

**Original Research Article**

<http://s-o-i.org/1.15/ijcrms-2016-2-3-1>

**Analyses of the impact of dietary habits on the risk of urolithiasis  
occurrence and recurrence**

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**Abstract**

**Introduction:** Urolithiasis affects mainly people of working age and due to its recurrent course often leads to disability. That's why, the prevention of incidence and progression of urolithiasis is an important task. **Objective:** To study the possible relationships between dietary habits and urolithiasis occurrence and recurrence. **Materials and methods:** It was conducted a retrospective epidemiological study of a representative sample of 443 patients with urolithiasis – basic group (403 of them - without recurrences and 40 - with recurrences) and 203 patients with other predominantly acute urological pathology – control group, who were in urologic in-patient departments of health care facilities of Ivano-Frankivsk region. **Results:** There were found no sufficient evidences that the quantity and quality of drinking water, starvation, predominant use of caffeinated drinks, spicy, salty, meat or dairy products, fruits and vegetables impact on the risk of urolithiasis occurrence and recurrence. It was established significant differences in diet and water regime depending on age, sex and place of residence of patients. **Conclusions:** Received results, on the background of contradictory data of other similar studies, point out to the further necessity of more detailed prospective.

**Keywords:** Urolithiasis, dietary habits.

**Introduction**

Urolithiasis is a chronic relapsing disease that is characterized by high prevalence in the world and a tendency to increase (Vozyanov AF et al, 2010). In particular, for the last ten years in Ukraine the part of urolithiasis varies between 0.4% -5.4% in the structure of prevalence (Mosienko GP, 2013).

Actuality of the problem is accentuated by the fact that urolithiasis affects mainly people of working age and often leads to disability of patients (Ermolenko TI, 2013). That's why the prevention of occurrence and recurrence of

urolithiasis becomes predominantly important (Mennuni G et al., 2015).

The results of research show that urolithiasis is the multifactor disease, based on upsetting of water-salt balance (Mosienko GP, 2013; Mennuni G et al., 2015). However, most scientists believe that modern lifestyle, dietary habits and overweight (problems of the affluent societies) emerge to be the important promoters of the "stone-boom" in the new millennium [Fink HA et al., 2015).

**Objective** of research was to study possible relationships between dietary habits and urolithiasis occurrence and recurrence.

**Materials and Methods**

It was carried out a survey of representative sample of 443 patients with urolithiasis (basic group) and 203 patients with other mainly acute urological pathologies (control group) who were hospitalized to urologic departments of health care facilities of Ivano-Frankivsk region.

Control group included mainly patients with acute pyelonephritis (63.1%), acute prostatitis (11.3%), and hyperplasia of the prostate (8.9%), acute cystitis (5.9%) and other (hydrocele, phimosis, acute orhoepidydmid, urethral stricture – in total 10.8%). Because the basic group was formed by chronic patients and control – by acute, in age structure patients with urolithiasis were somewhat "older": 50.8% of them (vs. 32.0% in the control group) were over the age of 50 years. The two groups did not differ by sex and place of residence and evenly (about 50%) were represented by male and female and residents of urban and rural areas.

In order to identify risk factors of urolithiasis recurrence, the basic group was divided into two subgroups: without recurrences (403 patients) and with recurrences (40 patients).

Outcomes of research have been received mainly as qualitative data. That’s why there were used ways of calculation: the each factor prevalence

per 100 respondents and the standard error for relative values. The estimation of the reliability of the data difference in the comparison groups was performed by using 2 test (Forthofer RN et al., 2007).

The uneven age structure of compared groups eliminated using the direct method of standardization (Forthofer RN et al., 2007).

