

## A Comparative Study of Glomerular Filtration Rate in Smokers and Non-Smokers

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**Abstract:** It is a comparative study of renal effects of smoking by creatinine clearance method. Like any other organ, kidney is also a target organ for the consequence of smoking. 25 smokers and 25 non-smoking control groups in the age group of 20-50 years were selected as per criteria for the study. Specified instructions are given to those who are undergoing the study and from investigations mean creatinine clearance was calculated.

In this study, the average 24 hr. urine output in non-smoking healthy men was 1048 ml and in chronic smokers was 986ml. The mean Glomerular Filtration Rate (GFR) by creatinine clearance method obtained in healthy non-smokers was 96.20 ml/min and in smokers was 96.74 ml/min. The GFR obtained in both non smoking healthy groups and smokers was found to be lower than the standard values. There was no marked difference in GFR between the two groups. This study showed no marked difference in the serum creatinine and urinary creatinine levels between healthy non smokers and smokers. Compared to western studies environmental factor may be one of the influencing factors.

**Keywords:** creatinine clearance, glomerular filtration rate, smokers, non smokers

### I. Introduction

In spite of all active measures for the cessation of practice of tobacco smoking, still it is the one of the issue in the community. It is the one of the principal cause of preventable disease, disability and premature death.

More than 4,000 substances have been identified in cigarette smoke, including some that are pharmacologically active, antigenic, cytogenic, mutagenic and carcinogenic.

Large population studies have shown a strong correlation between cigarette smoking and several diseases.

Atherosclerotic cardiovascular disease, cancer and COPD account for most of the excess mortality due to smoking.

Kidney is an important target organ of smoking induced damage<sup>[1]</sup>. Apparently because there is less information available at this point, this issue has been neglected by nephrologists.

Whether nicotine affects the renal circulation and function in humans is at present unknown. There are some studies done in the western world in the past on the effects of chronic smoking on renal functions like GFR which showed no significant variations in GFR<sup>[2]</sup>.

We had chosen to study the glomerular filtration rate by creatinine clearance in chronic smokers as there is no correct information available in Indian population.

The Creatinine clearance method was chosen to estimate G.F.R. as it is convenient to measure and inexpensive. It quite closely approximates Inulin clearance if it incorporates 24 hour urine collection, meat free diet etc.

### II. Materials and methods

25 smokers and 25 non-smoking control groups in the age group of 20-50 years were selected for the study from bystanders who were accompanying patients in yenepoya medical college hospital. The healthy non-smoking subjects are selected after taking a comprehensive history and thorough clinical examination. Smokers with a history of 10 pack years or more were selected for the study.

The exclusion criteria are

1. Hypertension
2. Diabetes
3. Pre-existing renal disease
4. Paralysis and wasting diseases
5. Conditions whereby complete bladder emptying is not possible (Urinary tract obstruction, other urinary tract abnormalities)
6. Ingestion of cooked meat and abrupt severe muscle damage
7. Drugs (for e.g.; Cimetidine, Triamterene, Spironolactone, Amiloride)

The following instructions were given to the subjects undergoing the study:-

1. They should not take any medication during the procedure
2. There should not be any major alteration in the feeding habits like increased protein diet
3. To avoid physical and mental stress during the procedure
4. The 24 hours collection of urine should be accurate
5. 5 ml of blood collected and the serum creatinine concentration was estimated by Jaffe reaction without deproteinisation kinetic method in the autoanalyser

From these data the Creatinine clearance calculated by using the conventional clearance formula;

