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THE EFFECT OF LONG-TERM AND REGULAR EXERCISES ON PREVENTING THE KIDNEY STONES

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Abstract. **Aim.** As the incidence of kidney stones increases, more research is needed to understand the lifestyle factors associated with it. So we examined the effect of long-term and regular exercises on the prevention of kidney stones. **Materials and methods.** This is a cross-sectional descriptive-analytical research. For this study, 45 sports instructors (mean age = 58.1 ± 1.39), who had regular long-term physical activities in their life (at least 10 years), were selected using simple random sampling, and 20 patients with kidney stones (mean age = 52.45 ± 3.29) who were admitted to the surgical ward of the hospital were randomly selected by two-stage cluster sampling. The data was collected in two personal information and physical activity questionnaires and were analyzed through the SPSS software, T-Test, Analysis of Variance and Chi-2 Independence test. **Results.** The level of mobility and physical activity of patients with kidney stones was very low. There was a significant relationship between exercise and kidney stones ($P < 0.001$), only 2 coaches had symptomatic kidney stones and their kidney stones were treated without the hospitalization. **Conclusion.** Regular and long-term exercise is effective in preventing kidney stones. In addition, people who have had kidney stones before, are also advised to consider exercise in their lifestyle to prevent getting kidney stones again.

Keywords: kidney stones, exercise, surgery, prevention

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ВЛИЯНИЕ РЕГУЛЯРНЫХ ЗАНЯТИЙ СПОРТОМ В ТЕЧЕНИЕ ДОЛГОГО ВРЕМЕНИ НА РАЗВИТИЕ МОЧЕКАМЕННОЙ БОЛЕЗНИ

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Аннотация. **Цель.** В связи с увеличением встречаемости мочекаменной болезни необходимы дополнительные исследования для определения факторов образа жизни, влияющих на ее развитие. Цель настоящего исследования состояла в оценке влияния регулярных занятий спортом в течение долгого времени на развитие мочекаменной болезни. **Материалы и методы.** Перекрестное исследование с применением описательно-аналитического метода. Методом простого случайного отбора в исследование включили 45 спортивных инструкторов (средний возраст 58,1 ± 1,39 года) с продолжительным опытом регулярных физических нагрузок (не менее 10 лет). Двухэтапную кластерную выборку использовали для отбора 20 пациентов с мочекаменной болезнью (средний возраст 52,45 ± 3,29 года), поступивших в хирургическое отделение больницы. Данные участников исследования собирали в форме двух анкет, содержащих вопросы об образе жизни и уровне физической активности. Полученные результаты проанализировали с помощью программного обеспечения SPSS с использованием t-критерия, дисперсионного анализа и критерия хи-квадрата. **Результаты.** Уровень подвижности и физической активности пациентов с мочекаменной болезнью был очень низким. Обнаружили статистически значимую зависимость между уровнем физической активности и наличием мочекаменной болезни ($P < 0,001$). Только у двух тренеров были симптомы мочекаменной болезни, поддающиеся лечению без госпитализации. **Заключение.** Регулярные физические упражнения являются эффективным средством предотвращения развития мочекаменной болезни. Кроме того, людям с мочекаменной болезнью в анамнезе также рекомендуется включить физические упражнения в свой образ жизни для предотвращения рецидивов заболевания.

Ключевые слова: мочекаменная болезнь, физические нагрузки, хирургия, профилактика

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Introduction. Kidney stones are among the most common urinary tract diseases with an incidence rate twice as high among men as compared to women [16]. In recent years, kidney stones have become increasingly prevalent across the world [26], ranging from 5–9% in Europe, 1–5% in Asia, 7% to 13% in North America [34] and almost one in 11 humans in the United States [27]. In Iran, the outbreak of kidney stones experienced a significant rise from 0.9 percent among young adults aged 15–29 years to 8.2 percent among elderly people aged 60–69 years [32].

Studies have found kidney stones to be related to the risks of hypertension [29], diabetes [40] and myocardial infarction [29], while it may also be a trigger for other genitourinary apparatus diseases [25]. This disease imposes high costs on patients because of the chance of recurrence [3]. It's expected to cost over $ 4 billion annually within the United States by 2030, plus the extra costs incurred by the patient because of job loss [3].

Besides the morbidity of the acute event, stone disease has become a permanent problem which needs deterrent therapy to die down cease-

less morbidity [42]. Numerous potentially modifiable risk factors for kidney stones are identified, including higher body mass index, lower intake of fluid, and intakes of a good kind of specific nutrients and beverages [8].

Kidney stone disease, one of the non-communicable diseases, could be prevented if behavioral habits change [2]. Inactivity (low mobility), are positively and significantly linked with kidney stone recurrence [1]. Physical inactivity and sedentary are highly widespread across the world. They have a bearing (big effect) on a variety of premature deaths and chronic diseases. Nowadays, inactivity is very common among one-third of the world's population, which results in some public health problems [15]. Both sedentary lifestyle (behavior) and Physical inactivity have their negative impacts on health [10] those people doing moderate exercise less than 150 minutes per week are more likely to experience renal stone, compared to others who perform exercise more than 150 minutes a week [28]. Exercise training reduce risk factor of renal stone [30].