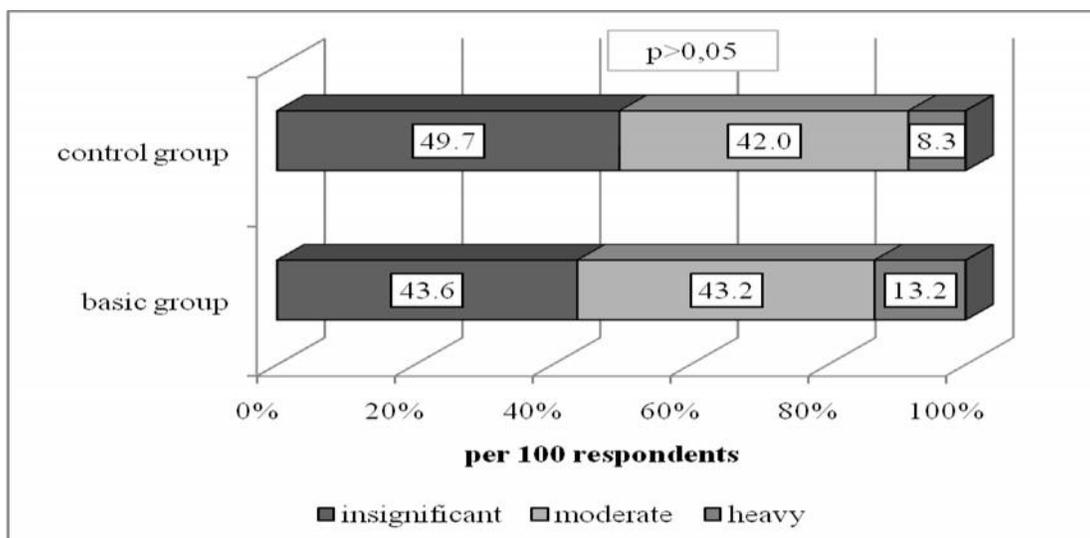
Taking into account that our research has retrospective epidemiological design, method of calculation of the Odds Ratio and its 95% Confidential Interval were used to identify risk factors of urolithiasis occurrence and recurrence (Forthofer RN et al., 2007).

**Results**

It was established that greater share of respondents with urolithiasis, regardless of their age and sex, usually drink raw water – 55.4 ± 2.4% vs. 44.6 ± 2.4%, who prefer boiled water. It is clear that rural residents drink raw water more often – 68.7 ± 3.1% vs. 42.2 ± 3.3% in urban areas (p<0.001).

However, the relationship between the preferences of consumed raw water and the presence of urolithiasis (OR = 0.71; 95% CI = 0.37-1.35) or its recurrence (1.04; 0.74-1.45) were found neither in crude nor standardized by age rates (p>0.05).

Also it was not established the relationship concerning the hardness of water determined on the base of respondents` estimates of intensity of sediment that falls after boiling (Fig. 1).



**Fig. 1.** Respondents' assessment consumed water hardness (by sediment after boiling)

As shown in Fig. 1, patients with urolithiasis more often used water that gives moderate or heavy sediment, but statistically significant confirmation of it was not received (0.93; 0.35-2.49;  $p>0.05$ ). It was not also established significant difference by this criterion between groups of patients with recurrent urolithiasis and without it (1.69; 0.94-3.02;  $p>0.05$ ).

Basic and control groups were almost equally distributed by the average daily water consumption ( $p>0.05$ ). Although doctors recommend to patients with urolithiasis to drink more than 2 liters of fluid a day, just  $7.3 \pm 1.2\%$  of the basic group, regardless of their age, place of residence and presence of recurrence, followed this advice. Another  $23.5 \pm 2.0\%$  used therapeutically acceptable volume of fluid - 1.5-2 liters per day. The rest two-thirds of respondents consumed insufficient quantity of water:  $46.1 \pm 2.4\%$  of them drank in average 1-1.5 of fluid per day and  $23.1 \pm 2.0\%$  less than one liter. Moreover, among women with urolithiasis, as well as among ones in the control group, the proportion of the last were significantly higher ( $p<0.001$ ) than among men: almost a third of them consumed less than one liter of water during the day (31.4% women of the basic group and 28.2% of control group vs. 14.2% and 11.0% respectively).

There were not received sufficient evidence that low consumption of water affects the stone formation recurrence (OR = 1.13; 95% CI = 0.75-1.69;  $p>0.05$ ).

