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# Chronic kidney disease and obesity; a mini-review to the current knowledge

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## ABSTRACT

Chronic kidney disease (CKD) is a health issue that may progress into end-stage renal disease (ESRD) and therefore lead to increased mortality from cardiovascular disease. Early detection of risk factors for CKD helps to improve them and prevent progression of this disease. Obesity is one of the most important yet preventable risk factors for CKD. Obesity is known as a cause of increased development of certain chronic diseases and may cause renal damage directly through hemodynamic and hormonal factors or indirectly via progression of diabetes and hypertension. With increased urban population and income, the diets containing high amounts of sugar, fats, and animal products have replaced traditional diets that contain highly fibrous complex carbohydrates. Currently, high-calorie foods and sedentary lifestyle are associated with obesity among children and adolescents. In 2017, the World's Kidney Day concentrated on obesity as a potent risk factor for development of kidney diseases.

### *Implication for health policy/practice/research/medical education:*

Chronic kidney disease (CKD) is a health issue that may progress into end-stage renal disease and therefore lead to increased mortality from cardiovascular disease. Obesity is one of the most important yet preventable risk factors for CKD. Obesity is known as a cause of increased development of certain chronic diseases and may cause renal damage directly through hemodynamic and hormonal factors or indirectly via progression of diabetes and hypertension.

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## Introduction

Since 1980, obesity has doubled worldwide. According to the World Health Organization (WHO) report, over 1.9 billion people aged 18 years and older in 2014 were overweight. Of these people, over 600 million were obese (1). Obesity is known as a cause of increased development of certain chronic diseases. Growing obesity epidemic has become a public health crisis worldwide and has affected many countries. Besides that, obesity has led to numerous socioeconomic and medical consequences in these countries (2).

## Materials and Methods

For this mini-review, we used a variety of sources by searching through Web of Science, PubMed, EMBASE, Scopus and directory of open access journals (DOAJ). The search was performed using combinations of the

following key words and or their equivalents such as; Obesity, chronic kidney disease, high blood pressure, chronic renal failure, hypertension and diabetes mellitus.

## Obesity

Obesity is a complex problem that plays a part in many metabolic problems such as diabetes mellitus, dyslipidemia, hypertension, and metabolic syndrome. In addition, the kidney may be affected by adverse effects of obesity. Obesity and overweight were reported to possibly have a significant contribution to the pathogenesis of CKD in around 14%-30% of the patients (3). Current evidence indicates that differences in incidence rate of kidney diseases among different regions of the world and also different prevalence rates of obesity revealing that obesity may be an important risk factor for kidney diseases (4). Obesity increases risk factors for cardiovascular diseases

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(CVD) including hypertension and type 2 diabetes and decreases high density lipoprotein-cholesterol (5). These risk factors are strongly associated with increased risk of developing chronic renal failure (CRF) and end-stage renal disease (ESRD). Association of obesity with abnormal renal function and focal segmental glomerulosclerosis can be the primary cause of CKD (3). Obesity may cause renal damage directly through hemodynamic and hormonal factors or indirectly via progression of diabetes and hypertension. Some evidences indicate that obesity and diabetes may have similar effects on the kidney (6). Several mechanisms have been recommended for association of obesity with hypertension, glomerulosclerosis, and therefore CRF, including changes in internal kidney tissue that leads to activation of the renin-angiotensin system, renal hyperfiltration, and therefore hypertension and glomerulosclerosis(7).

A study determined that abdominal obesity in young adults is an independent risk factor for CKD which is definitely race-associated. Obese youths are recommended to undergo periodical screening for renal function. General obesity was demonstrated to be a very important determinative risk factor in women, and abdominal obesity seems to be associated with renal failure in men (8).

In the past decade, the subjects of World Kidney Day that aims to raise awareness of kidney diseases and the importance of the kidneys to overall health have been specified to different purposes such as protecting the kidneys via maintaining normal blood pressure, managing diabetes mellitus, protecting heart, CKD, and aging. In 2017, the World Kidney Day concentrated on obesity as a potent risk factor for development of kidney diseases.

