Comparative epidemiological studies of urolithiasis among the population of the North-Western Region of The Azerbaijan Republic

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Abstract. Many epidemiological studies have addressed the role of excess body weight in the formation of kidney stones disease (KSD). We enrolled patients with KSD (1,032 patients) who in 2007-2011 were referred to the medical examination and in-patient treatment at the following central hospitals of the North-West geographical areas of the Republic of Azerbaijan consisting of Shekinsky, Zagatalsky, Balakensky, Oguzsky, Gahsky and Gabalinsky districts. During overall analysis of our study considering all the named areas we should note some generalized outcomes: a) when considering the relationship between the age of the patients and the development of KSD we revealed that in most cases patients within 2 age groups 16-30 and 41-50 years were at the high risk; b) when considering the relationship between body mass index (BMI) and the development of KSD we found that patients within 2 BMI groups 25.0-29.9 and 30.0-34.9 kg/m^2 were at the high risk. Finally, taking into account the above-noted summary information for each specific area and overall analysis we revealed subjects that must comply with prevention measures for KSD more carefully. These include unemployed males and those who have sedentary lifestyle, are overweight, belong to the older age group and particularly live in rural areas.
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Introduction

Kidney stone disease (KSD) is regarded to be one of the most urgent problems of the urology science in the past and at the present.

Studies of Soucie et al. indicated that 10% of the United States men and 4% of the women have a probability of kidney stone disease development [1, 2]. Eventually there's an increase in the gender difference of patients suffering from kidney stone disease from 1.8:1 to 3.8:1. In men the chance of developing kidney stones in the 3rd and 7th decades of life is 2-5 times higher compared to women.

In general, KSD includes oxalates, phosphates, urates, struvites (magnesium ammonium phosphate) and cystine. In 52% of patients from the test group we revealed stones consisting of oxalates, 13% phosphates, 15% of the mixture of oxalates and phosphates, 4% struvites, 8% urates and 8% of other components [3, 4].In two thirds of patients with stone disease there's a probability of recurrent formation of stones within 8 years. KSD is more often observed in patients from the age group of 30-60 years.

The geographical regions where the prevalence of kidney stone disease is higher include countries of the White Sea, East India, Northern Australia, Central Europe, Malaysia, Middle America. These are often referred to as "stone belt". In particular, sedentary and static work is regarded as a considerable risk factor in the formation of a kidney stone. Diet for KSD is considered to be a very important etiological factor [5, 6]. Main health risks in the development of KSD may include age, gender, profession, social class (the level of welfare) of the patient, seasons and climatic factors, diet and fluid intake and genetic features [7]. We investigated epidemiological factors that can be considered as a risk factor for the development of KSD. These include age, race, education, body mass, arterial pressure of patients, intake of vitamin C and diuretics [8]. People with overweight are at high risk of KSD. Thus, *the body mass index* (BMI) of more than 30 kg/m^2 is considered to be a risk factor for the development of KSD [9]. Diet and lifestyle of patients are also considered to be considerable risk factors for the development of KSD. In order to study this issue we used the following index called BMI [10]. The main purpose of our study is a comparative analysis of Kidney stone disease (KSD) by a number of epidemiological risk factors among the population of the North-West geographical areas of the Republic of Azerbaijan consisting of Shekinsky, Zagatalsky, Balakensky, Oguzsky, Gahsky and Gabalinsky districts.

Materials and methods

We enrolled patients with KSD (1,032 patients) who in 2007-2011 were referred to the medical examination and in-patient treatment at the following central hospitals of the North-West geographical areas of the Republic of Azerbaijan consisting of Shekinsky, Zagatalsky, Balakensky, Oguzsky, Gahsky and Gabalinsky districts.

Results and discussion

Results of the study are as follows: distribution of patients by gender, average age level,

minimum and maximum age limits, male/female ratio, marital status, profession, geographic status of residence, age and BMI of patients, etc.

Table 1. The number of patients with Kidney stone disease by gender, average age level, male/female ratio, and the distribution of the minimum/maximum age limit

Districts	Research subjects				
	Number and percentage of patients by gender ((n) (p% ± mp))		Average age level in the total number of patients (M ± m)	Minimum and maximum age limit	Male/female ratio among patients
	Males	Females			
Shekinsky	250 (78.37 ± 2.31%)	69 (21.63 ± 2.31%)	40.19 ± 0.90	>7 <86	3.6/1
Zagatalsky	151 (69.59 ± 3.12%)	66 (30.41 ± 3.12%)	50.80 ± 1.25	>2 <84	2.29/1
Balakensky	98 (55.68 ± 3.74%)	78 (44.32 ± 3.74%)	43.03 ± 1.34	>10 <83	1.26/1
Oguzsky	95 (75.40 ± 3.84%)	31 (24.60 ± 3.84%)	41.33 ± 1.07	>12 <81	3.06/1
Gahsky	51 (62.20 ± 5.35%)	31 (37.80 ± 5.35%)	44.60 ± 1.84	>8 <83	1.64/1
Gabalinsky	60 (53.57 ± 4.71%)	52 (46.43 ± 4.71%)	40.91 ± 1.73	>15 <80	1.15/1
Summary	705 (68.31 ± 1.45%)	327 (31.69 ± 1.45%)	44.16 ± 0.54	>2 <86	2.16/1

