



## SEASONAL VARIATION OF UROFLOWMETRY PARAMETERS IN CENTRAL SRI LANKA

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### ABSTRACT

**Introduction:** Uroflowmetry is a fairly uncomplicated and non-invasive investigation method which is used to assess patients with various urinary pathologies and Lower Urinary Tract Symptoms (LUTS). There is a widely believed perception towards variations in LUTS with seasonal changes. Basic uroflowmetry parameters can be used to assess such correlation. Although several countries have observed contradictory findings on this hypothesis, there is no literature available from tropical countries where the seasonal changes are more subtle to almost nonexistent. **Objective:** Analyze the uroflowmetry parameters and their alterations over a few years and correlate them with the weather changes of that particular time period to look for any associations. **Method:** Patients who underwent Uroflowmetry at the Faculty of Medicine, University of Peradeniya from 2014-2021 were evaluated, along with climate data of the corresponding dates from the nearest climate station (Katugasthota). **Results:** A total of 3854 patients were enrolled in our study during a period of 8 years. Among the study group, 3484 were male patients (90.7%) while only 358 were female (9.3%). The mean age of all the patients was 61.46 years in an age range of 10 - 94 years. From Pearson correlation, significant association of uroflowmetry parameters with seasonal changes was observed differently in 2014-2021 ( $p < 0.05$ ). **Conclusion:** Different basic uroflowmetry parameters were associated with climate changes in seasons but didn't show a consistent correlation throughout the 8 years.

### INTRODUCTION

Lower Urinary Tract Symptoms (LUTS) are a group of symptoms which correlates to the human genitourinary tract. They are broadly classified into storage symptoms and voiding symptoms. Common storage symptoms include urgency, frequency, urge incontinence and nocturia. Whereas common voiding symptoms include poor stream, sense of incomplete evacuation, dribbling, hesitancy and prolonged micturition.<sup>[6]</sup> Uroflowmetry is a fairly uncomplicated and non-invasive investigation method which is used to assess patients with various urinary pathologies and LUTS. Along with a calculated post micturition residual volume using ultrasonography, Uroflowmetry is sufficient for a thorough initial investigation of a patient with LUTS.<sup>[5]</sup>

There is abundant literature to support a clear seasonal variation of disease conditions like Asthma, Allergies, Ischaemic heart disease and Cerebrovascular occlusive diseases.<sup>[2][4]</sup> But the seasonal variation of LUTS is more of a formulated hypothesis based on physiological evidence. With the variation of environmental

temperature the amount of sweat produced by the body varies. Also with colder temperatures, the body adheres to peripheral vasoconstriction in order to conserve body heat. Along with these factors, the Gauer-henry reflex is activated in cold temperatures which impairs the secretion of Antidiuretic hormone (ADH).<sup>[7]</sup> All these factors will contribute to an increased urinary output in a fairly cold and humid environment. This has led to a widely believed perception towards variations in LUTS with seasonal changes.

But a study done in Edinburgh, UK in January 2000 revealed that there was no significant variation of uroflowmetry parameters associated with seasonal changes. However there was an association with increased nocturnal symptoms.<sup>[1]</sup> Similarly, a study performed on a cohort of South Korean men with BPH has shown a change in IPSS score with increasing symptoms in colder climates, but hasn't found a significant correlation of uroflowmetry parameters with above seasonal changes.<sup>[3]</sup> On the contrary to these, a study published in Japan in the year 2007, showed a

significant increment in 'Qmax' in cold winter seasons compared to the warmer seasons, but a similar study performed in Japan in 2016 showed no associations between uroflowmetry parameters against seasonal changes. But this study was performed on patients with BPH who have been treated with alpha blockers.<sup>[4]</sup>

The UK, South Korea and Japan are temperate countries where there is a clear demarcation between major weather seasons. But however there is no literature available from tropical countries where the seasonal changes are more subtle to almost nonexistent. Also factors like rainfall and humidity differ at large in tropical countries compared to the others. Therefore our study aims to analyze the uroflowmetry parameters and their alterations over a few years and correlate them with the weather changes of that particular time period to look for any associations. It will give a more clear idea as uroflowmetry parameters can be strongly associated with LUTS.

## METHODOLOGY

3843 patients who underwent Uroflowmetry at the Faculty of Medicine, University of Peradeniya from 2014/06/07 to 2021/05/21 were evaluated, along with climate data of the corresponding dates from the nearest climate station (Katugasthota).