There were received either insufficient evidence of the relationship between consumption of caffeinated drinks (tea, coffee, cola, etc.) with the occurrence and recurrence of urolithiasis. Almost 40% of respondents ( $36.5 \pm 2.5\%$  of patients with urolithiasis and  $38.9 \pm 3.6\%$  of respondents in the control group,  $p>0.05$ ), regardless of gender and place of residence, always use these products and only  $23.0 \pm 2.2\%$  and  $18.9 \pm 2.9\%$  respectively – completely expelled them from their ration. Use of caffeinated drinks significantly decreased only with the age ( $p<0.001$ ), which may be connected with well-known age-related outspread of cardiovascular disease, including hypertension.

Another factor, which according to the research can promote stone formation, is a long-term starvation. In our study there were not found significant difference of these data between the control group and patients with urolithiasis, the presence or absence of recurrences ( $p>0.05$ ), and the corresponding calculations of Odds ratio was 4.38 (0.82-23.37) and 1.50 (0.31-7.28). Thus, the absolute majority of respondents of the basic group ( $78.7 \pm 2.0\%$ ) said that they never faced long-term starvation. But one in five respondents ( $19.7 \pm 1.9\%$ ) had such experience, few respondents (7 persons or  $1.6 \pm 0.6\%$ ) frequently practiced starvation. It should be noted that those phenomena were more widespread among persons of 30-39 years ( $37.7 \pm 5.8\%$ ,  $p<0.01$ ) and women ( $28.0 \pm 3.0\%$  vs  $14.2 \pm 2.4\%$  men,  $p<0.01$ ), which obviously starve or follow strict diets because of cosmetic reasons.

The analysis of other dietary habits found out that there is no significant difference between any of the compared groups concerning regularity eating ( $p>0.05$ ). It is shown that the majority of respondents of the basic group followed three times regime of nutrition ( $64.5 \pm 2.3\%$ ) and  $18.7 \pm 1.9\%$  – four times.

The nutrition rationality estimated by the frequency of consumption fresh fruits and vegetables. It was established that only half of the responded patients with urolithiasis ( $54.1 \pm 2.5\%$ ), regardless of their age, place of residence and presence of recurrences, take them constantly, and the rest – from time to time. Similar proportions and peculiarities were typical for respondents in the control group, both by crude and age-standardized rates ( $p>0.05$ ). It should be mentioned that women more often follow balanced diet than men. Thus,  $63.5 \pm 3.3\%$  of them constantly include to their diet fresh fruits and vegetables, while men - only  $44.6 \pm 3.5\%$  ( $p<0.001$ ). However, there are not enough evidences that the use of these products reduces the chances of urolithiasis occurrence (OR = 0.63; 95% CI = 0.28-1.38) and its recurrence (1.03; 0.71-1.49;  $p>0.05$ ).

Overall irrational type of nutrition is confirmed by data on preferences to consumption spices and salt which increase the acidity of urine and provoke stone formation. Only  $21.7 \pm 2.0\%$  of responded patients with urolithiasis follow the recommended limitation of eating spicy and salty foods. The rest – which is the majority, use these products where  $17.5 \pm 1.9\%$  – permanently. The last indicator is less spread among women than men ( $12.2 \pm 2.3\%$  vs.  $22.9 \pm 3.0\%$ ,  $p < 0.001$ ) and significantly decreases with age (from  $26.1\%$  under the age of 30 to  $7.3\%$  at the age of 60 and older,  $p < 0.001$ ). It was not established significant difference in the prevalence of eating spicy and salty foods in the control group ( $p > 0.05$ ) and in the groups with presence and absence of recurrence ( $p > 0.05$ ), which means that there are not proofs that this factor leads to incidence (1.42; 0.57-3.54) and progression of the disease (1.05; 0.70-1.59). At the same time, the elimination of inconsistency between age structures in compared groups using the method of standardization showed that the proportion of people who prefer spicy and salty food would be even higher among patients with urolithiasis. Obviously, with the occurrence and the progression of the disease, patients receiving medical advice about the diet, follow more healthy type of nutrition. In our opinion, received data confirm that this factor should be taken into account in prevention programs of stone formation.