If you look at the prevalence and percentage of patients by gender (male/female ratio), the incidence of KSD in males in all areas was relatively higher. But this result in each area was presented by various indicators. So, in Shekinsky (78.37%/21.63%) and Oguzsky (75.40%/24.60%) districts there was a big difference in the ratio of males/females. However this difference was low in Balakensky (55.68%/44.32%) and Gabalinsky (53.57%/46.43%) districts. In Zagatalsky (69.59%/30.41%) and Gahsky (62.20%/37.80%) districts the ratio of male/female difference was average. In the overall number of patients there was a moderate difference in the ratio of male/female (68.31%/31.69%).

The average age level of the patients in Zagatalsky district (50.80 years) was higher than in other areas. While in other areas the average age level (40-44) was approximately equal.

Professional or craft activity of patients was the next subject of the study. It can be clearly seen in the following table (Table 2).

Table 2. Distribution of patients with Kidney stone disease by professional and craft activity

Districts	Groups of patients by the type of professional and craft activity					
	Physical work n1 n% ± SD	Sedentary work n2 n% ± SD	Student/Pupil n3 n% ± SD	Unemployed n4 n% ± SD	Pensioner n5 n% ± SD	Disabled n6 n% ± SD
Shekinsky	64 (20.06±2.24)	91 (28.53±2.53)	46 (14.42±1.97)	86 (26.96±2.48)	30 (9.40±1.63)	2 (0.63±0.44)
Zagatalsky	17 (7.83±1.82)	22 (10.14±2.05)	12 (5.53±1.55)	78 (35.94±3.26)	79 (36.41±3.27)	9 (4.15±1.35)
Balakensky	12 (6.82±1.90)	21 (11.93±2.44)	14 (7.95±2.04)	73 (41.48±3.71)	49 (27.84±3.38)	7 (3.98±1.47)
Oguzsky	21 (16.67±3.32)	82 (65.08±4.25)	4 (3.17±1.56)	16 (12.70±2.97)	3 (2.38±1.36)	0 (0.00±0.00)
Gahsky	3 (3.66±2.07)	14 (17.07±4.16)	8 (9.76±3.28)	33 (40.24±5.42)	18 (21.95±4.57)	6 (7.32±2.88)
Gabalinsky	7 (6.25±2.29)	18 (16.07±3.47)	7 (6.25±2.29)	67 (59.82±4.63)	10 (8.93±2.69)	3 (2.68±1.53)
Summary	124 (12.02±1.01)	248 (24.03±1.33)	91 (8.82±0.88)	353 (34.21±1.48)	189 (18.31±1.20)	27 (2.62±0.50)

In Shekinsky district group of patients involved in sedentary work (91 patients (28.53 ± 2.53%)) prevailed over other groups. In Zagatalsky district unemployed and pensioners were prevalent (78 patients (35.94 ± 3.26%) and (79 patients (36.41 ± 3.27%)) respectively. In Balakensky district the most prevalent group consisted of unemployed patients (73 patients (41.48 ± 3.71%)), while in Oguzsky district - group of patients involved in sedentary work (82 patients (65.08 ± 4.25%)). In Gahsky the group of unemployed patients (33 patients (40.24 ± 5.42%)) prevailed over other groups and similarly in the Gabalinsky district the group of unemployed patients (67 patients (59.82 ± 4.63%)) was the major one. Unemployed patients (353 patients (34.21 ± 1.48%)) prevailed over other groups in all the areas.

Another part of our study was aimed at the relationship between age indicators and BMI of patients.

In the first instance you can see a comparative analysis of patients with age-related indicators for each studied geographical area and in general, as well as their relationship with the development of KSD.

Description of the relationship between age and the development of KSD in patients is presented below:

The number of patients in the age groups of 16-30 year-old and 41-50 year-old prevailed over other groups: in Shekinsky district (16-30 year-old group - 101 patients (31.66 ± 2.60%), 41-50 year-old group - 83 patients (26.02 ± 2.46%)), in Gabalinsky district (16-30 year-old group - 38 patients (33.93 ± 4.47%), 41-50 year-old group - 29 patients (25.89 ± 4.14%)), in Gahsky district (16-30 year-old group - 16 patients (19.51 ± 4.38%), 41-50 year-old group - 22 patients (26.83 ± 4.89%)). In the total number of patients (16-30 year-old group - 238 patients (23.06 ± 1.31%), 41-50 year-old group - 240 patients (23.26 ± 1.32%)) there was a similar trend.