- Minimum, maximum and average air temperature.

- Minimum, maximum and average relative humidity.
- Minimum maximum and average rainfall.

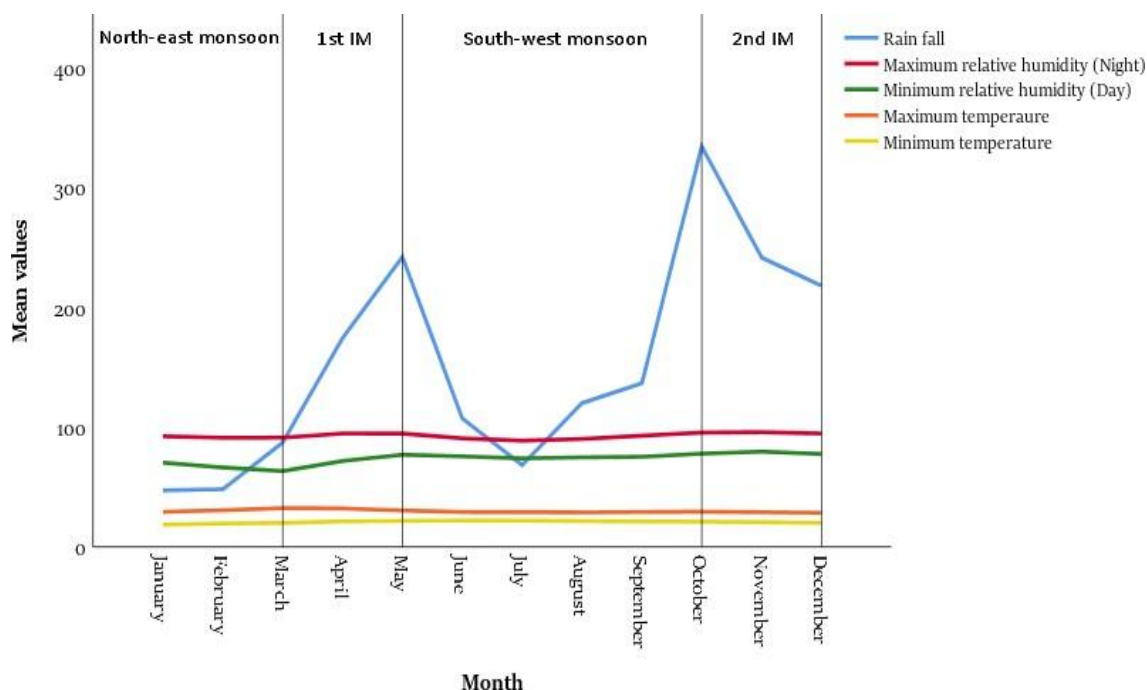
A retrospective study was conducted using the above mentioned datasets to assess the seasonal variation of basic uroflowmetry parameters via IBM SPSS ver.26.

Pearson correlation was used to obtain associations of statistical significance. A significance of <0.05 was accepted for all analysis.

## RESULTS AND DISCUSSION

A total of 3854 patients were enrolled in our study during a period of 8 years. Among the study group, 3484 were male patients (90.7%) while only 358 were female (9.3%). The mean age of all the patients was 61.46 years in an age range of 10 - 94 years.

Plots shown below illustrate the variation of climate factors (Graph 1) and uroflowmetry parameters (Graph 2) throughout the year. According to Graph 2, total void volume and the residual volume are the uroflowmetry parameters which show distinct fluctuations through different seasons.



**Figure 1: Monthly mean values of Rain fall, Maximum relative humidity, Minimum relative humidity, Maximum temperature and Minimum relative humidity, Maximum temperature and Minimum temperature during 2014 June to 2021 May.**