Results of the survey concerning the rate of meat products eating, which may be risk factors for stone formation, shown that almost for 40% of patients with urolithiasis ( $40.5 \pm 2.4\%$ ) it is a permanent component of the diet. The intake of meat products also decreases with age to  $28.7\%$  among over 60-year-olds ( $p < 0.001$ ).

Moreover, the highest level of this indicator occurs in the age of 40-49 years –  $56.3\%$ . As according to the previous characteristics, women were more disciplined than men: among them there are less of those who eat meat constantly ( $32.7 \pm 3.3\%$  to  $48.7 \pm 3.5\%$  respectively,  $p < 0.01$ ). However, there were not established significant differences in comparison to the control group concerning the prevalence of meat products consumption, either by crude or by age-standardized rates ( $p > 0.05$ ). In the study there were not also received sufficient evidence that eating meat leads to recurrence of stone formation (1.57; 0.49-5.02;  $p > 0.05$ ).

More than a third of patients with urolithiasis ( $35.6 \pm 2.4\%$ ), regardless of age and gender, indicated that they constantly eat dairy products. These dietary habits are more typical for rural residents ( $45.2 \pm 3.5\%$  vs.  $26.0 \pm 3.1\%$  in the cities,  $p < 0.001$ ). Prevalence of dairy products intake in the control group was the same as in the basic one ( $p > 0.05$ ). At the same time, as seen in Fig.2, there is a difference in the rates of dairy products consumption among patients with and without recurrence of urolithiasis ( $p < 0.05$ ).

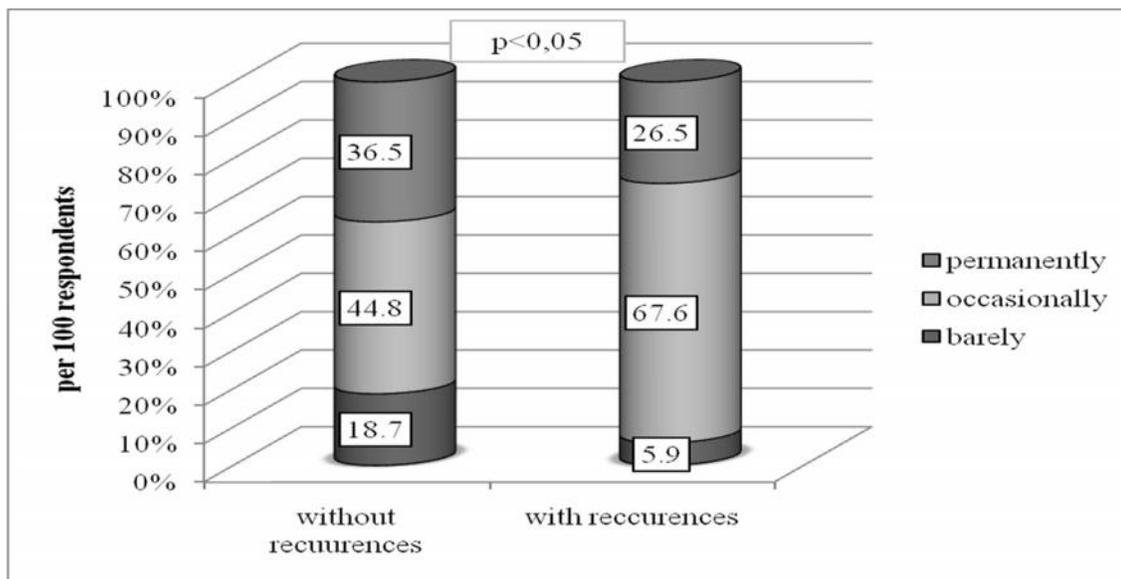


Fig. 2. The prevalence of dairy products consumption among patients with and without recurrence of urolithiasis

Although respondents with recurrent urolithiasis fewer pointed out that they permanently use such products (26.5% vs. 36.5% of respondents with no recurrence of urolithiasis), but among them there are three times less of those who almost don't consume them in their diet (5.9% vs. 18.7%). However, there were not obtained sufficient evidence that milk drinking impact the any risk of urolithiasis occurrence (0.63; 0.28-1.38) or its recurrence (1.03; 0.1-1.49) ( $p>0.05$ ).

