinary albumin/creatinine ratio
  - B. Ultrasound of kidneys and urinary bladder
  - C. Serum creatinine
  - D. Urine culture and sensitivity
10. In obesity, the body composition in comparison to normal weight person has:
  - A. Increased adipose tissue
  - B. Increased adipose tissue and increased muscle mass
  - C. Increased adipose tissue and decreased muscle mass
  - D. Osteoporosis

ANSWERS:  
1. C  
2. A  
3. C  
4. C  
5. C  
6. A  
7. A  
8. C  
9. A  
10. B

## MYTHS AND FACTS

1. **Myth: I can stop taking diabetes medicines once my blood sugar is under control.**

**Fact:** People with Type 2 diabetes at the initial stage of the disease are able to control their blood sugar without medication by losing weight, eating a healthy diet and undertaking regular exercise. But, diabetes is a progressive disease and after a certain time period, efforts to stay healthy may be employed, yet one may need medication to keep blood sugar within the target range. Discontinuation of medications can be attempted stepwise and not suddenly.

2. **Myth: I was told I have diabetes, so now I will have to eat a special diet.**

**Fact:** People with diabetes can eat the similar foods that others eat. In fact, the American Diabetes Association no longer recommends specific amounts of carbohydrate, fat or protein in the diet. But, they do suggest that people with diabetes should get adequate carbohydrate from vegetables, whole grains, fruits, and legumes. Foods that are high in fat, sodium and sugar are to be avoided in routine. These recommendations are similar to what the normal populations should be ideally eating.

If one has diabetes, one should work with the health-care provider to develop a meal plan that works best for the individual and have an ease to follow consistently. A healthy and balanced meal plan with a healthy lifestyle will help one to achieve optimum glycemic control.

3. **Myth: Fat does not matter, so I can ignore the fat content and fat quality in my meals.**

**Fact:** Fat does not have a direct impact on blood glucose levels. However, a large amount of fat in a meal can delay stomach emptying and slow the digestion of carbohydrate, thus keeping one's blood glucose levels elevated for a longer period. This makes it difficult to keep one's blood glucose levels consistently within the desirable range.

Fat provides 9 calories per gram compared to carbohydrates and protein which give 4 calories per gram. So for those who want to lose weight, it is not at all helpful or advisable to ignore the fat content in their meal. Of the total fat intake, consuming a high proportion of saturated fat may also lead to undesirable lipid profiles and increased risk of cardiovascular disease. Hence, total fat intake and the quality of fat of the meal does matter.

4. **Amputation is inevitable for most people with Type 2 diabetes.**

**Fact:** Poorly controlled blood sugars for an extended period of time, can lead to peripheral blood vessel and nerves damage in the long run. This, in turn leads to complications such as foot ulcers, nerve damage, blindness, kidney failure, heart disease, stroke and amputation.

However, these complications are avoidable if the glycemic control is managed efficiently. Thus, it is important for persons with diabetes to go for a regular evaluation of their feet, eyes and kidney to monitor and prevent complications.

JJ

# CERTIFIED DIABETES EDUCATOR COURSE

*Dr Chandalia's DENMARC in association with Help Defeat Diabetes Trust (HDDT) presents to you a course to be a Certified Diabetes Educator (CDE)!*

Help Defeat Diabetes Trust (HDDT) is a registered, non-profit public trust, having amongst its many objectives, the main objective of promoting education and awareness about diabetes among people from different fields.

## **Who can enroll?**

Graduates in Nutrition, Nursing, Pharmacy, Occupational and Physiotherapy.

## **What is the duration of the course?**

6 months, including 3 months (300 Hours) of hands-on training and experience with a recognized mentor in your own town (see this on our website).

## **How can I do this course from my place of residence?**

A Suitable Mentor can be selected from the registrant locality under whom the training can be done.

## **How will I get the course material?**

All course material is available online on our website.

## **What are the course fees?**

The standard fees for the course are INR 10,000/- only.

## **Where can I get more information about this course?**

Kindly visit our website <http://www.helpdefeatdiabetes.org> or you can get in touch with us on our email id: [heldefeatdiabetesinfo@gmail.com](mailto:heldefeatdiabetesinfo@gmail.com).



# CERTIFIED DIABETES EDUCATOR COURSE

## HELP DEFEAT DIABETES TRUST announces

### Reward of Rs. 10,000/- for securing the highest marks every year



**Nature of Course:** Virtual and Hands on

**Duration:** 6 months

**Course Highlights:**

- Get certificate of training in diabetes
- Get practical exposure under a recognized mentor in your own town
- Get access to 800 pages of study material and more than 18 audio & audiovisuals.

**Criteria for award:**

- To complete the course in given time frame i.e. 6 months.
- To secure highest marks in the current year.

For further details visit [helpdefeatdiabetes.org](http://helpdefeatdiabetes.org)

# MEMBERSHIP FORM

## Association of Diabetes Educators (ADE)

(For eligibility criteria: Check Website [www.diabeteseducatorsindia.com](http://www.diabeteseducatorsindia.com))



Name ..... Date of Birth: .....

Address .....