$$C = \frac{U \times V}{P}$$

Where C is the Creatinine clearance in ml/min

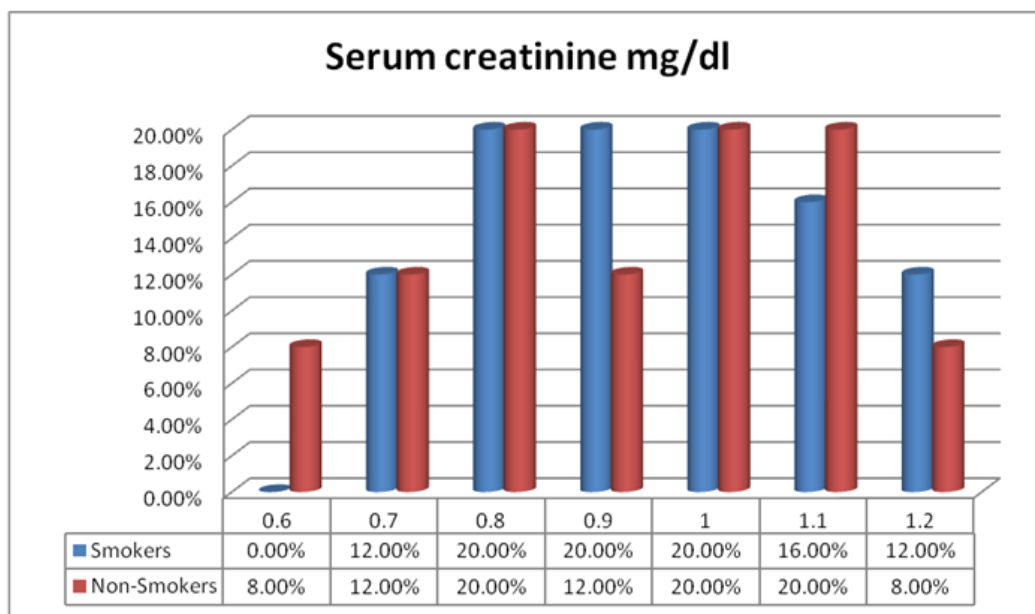
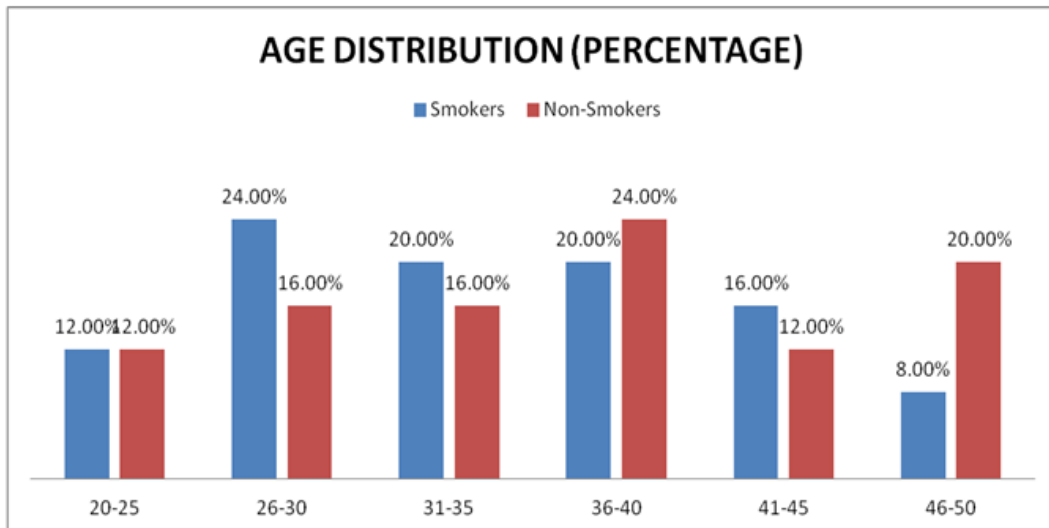
U is the Creatinine clearance in urine mg/dl

P is the Creatinine clearance in plasma mg/dl

V is the urine excreted per minute in ml

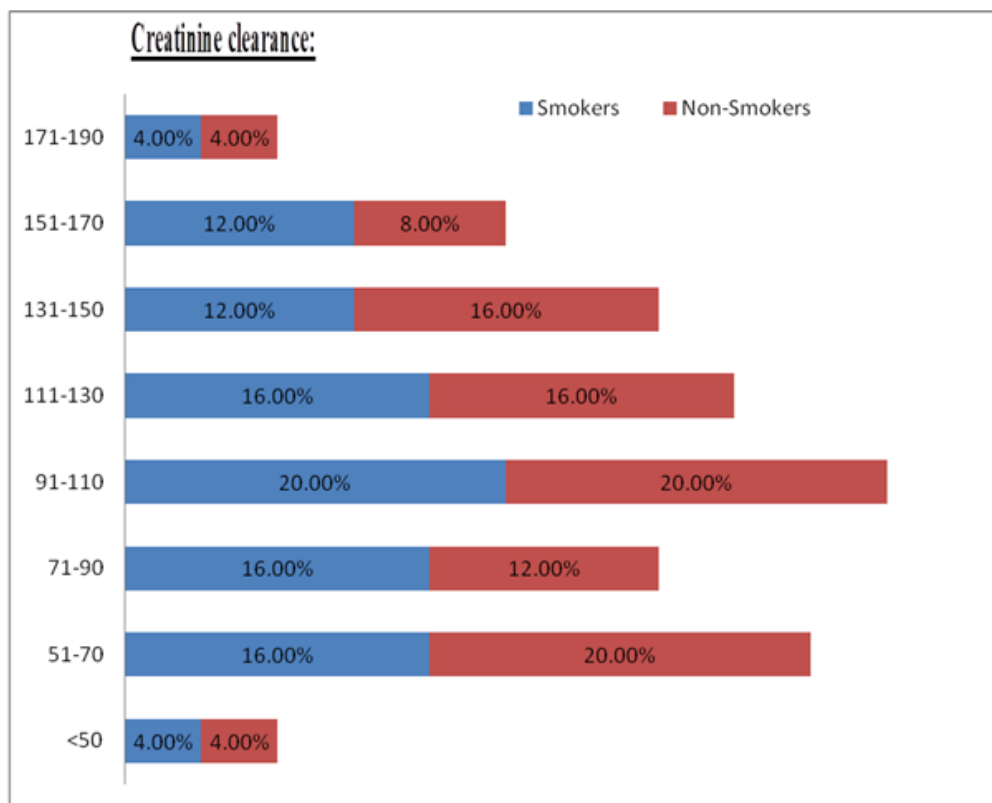
The rate of urine flow per minute 'V' is calculated by dividing the volume of 24 hour urine by the number of minutes which the collection period was lasted (24× 60 minutes)