While in Zagatalsky district *(41-50 year-old group - 40 patients (18.43 ± 2.63%)*, >71 year-old group - 43 patients (19.82 ± 2.71%)) 41-50 year-old and >71 year old age groups were predominant compared to other age groups, in Balakensky district (16-30 year-old age group - 36 patients (20.45 ± 3.04%), 51-60 year-old group - 37 patients (21.02 ± 3.07%)) patient from 16-30 and 51-60 year-old age groups were more prevalent compared to other groups.

In Oguzsky district (31-40 year-old age group - 39 patients (30.95 ± 4.12%), 41-50 year-old age group - 41 patients (32.54 ± 4.17%)) a number of patients from 31-40 and 41-50 year-old age groups prevailed compared to other groups.

Table 3. Comparative analysis of the number of patients with Kidney stone disease by age indicators

Districts	Distribution of patients with Kidney stone disease age indicators						
	<15	16-30	31-40	41-50	51-60	61-70	> 71
	n1 % ± SD	n2 % ± SD	n3 % ± SD	n4 % ± SD	n5 % ± SD	n6 % ± SD	n7 % ± SD
Shekinsky	5 (1.57±0.70)	101 (31.66±2.60)	55 (17.24±2.11)	83 (26.02±2.46)	45 (14.11±1.95)	13 (4.08±1.11)	17 (5.33±1.26)
Zagatalsky	7 (3.23±1.20)	27 (12.44±2.24)	34 (15.67±2.47)	40 (18.43±2.63)	33 (15.21±2.44)	33 (15.21±2.44)	43 (19.82±2.71)
Balakensky	2 (1.14±0.80)	36 (20.45±3.04)	32 (18.18±2.91)	25 (14.20±2.63)	37 (21.02±3.07)	23 (13.07±2.54)	21 (11.93±2.44)
Oguzsky	1 (0.79±0.79)	20 (15.87±3.26)	39 (30.95±4.12)	41 (32.54±4.17)	20 (15.87±3.26)	2 (1.59±1.11)	3 (2.38±1.36)
Gahsky	3 (3.66±2.07)	16 (19.51±4.38)	13 (15.85±4.03)	22 (26.83±4.89)	14 (17.07±4.16)	8 (9.76±3.28)	6 (7.32±2.88)
Gabalinsky	3 (2.68±1.53)	38 (33.93±4.47)	12 (10.71±2.92)	29 (25.89±4.14)	13 (11.61±3.03)	7 (6.25±2.29)	10 (8.93±2.69)
Summary	21 (2.03±0.44)	238 (23.06±1.31)	185 (17.93±1.19)	240 (23.26±3.2)	162 (15.70±1.13)	86 (8.33±0.86)	100 (9.69±0.92)

Now we will present the results regarding the relationship between BMI and the development of KSD for each area and in general, as well as their explanation.

Table 4. Comparative description of patients with Kidney stone disease by the value of body mass index (BMI)

Districts	Distribution of patients with Kidney stone disease by body mass index.					
	<18.5 kg/m^2	18.5-24.9 kg/m^2	25-29.9 kg/m^2	30-34.9 kg/m^2	35-39.9 kg/m^2	> 40 kg/m^2
	n1 % ± SD	n2 % ± SD	n3 % ± SD	n4 % ± SD	n5 % ± SD	n6 % ± SD
Shekinsky	9 (2.82±0.93)	100 (31.35±2.60)	176 (55.17±2.78)	32 (10.03±1.68)	2 (0.63±0.44)	0 (0.00±0.00)
Zagatalsky	11 (5.07±1.49)	98 (45.16±3.38)	88 (40.55±3.33)	15 (6.91±1.72)	4 (1.84±0.91)	1 (0.46±0.46)
Balakensky	2 (1.14±0.80)	63 (35.80±3.61)	77 (43.75±3.74)	28 (15.91±2.76)	6 (3.41±1.37)	0 (0.00±0.00)
Oguzsky	1 (0.79±0.79)	13 (10.32±2.71)	60 (47.62±4.45)	41 (32.54±4.17)	11 (8.73±2.51)	0 (0.00±0.00)
Gahsky	3 (3.66±2.07)	15 (18.29±4.27)	33 (40.24±5.42)	23 (28.05±4.96)	7 (8.54±3.09)	1 (1.22±1.21)
Gabalinsky	3 (2.68±1.53)	34 (30.36±4.34)	50 (44.64±4.70)	23 (20.54±3.82)	2 (1.79±1.25)	0 (0.00±0.00)
Summary	29 (2.81±0.51)	323 (31.30±1.44)	484 (46.90±1.55)	162 (15.70±1.13)	32 (3.10±0.54)	2 (0.19±0.14)

