

# **Impact of obesity on kidney disease**

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internal medicine

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## **List of abbreviations**

**ACR: albumin creatinine ration**  
**Ang. II: angiotensin II**  
**BMI : Body mass index**  
**CKD: chronic kidney disease**  
**cr : creatinine**  
**CRP: C-reactive protein**  
**DBP : diastolic blood pressure**  
**DM: diabetes mellitus**  
**eGFR : estimated glomerular filtration rate**  
**ESRD: end stage renal disease**  
**FSGS: focal segmental glomerulosclerosis**  
**FFA: free fatty acids**  
**IL-6: Interleukin- 6**  
**IRS: insulin resistance syndrome**  
**NO: nitric oxide**  
**ORG: obesity related glomerulopathy**  
**PAPAR  $\gamma$ : peroxisome proliferator activated receptor  $\gamma$**   
**PKC: phosphor kinase C**  
**RAAS : rennin angiotensin aldosterone system**  
**SBP : systolic blood pressure**  
**TNF: tumor necrosis factor**  
**US: united states**  
**WAT: white adipose tissue**

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# Introduction

The worldwide prevalence of obesity has increased dramatically over the last several decades. In the United States alone, over 70% of adults 20 to 74 years of age are now considered overweight or obese. (**Hedley et al., 2004**).

The incidence and prevalence of end-stage renal disease (ESRD) continues to grow steadily. (**US Renal Data System 2008**). Although much less common than obesity, ESRD is an important health problem because of the high cost of renal replacement therapy, the associated high mortality and the effect on patients' quality of life. (**Goeree et al., 1995**).

Emerging evidence suggests that obesity may be independently related to kidney disease. For instance, animal studies have demonstrated that obesity per se can cause structural glomerular changes (**Henegar et al., 2001**).

Obesity increases sodium reabsorption, impairing naturesis. Obesity also causes renal vasodilatation and glomerular hyperfiltration that initially serves as compensatory mechanism to maintain sodium balance in the face of increased tubular reabsorption. In long term these changes create a haemodynamic burden on the kidneys that causes glomerular injury. (**Hall et al., 2004**).

With prolonged obesity, there is urinary protein excretion and gradual loss of kidney function. (**Hall et al., 2004**).

Elevated rates of urinary excretion predicts target organ damage, notably renal disease so the identification of obese

albuminuric individuals has the potential of defining persons at increased risk of chronic kidney disease (**chagnac et al., ٢٠٠٠**).

There is also an evidence that obesity per se is a pro-inflammatory state. Obesity is associated with increased levels of acute phase reactants and cytokines as well as oxygen species. (**bagby, ٢٠٠٤**).

**Wu et al., ٢٠٠٦** studied gene expression profiles in renal biopsies of six patients with obesity-related glomerulopathy. Compared with normal controls, the expression of genes related to lipid metabolism, inflammation and insulin resistance was significantly increased.

## **Aim of the work**

Study the association and impact of obesity on chronic kidney disease.

# Review of literature

## OBESITY

### DEFENITION:

#### Body Mass Index:

The World Health Organization defines obesity as “abnormal or excessive fat accumulation in adipose tissue, to the extent that health is impaired”. The degree of health impairment is determined by three factors: the amount of fat, the distribution of fat, and the presence of other risk factors (*World Health Organization, ۲۰۰۰*).

Body mass index (BMI) is calculated by dividing weight (in kilograms) by height (in meters squared). There is a strong curvilinear relation between BMI and relative body fat mass. The BMI has been proved relatively reliable, except in the extremes of age or height and in those individuals who are very fit and have a muscular build. Thus, the current practical definition of obesity is based on the relationship between BMI and health outcome rather than BMI and body composition (*Fernandez et al., ۲۰۰۳*).

*Hill et al., ۲۰۰۵* summarized the guidelines for classifying weight status by BMI. Large epidemiologic study has established that there is a strong relationship between BMI and mortality. Obese persons have higher risk for adverse health consequences than those who are overweight (*Ross and Katzmarzyk, ۲۰۰۳*).

A diversity of tables have been published to rapidly calculate the BMI of a subject and to assign a weight classification. An example is shown here (*Ogden et al.*, ۲۰۰۴).

■TABLE ۱: Weight Classification by Body Mass Index■

Status	Obesity Class	Body Mass Index (kg/m <sup>۲</sup> )	Risk of Disease
Underweight		< ۱۸.۵	Increased
Normal		۱۸.۵-۲۴.۹	Normal
Overweight		۲۵.۰-۲۹.۹	Increased
Obesity	I	۳۰.۰-۳۴.۹	High
	II	۳۵.۰-۳۹.۹	Very high
	III	> ۴۰.۰	Extremely high

(*Hill et al.*, ۲۰۰۵)

#### Factors Affecting BMI-Related Risk:

Several factors influence BMI-related health risk. For example, obese persons with excess abdominal fat are at increased risk for diabetes, hypertension, dyslipidemia, and ischemic heart disease than obese persons whose fat is located predominantly in the lower body (*Berggren et al.*, ۲۰۰۴). Visceral adiposity can be measured in a number of ways: by MRI scanning or CT scans of the abdomen or by dual X-ray absorptiometry (DEXA) with a specific abdominal window. Such techniques are expensive and difficult to apply to the assessment of central obesity in most clinical practice. However, assessment of visceral fat by a single CT slice at L۴/L۵ has become a recognized reference measure and is often used in obesity studies (*Caterson and Gill*, ۲۰۰۲).

#### Other Methods Used for Determination of Obesity:

*Bioelectrical impedance* is a less expensive method for assessing body composition, but measures are a complex function of electrolyte and water content, and are not accurate without careful standardization (*Ryo et al.*, 2009).

Other inexpensive and practical methods to accurately localize body fat distribution in humans include:

- 1) *Waist circumference* (the narrowest circumference midway between the lower border of the ribs and the upper border of the iliac crest, taken from the side) is highly correlated with abdominal fat mass and is therefore often used as a surrogate marker for abdominal (upper body) obesity. Waist circumference values denoting increased risk for metabolic diseases have been proposed on the basis of epidemiologic data. For men, a waist circumference greater than 102 cm (40 inches) and, for women, a waist circumference greater than 88 cm (35 inches) have been proposed as cutoff values for increased risk (*Stewart et al.*, 2003).
- 2) The waist to hip ratio (WHR). A WHR of more than 1.0 in men and 0.85 in women identify subjects with abdominal fat accumulation (*Kopelman*, 2000).

Another factor that modifies the risk of obesity-related complications is weight gain during adulthood. In both men and women, weight gain of 5 kg or more since age 18 to 20 years is associated with an increased risk of diabetes, hypertension, and coronary heart disease, and the risk of disease increases with the amount of weight gained (*Koh-Banerjee et al.*, 2004).

Risks of developing obesity-associated diabetes or cardiovascular disease can also be modified by aerobic fitness. The incidences of diabetes and cardiovascular mortality were lower in those who were fit, as defined by maximal ability to consume oxygen during exercise, than in those who were unfit (*Nagano et al.*, 2004).