.....

Telephone: Res: ..... Office: ..... Cell: .....

E-mail id: .....

Educational Qualifications:.....

.....

.....

Work Experience: .....

.....

.....

Currently employed at: .....

.....

Certificates attached\*: .....

.....

Please pay the membership fees through NEFT / RTGS to the following bank account.

Account name: Association of Diabetes Educators

Account type: Savings Account

Name of the bank: Bank of India

Account number: 006610110001734

IFSC Code: BKID0000066

.....  
Signature

## CHALLENGES IN DIABETES EDUCATION

AN AWARD FOR PROBLEM RESOLUTION IN DIABETES EDUCATION

SPONSORED BY DR. CHANDALIA'S HELP DEFEAT DIABETES  
TRUST



**Prize money of Rs. 10,000 for reporting a problem case**

Dr. Chandalia's HDDT aims to enhance the quality of Diabetes education in India by creating a world-class research and education environment and to build up a platform of networking and knowledge sharing within diabetologists and/or diabetes educators.

Challenges in Diabetes Education 2023 places special emphasis on supporting educational initiatives that have the potential to improve and significantly revolutionize diabetes care, enhance self-management and/or support patients with Type 1 or Type 2 Diabetes Mellitus. The educator should describe an individual or group case history and identify the problem in diabetes education. Furthermore, s/he should describe the plan of education to resolve the issue, partly or totally. The issue described may be related to patient perceptions, knowledge, behaviors and implementation of advice given. S/He should describe her struggle in resolving the issue including her triumphs and failures, the methodologies used and ethical, socio-economic and behavioral aspects of the case.

General Rules and Regulations regarding the eligibility Criteria for the Award

- The applicant of the Award should be a citizen of India and member of Association of Diabetes Educators.
- The case discussion should be on the subject of Diabetes Education.

The best case chosen by a group of referees will be awarded "Challenges in Diabetes Education Award- 2023" - which will carry a cash prize of Rs 10,000. The awardee will get the opportunity to present the case in the annual meeting of Association of Diabetes Educators and publish it in the journal of Diabetes Education.

**The last date for the submission is 30th December, 2023 !!!!**

(Instructions for authors is available on website [www.diabeteseducatorsindia.com](http://www.diabeteseducatorsindia.com))





# ADD VALERA

Evogliptin 5mg Tablets



**Minimize Glycemic Variability.  
Prevent diabetic complications with the right DPP4i**



**Elderly  
patients**



**Patients with  
CV risk**



**Renally  
impaired patients**



**Patients with  
newly diagnosed  
diabetes**


**VALERA (Evogliptin Tablets 5 mg) Composition:** Each tablet contains: Evogliptin hydro bromide hydrate equivalent to Evogliptin.....5 mg **Therapeutic Indications:** For the treatment of type 2 diabetes mellitus as an adjunct to diet and Exercise to improve glycaemic control, when used as a monotherapy or in combination with metformin. **Dosage and method of administration:** The usual adult dosage is 5 mg of Evogliptin administered orally once daily. **Use in Paediatrics:** Safety and efficacy in paediatrics have not been established. **Use in the Elderly:** There were 119 elderly patients (22.6%) aged 65 years or older out of a total of 527 patients in the phase II and III clinical studies of evogliptin. The administration in elderly patients has not been fully investigated. Since the elderly generally have decreased physiological functions such as hepatic and renal functions, caution needs to be exercised during administration while monitoring the patient's condition. **Contraindications:** Evogliptin Tablets are contraindicated in patients with: • Hypersensitivity to the drug or any of its components • Severe ketosis, diabetic coma or pre-coma and type 1 diabetes **Special warnings and precautions for use:** 1) Heart failure: Caution should be exercised 2) Renal impairment: Evogliptin should be cautiously administered while monitoring the patient's condition. As there is no clinical experience of Evogliptin in patients with end-stage renal impairment requiring dialysis, administration of Evogliptin is not recommended in such patients. 3) Hepatic impairment: Caution should be exercised in such patients. 4) Acute pancreatitis: There is no report of acute pancreatitis in patients administered with evogliptin. 5) Use in Pregnant women: Use in pregnant women is not recommended. 6) Use in Nursing Mothers: Evogliptin should not be used in nursing mothers. **Undesirable effects:** The most commonly reported AE was Gastritis. Periodontitis, Nasopharyngitis, Erectile dysfunction, Dyspepsia, Arthralgia, Diarrhoea, Pruritus, sciatica, Hypoglycaemia, dyslipidaemia, elevated amylase or lipase levels. **General Precautions:** 1) Concomitant administration with drugs known to cause hypoglycemia: Insulin secretagogues such as insulin or sulfonylurea may cause hypoglycemia. Thus, lowering the dose of insulin or insulin secretagogues may be required to minimize the risk of hypoglycemia in case of concomitant administration with evogliptin. 2) Severe and disabling joint pain **Shelf-life:** 36 months For more information refer full prescribing information.

For Further Information Contact Details: Medical Affairs; Alkem House; Senapati Bapat Marg, Lower Panel; Mumbai, Maharashtra: 400 011.



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