Description of the relationship between BMI and the development of KSD is presented below:

The number of patients was particularly higher in the group with BMI 25-29.9 kg/m^2 compared to patients from the other BMI groups in the following districts: in Shekinsky district (BMI 25-29.9 kg/m^2 - 176 patients (55.17 ± 2.78%)), Balakensky district (BMI 25-29.9 kg/m^2 - 77 patients (43.75 ± 3.74%)), Gabalinsky district (BMI 25-29.9 kg/m^2 - 50 patients (44.64 ± 4.70%)) and in general (BMI 25-29.9 kg/m^2 - 484 patients (46.90 ± 1.55%)).

The number of patients was particularly higher in the group of patients with BMI 25.0-29.9 kg/m^2 and 30.0-34.9 kg/m^2 compared to patients from the other BMI groups in the following districts: Oguzsky district (BMI 25.0-29.9 kg/m^2 - 60 patients (47.62 ± 4.45%), BMI 30.0-34.9 kg/m^2 - 41 patients (32.54 ± 4.17%)), Gahsky district (BMI 18.5-24.9

kg/m^2 - 33 patients (40.24 ± 5.42%), BMI 25-29.9 kg/m^2 - 23 patients (28.05 ± 4.96%)).

The number of patients with BMI 18.5-24.9 kg/m^2 was higher than patients from other BMI groups in Zagatalsky district (BMI group 18.5-24.9 kg/m^2 - 98 patients (45.16 ± 3.38%) area.
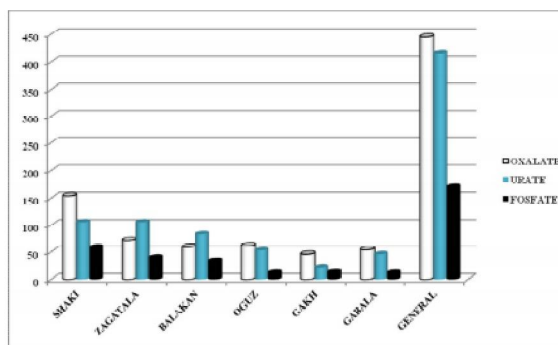

Figure 1. Comparative analysis of patients with kidney stone disease on mineral and salt composition of urinary stones.

The number of patients in the group with oxalate-mineral stone composition was particularly higher in comparison with other groups while at the second place were stones with urate-mineral stone composition: in Shekinsky district, (oxalate group - 154 patients (48.28 ± 2.80%), urate group - 106 patients (33.23 ± 2. 64%)), Oguzsky district (oxalate group - 61 patient (48.41 ± 4.45%), urate group - 53 patients (42.06 ± 4.40%)), Gahsky district (oxalate group - 46 patients (56.10 ± 5.48%), urate group - 23 patients (28.05 ± 4.96%)), Gabalinsky district (oxalate group - 54 patients (48.21 ± 4.72%), urate group - 46 patients (41.07 ± 4.65%)) areas in general (oxalate group - 445 patients (43.12 ± 1.54%), urate group - 417 patients (40.41 ± 1.53%)).

On the contrary the number of patients in the urate-mineral stone composition significantly prevailed over other groups, while the second place was taken by a group of patients with oxalate-mineral stones composition: in Zagatalsky district (urate group -106 patients (48.85 ± 3.39%), oxalate group -71 patients (32.72 ± 3.19%)) and Balakensky district, (urate group -83 patients (47.16 ± 3.76%), oxalate group -59 patients (33.52 ± 3.56%)).

In all cases renal stones with phosphate-mineral salt composition were at the last place in the overall number of patients.

CONCLUSION

During general analysis of our study considering all the areas we should note some general outcomes: a) in the general consideration of the relationship between professional or craft activity in patients with KSD and the process of renal stones

development sedentary work and unemployed lifestyle were prevalent; b) on considering the relationship between age and the development of KSD in most cases patients from the age groups of 16-30 and 41-50 years were at high risk; c) analysis of the relationship between BMI and the development of KSD revealed that patients from BMI groups 25.0-29.9 and 30.0-34.9 kg/m^2 are at the highest risk; g) when considering mineral salt composition of urinary stones the most common was oxalate-mineral composition and at the second place were urates.

Conclusion

Finally, taking into account the above-noted summary information for each specific area and overall analysis we revealed subjects that must comply with prevention measures for KSD more carefully. These include unemployed males and those who have sedentary lifestyle, are overweight, belong to the older age group and particularly live in rural areas.

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