### Renal diseases and obesity

CKD is a health issue that may progress into ESRD and therefore lead to increased mortality from CVD. Current statistics indicate that 10%-16% of adults are suffering from CKD in different regions across the world. Several predisposing and risk factors have been so far offered for development of CKD including genetic factors, age, gender, race, culture, family history, medication, smoking, socioeconomic status, obesity, and certain comorbidities such as hypertension and diabetes (9). Age is an effective factor on development of CKD. In people aged over 30 years, the chance of developing CKD increases by 1.45-2.18 times per 10-year increase in age. Twenty-three percent of dialysis patients have family history of ESRD. The families of dialysis patients are recommended to undergo screening for kidney diseases (10). In addition, according to several studies conducted by different approaches, smoking plays role in renal damage through increasing microalbuminuria, proteinuria, and serum creatinine and decreasing glomerular filtration rates (5). Early detection of risk factors for CKD helps to improve them and prevent progression of this disease. Obesity is one of the most important yet preventable risk factors for CKD(11). Pathogenic mechanisms responsible for

microalbuminuria/proteinuria in obese people displayed excessive glomerular filtration rate. Animal and human studies demonstrated that obesity led to glomerular hyperperfusion and hyperfiltration that in turn cause proteinuria and focal segmental glomerulosclerosis (5). Besides that, leptin secreted by additional adipose tissue can directly lead to renal fibrosis (12). Abnormal hydration of fat-free body mass and the patterns of fat distribution especially in ESRD can be indicative of association between obesity and kidney diseases. In obesity or inflammatory conditions such as CKD, ESRD, and heart failure, deposition of the subcutaneous adipose tissue is diverted toward deposition of perivisceral adipose tissue (yellow fat) that, in addition to inducing visceral insulin resistance, specifically and significantly develops CD<sub>68</sub> that causes deposition of immune cells in adipose tissue. Such immune cells produce further pro-inflammatory factors from adipose tissue including leptin, adiponectin, resistin, and vasfatin. Adipose tissue is related to other organs of the body through biological cytokines secreted by the adipose tissue named adiponectin (13,14).

Nervous tissue helps to regulate and control feeding and accumulation of fat in the adipose tissue through the messages of sympathetic nerves. Adiponectin plays anti-inflammatory and anti-atherogenic roles and contributes to fat and glucose metabolism as well as energy balance in physiological conditions. Its role is not only a protective factor but also a risk factor for ESRD patients due to change in structure, proportion, and function of the kidney. In ESRD, circulatory adiponectin level increases for several reasons such as declined glomerular filtration and renal excretion of adiponectin, receptors resistance to adiponectin in uremic inflammation and decrease in these receptors, and metabolic disturbances. In ESRD, retention of water and salt and over activity of renin-angiotensin-aldosterone system occurs that may lead to increase levels of circulatory adiponectin in the patients (14). Increased insulin resistance causes an increase in adiponectin in ESRD patients. In inflammatory conditions, rapid and dramatic weight loss changes regulation of inflammation factors and adiponectin. It was demonstrated that weight loss is associated with significant decrease in proteinuria (15). A large proportion of the world's population are suffering from overweight and obesity (16). With increased urban population and income, the diets containing high amounts of sugar, fats, and animal products have replaced traditional diets that contain highly fibrous complex carbohydrates. Currently, high-calorie foods and sedentary lifestyle are associated with obesity among children and adolescents (5).

Therefore, any modality taken to reduce obesity prevalence should not only aim to prevent obesity in the community (primary prevention) but also help to prevent further weight gain in obese and overweight people before development of complications due to obesity (secondary prevention). It seems that raising people's knowledge and attitude toward selecting healthy foods is a strategy required to improve their diets. Besides that, strategies to

increase physical activity are considered a key part of any approach to prevent obesity.

### Conclusion

To deliver efficient health care services to prevent chronic diseases, pharmacotherapy is not sufficient and instead stable behaviors of healthy lifestyle should be promoted through long-term implementation (17).

### Authors' contribution

LM and SB searched and gathered the related articles. LM prepared the draft. SB edited the final manuscript. All authors read and signed the final paper.

### Conflicts of interest

The authors declare no conflicts of interest.

### Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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