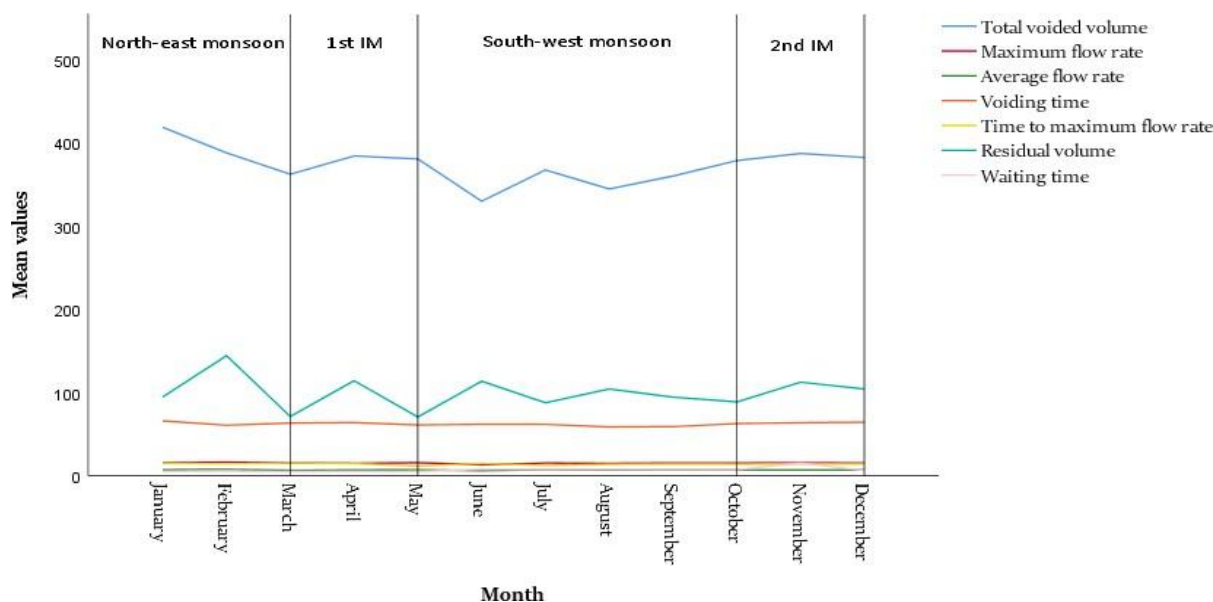


Figure 2: Monthly mean values of Total voided volume, Maximum flow rate, Voiding time, Time of maximum flow rate, Waiting time and Residual volume during 2014 June to 2021 May.

Different uroflowmetry parameters that showed correlation with environmental factors according to the Pearson Correlation are summarized below (Table 1). Although there is no consistent correlation observed

over the whole period, following correlations were revealed between climate factors and different basic uroflowmetry parameters. No correlation was observed in the datasets of 2014 and 2017.

Table 1: Results from Pearson Correlation between uroflowmetry parameters and climate factors from 2014-2021.

	2015	2016		2018			2019		2020			2021			
	Voiding Time	Ave. Flow rate	Voiding Time	Total Voided Volume	Vol. at max. flow	Max. Flow rate	Ave. Flow rate	Max. Flow rate	Ave. Flow rate	Residual Volume	Vol. at max. flow	Voiding Time	Time to Max. Flow	Total Voided Volume	Ave. Flow rate
Rain fall	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0
Max Relative humidity night	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
Min Relative humidity day	0	1	0	0	0	1	1	0	0	1	1	1	1	0	0
Maximum Temperature	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1

1 - Correlation is significant at the 0.05 level (2-tailed)  
 0 - Correlation is not significant at the 0.05 level (2-tailed)

A study carried out in UK over a period of 4 years has found a seasonal variation in nocturia, but not other frequency-volume parameters, symptom severity or uroflowmetry parameters were significant in men with lower urinary tract symptoms.<sup>[1]</sup> Similarly, a study performed on a cohort of South Koreanmen with BPH has shown a change in IPSS score with increasing symptoms in colder climates, but hasn't found a significant correlation of uroflowmetry parameters with above seasonal changes.<sup>[2]</sup> In contrast, a research done in Japan has concluded some correlations between uroflowmetry parameters and climate factors such as temperature.<sup>[3]</sup>

It is clear that the effects of climatic changes on uroflowmetry parameters in various countries with different geographical features have been investigated and contradictory results have been found. Our study includes a comprehensive analysis over a period of 8 years and has revealed correlations between climate

factors (rainfall, temperature and humidity) and basic uroflowmetry parameters with changes in seasons.

**CONCLUSION**

Seasonal variation of basic uroflowmetry parameters was studied compared to north-east monsoon and inter monsoon periods from 2014 – 2021. It can be concluded that, different basic uroflowmetry parameters were associated with climate changes in seasons but didn't show a consistent correlation throughout the 8 years.

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