## Discussion

In similar scientific studies it is also showed that the quality and quantity of consumed water, has an impact on the occurrence and progression of urolithiasis. In particular, Abeywickrama B. and others (2015) showed that the hardness of drinking water is closely connected to stone formation. Many scientists believe that the regulation of fluid intake toward increasing to 2-3 liters per day is important in complex prevention and metaphylaxis of urolithiasis (Agarwal MM et al., 2011; Dai Met al., 2013; Fink HA et al., 2013; Friedlander JI et al., 2015; Xu Cet al., 2015).

However, there were not received definite answers to the questions about the relationship between consumption of caffeinated drinks – coffee, tea, Coca-Cola and urolithiasis. For example, in studies of Dirk J. Kok (2012) and Wang J, and others (2013) there were received data, that drinking tea in a large amounts may be an independent risk factor of urolithiasis. However, in Xu C. and others` research (2015) there were received quite opposite results, which show that increase of tea consumption, on the contrary, reduces the risk of stone formation.

Opinions of scientists about the impact of coffee consumption on stone formation are also quite contradictory. On the one hand, Ferraro PM and others (2014) according to the results of three independent cohort studies and Wang S. and coauthors (2014) according to the results of the systematic review and meta-analysis declare that drinking coffee reduces the risk of urolithiasis. However, according to the results of another meta-analysis which was conducted by Xu C. and others (2015), the data were not confirmed. Passman CM and coauthors (2009) believe that

Coca-Cola drinking increases the risk of urolithiasis.

Some researchers obtained evidence concerning the impact of starvation on the increased risk of urolithiasis (Siener R, 2006; Dirk J, 2012).

Opinions of scientists concerning the relationship between the consumption of meat and salty foods and stone formation are almost identical. The excessive consumption of animal protein and salt is considered to be the most important risk factor for the formation of calcium oxalate stones (Taylor E.N. et al., 2004; Siener R. et al., 2005; Dirk J, 2012; Robertson WG, 2015).

The outcomes concerning the consumption of fruits and vegetables are controversial. In the study Women's Health Initiative it was showed that their use reduces the risk of urolithiasis in women during menopause (Sorensen MD et al., 2014). Dirk J. Kok (2012) recommends compensating the reduction of meat products consumption by sufficient quantity of fruits and vegetables. At the same time, Dai M. and others (2013) warned that consumption of leafy vegetables more than 3 times a day is closely connected with the risk of stone formation in men and women.

Xu C. and coauthors (2015) according to a systematic review and meta-analysis showed that there are not sufficient evidences of the relationship between milk consumption and the risk of urolithiasis. On the other hand, Dirk J. Kok (2012) recommends adding milk to tea in order to reduce the risk of stone formation.

In spite of the existence of contradictory data concerning the impact of different products and drinks use to urolithiasis, Straub M and coauthors (2005) believe that approximately 75% of such patients can prevent recurrent stone formation only by change of their lifestyle and eating habits. However, most scientists underline the importance of an individual approach to the correcting of eating habits.

## Conclusion

In retrospective analytical study there were found no sufficient evidences that the quantity and quality of drinking water, starvation, predominant use of caffeinated drinks, spicy, salty, meat or dairy products, fruits and vegetables impact on the risk of urolithiasis occurrence and recurrence.

Established significant differences in diet and water regime depending on age, sex and place of residence of patients, on the background of contradictory data of other similar studies, point out to the further necessity of more detailed prospective studies of dietary habits impact on the occurrence and mechanisms of stones formation in urinary tract.

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**How to cite this article:**

Oryna Detsyk, Dmytro Solomchak. (2016). Analyses of the impact of dietary habits on the risk of urolithiasis occurrence and recurrence. *Int. J. Curr. Res. Med. Sci.* 2(3): 1-7.