**2.1. Observations and results**



2.2 Creatinine clearance

Factors	Non-smokers Mean	Smokers Mean
24-hr. urine output	1048	986
Serum creatinine	0.82	0.84
Urine creatinine	108.4	118.68
Creatinine clearance obtained	96.20	96.74



III. Discussion

The glomerular filtration rate of 25 healthy non smoking men and 25 chronic smokers in the age group of 20-50 years were estimated by creatinine clearance method.

In this study, the average 24 hr. urine output in non-smoking healthy men was 1048 ml and in chronic smokers was 986ml. The 24 hr urine output measured was found to be less than 1500 ml in 72 % of healthy non-smokers and 76 % of smokers.

The decreased volume in 24 hr urine output among both the groups is definitely striking compared to western standards.

This decrease in urine output may be due to the environmental factors like increased heat and humidity resulting in increased sweat production. A man working under sun for 8 hrs a day can lose up to 10 liter of sweat<sup>3</sup>.

This study showed that no marked difference in the serum creatinine and urinary creatinine levels between healthy non-smokers and smokers.

3.1. 1. Creatinine clearance:

The mean Glomerular Filtration Rate by creatinine clearance method obtained in healthy non-smokers was 96.20 ml/min and in smokers was 96.74 ml/min. There was no marked difference between the two groups. The lowest value of creatinine clearance in non-smokers was 47.30 ml/min.

The study done by Jean Michel Halimi et al<sup>[4]</sup> showed no significant difference in the Glomerular Filtration Rate between the healthy non-smokers and smokers. The GFR obtained by them was 112 ± 5 ml/min in healthy non-smokers and 109 ± 6 ml/min in chronic smokers.

In chronic smokers, no effect of nicotine on renal function (GFR by 99<sup>m</sup> TC-EDTA clearance) was detected in the study done by Jean Michel Halimi et al. These findings may suggest that tolerance of the renal vasculature to nicotine tends to develop during chronic smoking in man and may be related to stimulation of Guanylate Cyclase activity. This increase in Cyclic GMP may be the cause of the renal tolerance to nicotine observed in smokers<sup>[5, 6]</sup>.

Jean Michel Halimi et al also observed that administration of nicotine to healthy non-smokers was associated with renal vasoconstriction and a fall in Glomerular filtration rate, possibly through alteration of cyclic GMP dependent vasoactive mechanisms<sup>[4, 7]</sup>.

In contrast to the study done by Jean Michel Halimi et al, the study done by us even though showed no variation in Glomerular Filtration Rate between smokers and non smokers, had found GFR to be lower than the standard values.

Gambaro G. et. al. also studied the renal impairment in smokers. According to their study, compared with healthy non-smokers, smokers also had a normal GFR done by radionuclide studies.

The GFR in our study was found to be lower than the standard values due to the following reasons:

- a. Diminished body size compared to the western population. The creatinine production depends upon the body mass. When the body surface area and weight decreases, the GFR also decreases.
- b. When the urinary output and excretion of creatinine in urine is less, GFR is also less.
- c. In hot and humid climates, the water loss from the body is more through sweat and evaporation which results in depletion of the intravascular compartment which in turn causes a fall in GFR.

#### **IV. Conclusion**

The mean Glomerular Filtration Rate by creatinine clearance method in healthy non-smokers was 96.2 ml/min and in chronic smokers was 96.7 ml/min. There was no marked difference in GFR between the two groups.

In chronic smokers, there was no effect of smoking or nicotine on GFR which may be attributed to the tolerance of renal vasculature to nicotine which tends to develop during chronic smoking.

The GFR obtained in both non smoking healthy groups and smokers was found to be lower than the standard values.

The average 24 hr. urine output in both the groups of non smokers and smokers was found to be less than the western standards due to environmental factors like increased heat and humidity.

This study showed no marked difference in the serum creatinine and urinary creatinine levels between healthy non smokers and smokers.

In the light of the above observations it may be necessary to estimate the normal values of various physiological and biochemical parameters in a particular environmental set up, so as to have baseline data which can help in distinguishing health and disease.

#### **References**

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