WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 5.045
Volume 3, Issue 10, 483-487. Research Article ISSN 2277– 7105

# INFLUENCE OF WATER QUALITY ON UROLITHIASIS

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Article Received on
16 September 2014,

Revised on 10 Oct 2014,
Accepted on 03 Nov 2014

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## INTRODUCTION

The beneficial effect of a high fluid intake on stone prevention has long been recognized. Very few studies have examined the relationship between water hardness and the incidence of stone across the world. There have been conflicting data regarding mineral content and water hardness in incidence of urolithiasis. Some studies documented that higher water hardness is associated with higher incidence of urolithiasis. In contrast, other studies found soft water is associated with higher risk of developing urolithisis. In a country like ours, with a heterogenous water resources and a vast difference in its mineral content, we intend to study the association of stone disease with water hardness.

**Objective:** To analyze the impact of water hardness and its mineral content on urolithiasis.

## MATERIALS AND METHODS

Patients presented with history of urolithiasis to the department of urology in BLDEU's Shri B. M. Patil Medical College Hospital and Research Centre Bijapur, Karnataka, India, were included in the study. We have analysed 195 water samples from the patients suffering from urolithiasis and 50 samples from patients who had come for non-urologic diseases to our hospital as a control group.

### Inclusion criteria

1. All patients with Renal and Ureteric calculi
2. Patients confirmed of Urinary stones either by USG or KUB X ray or CT scan presenting to BLDEA's Hospital for the treatment of Stone disease.
3. Age of patient between 5 to 70 years.

**Exclusion Criteria**

1. Urinary Lithiasis due to secondary causes like Anatomical Abnormality of Urinary tract, Bladder outlet obstruction.
2. Stones due to inherited errors of Metabolism.
3. Drug induced Stones.

**RESULTS**

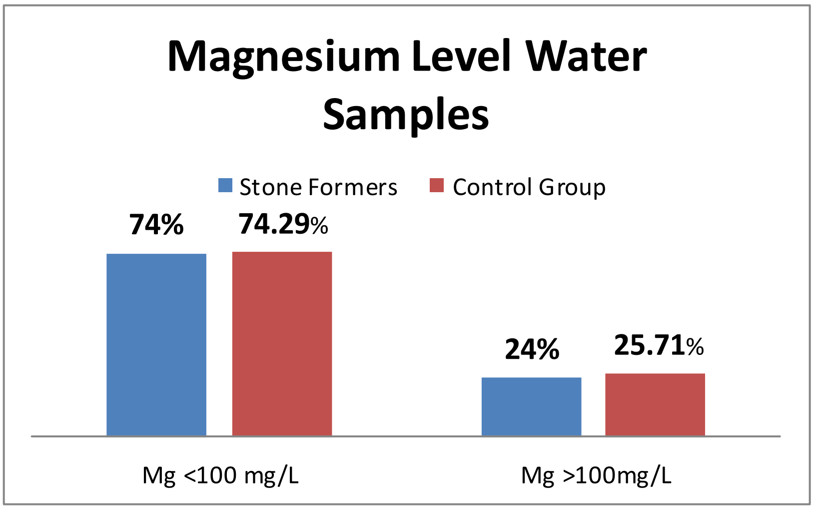
In this study 195 samples of water from patients with urolithiasis and 50 in the control group were analysed. The mean age of the patients was 41.5 years old, and 57.5% of them were male. This study shows water hardness is directly related to increased incidence of urolithiasis. The mineral content i.e. calcium content of 26 (34.6%) water samples and magnesium content of 54 (72%) samples were above the permissible limit of 75mg/l and 30mg/l respectively. The calcium level of the water ranged from 19 mg/L to 380 mg/L (mean, 57.7 ± 4.1 mg/L); magnesium level, from 13.5 mg/L to 210 mg/L (mean, 34.1 ± 24.1 mg/L). The water hardness ranged from 96 ppm to 2408 ppm (mean, 348 ± 176 ppm). More importantly, over 87% of the samples had a very hard (> 180 ppm) water supply. There was no sample with soft water and only 4.2% had slightly hard water.

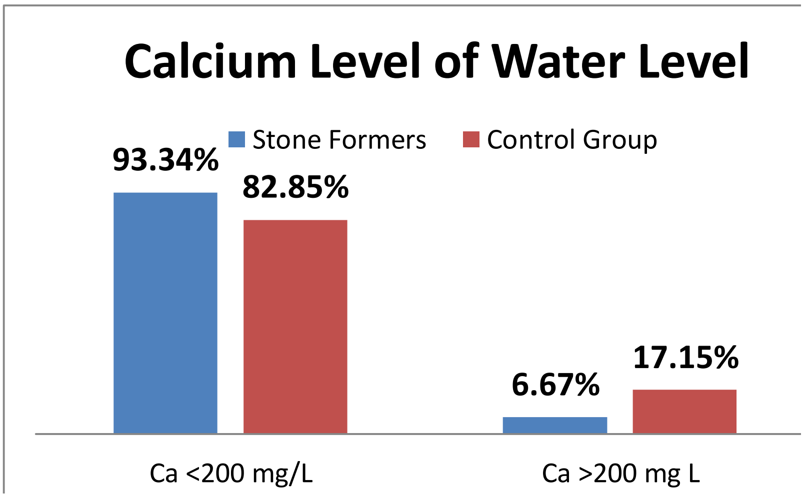
| Water hardness | stone formers n (%) | Control group n(%) |
|---|---|---|
| < 300 ppm | 36(18.46%) | 33 (94.2%) |
| > 301 ppm | 159 (81.54%) | 2 (5.71%) |

| Water hardness | Stone formers n (%) | Control group n (%) | P Value |
|---|---|---|---|
| < 300 ppm | 36(18.46%) | 33 (94.2%) | <0.0001 |
| > 301 ppm | 159 (81.54%) | 2 (5.71%) | |

| | | Stone formers n (%) | Control n (%) | P Value |
|---|---|---|---|---|
| Magnesium | <100 mg/L | 154 (78.97%) | 26 (74.29%) | 0.8457 |
| | >100mg/L | 41 (21.03%) | 9 (25.71%) | |

| | | Stone formers n (%) | Control n (%) | P Value |
|---|---|---|---|---|
| Calcium | <200mg/L | 171 (87.69%) | 29 (82.85%) | 0.0880 |
| | >200mg/L | 24 (12.30%) | 6 (17.15%) | |




## DISCUSSION

Several studies documented that higher water hardness is associated with higher incidence of urolithiasis among the population supplied with such water. In contrast, more studies found softer water to be associated with higher risk for urolithiasis. Nevertheless, most recent epidemiological studies explain these controversial results by differences in the study designs and say that water hardness ranging between the values commonly reported for drinking water is not a significant factor in urolithiasis (Singh et al, 1993; Ripa et al, 1995; Kohri et al, 1993; Kohri et al, 1989). Any correlation between water hardness, or the drinking water calcium or magnesium level, and the incidence of urolithiasis was not found in the last vast USA epidemiological study with 3270 patients (Schwartz et al, 2002). The quoted Japanese studies did not find that the water calcium or magnesium levels alone had an effect on the incidence of urolithiasis. High hardness (>500 mg/l), which is not typical of drinking water, may be associated with higher risk for urinary and salivary stone formation as documented by a Russian epidemiological study (Mudryi, 1999). The author says that a long-term intake of drinking water harder than 500 mg/l results in a higher local blood supply in the kidneys and subsequent adaptation of the filtration and resorption processes in the kidney. This is believed to be a protective reaction of the human body, which may lead, if the conditions persist, to alteration of the body's regulatory system with possible subsequent development of urolithiasis and hypertension. Risk for urolithiasis was also associated with intake of water with a hardness of 1050 mg/l (Ca 370 mg/l) as documented by the already quoted Italian study (Coen et al, 2001). In the areas of the Tula region supplied with drinking water harder than 500 mg/l, higher incidence rates of cholelithiasis, urolithiasis, arthrosis and arthropathies as compared with those supplied with softer water were reported (Muzalevskaya et al, 1993). Although many pathophysiological studies have shown a prophylactic role for magnesium ingestion and risk for urinary calculus formation.5,13-20,25,26 The relation between magnesium content of drinking water and urolithiasis incidence is not well clear in epidemiological studies. Others did not observe any significant role for magnesium in the urinary calculus incidence.5,7 Kohri and coworkers collected tap water in 85major cities throughout Japan and examined the relationship between the nature of the water and the soil, and the urolithiasis incidences available from a previous epidemiological study. In their study, calcium and magnesium levels of the tap water were not correlated with urinary calculus incidence. Nevertheless, they observed that the magnesium calcium ratio of the tap water in different geological areas was negatively correlated with the incidence of calcium-containing urinary calculi.21,22 Their study has shown a marginally significant inverse correlation between the magnesium level of the tap water and the urolithiasis rate of that city.

## CONCLUSION

Though the cause of urolithiasis is very complex and wide, in this study, the major cause is the presence of water hardness, and high amount of magnesium in the drinking water.

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