Several epidemiological studies have reported increased risk of kidney stones with greater body mass index (BMI, weight in kg/height in m2) [33, 43] however, other studies found no clear association [24]. Additionally, several studies also found a positive association between greater waist circumference and weight gain and risk of kidney stones [39], although this wasn't consistently observed [24]. There's evidence that physical activity may reduce weight gain [21–23], and will therefore also potentially have a beneficial role in relevancy risk of kidney stones, however, the available evidence is currently limited and inconsistent with one study showing a reduced risk [33], while three other studies found no significant association [7].

Kidney stone disease is painful. Sometimes have to hospitalization, sometimes led to surgery, also these spend many time and money. additionnally, prevent of any disease is simpler and important than treatment, Therefore, the aim of the study is to research the effect of long-term and regular exercises on the prevention of kidney stones.

Method

Study Sample

The present study is a descriptive cross-sectional, analytical study that was conducted in 2022. The study population in this study was the patients with kidney stones hospitalized in Shiraz hospitals and coaches in Shiraz. The present 20 samples in this study was selected through a two-stage cluster sampling method from 76 patients admitted in 1 week by selecting Faghihi Martyr Hospital and Nemazi Hospital in Shiraz which are the centers of urology surgery in Shiraz. Participants in this statistical sample were 20 patients with kidney stones who were admitted to the surgical ward with the age range (52.45 ± ± 3.29). The statistical population of sports coaches in the study was 124 sports coaches with age range (58.1 ± 1.32) in Fars province, of which 45 coaches were selected using simple random sampling. Athletes must have had regular physical activity for the past 10 years. The purpose of this study was fully explained to the participants and their names were not mentioned in the questionnaires.

Data collection

For collecting the information, two questionnaires were used: a personal information questionnaire, which contains the person's demographic information, smoking habit and etc, and "Beck physical activity" questionnaire.

Beck Physical Activity Questionnaire includes two sections of personal demographic information such as age, sex, marital status, housing status, level of education, history of individual and family illness, height, weight and occupation and special questions according to the purpose of the research. Such as questions about the person's job and the amount of activity during work and leisure. In total, the special questions of this questionnaire included 16 questions. The questionnaire used a 5-point Likert scale in which the options were never, rarely, sometimes, often and always, 0 for never and 4 for always.

Statistical Methods

Data were described as mean (M) and standard deviation (SD). Treatment effects were analyzed by SPSS software version 21. The data was analyzed through methods such as descriptive statistics and inferential statistics including T-Test, ANOVA and Chi-2 Independence test.

Results. The results of demographic characteristics showed that most of participants in this study were men (61.5 %), married (83.1 %) and had diploma and post-diploma education (72.6 %). Also, the mean age of athletes was 58.1 ± 1.32 and the mean age of patients with kidney stones was 52.45 ± 3.29 years. Moreover, the results showed that the mean physical activity of patients with kidney stones was 1.70 ± 0.07, which was at a moderate level based on Likert scale. Also, none of the people with kidney stones had professional sports activities.

Table 1

Investigating the relationship between mobility and health status variables

Variable	Mobility			
Health Status	Mean ± sd	T-test	Df	P-value
Patients	1.70 ± 0.32	13.97	49	0.000
Athletes	2.98 ± 0.32			

Table 2

Investigating the relationship between mobility and underlying diseases

Variable	Mobility			
History of Disease	Mean ± sd	t-test	Df	P-value
Yes	2.12 ± 0.78	2.55	47	0.014
No	2.68 ± 0.61			

Table 3

The relationship between gender and the risk of developing kidney stones

Sex	Abundance patient	Abundance athlete	t-test	Df	P-value
Men	11 (55 %)	30 (65.9 %)	0.200	1	0.655
Women	9 (45 %)	15 (34.1 %)			
Total	20	45			

By investigating the relation between participants' mobility and their health status-based on independent-t test, it could be seen that there was a significant relation between mobility and health ($P < 0.05$) (Table 1). In addition, the mobility of athletes was more than that of patients with kidney stones.

Table 2 shows that there was a significant relationship between the incidence of underlying diseases such as diabetes, hypertension and heart disease and the rate of mobility ($P < 0.05$) and according to the means, the incidence of these diseases was more in people with less mobility.

Also, the results showed that there was no significant relationship between gender and kidney stone disease, and the risk of kidney stone disease was the same among men and women ($P = 0.655$) (Table 3).

Discussion. As reported, the prevalence and spread of kidney stone is increasing in the world [24]. In this study we found a significant inverse association between physical activity and risk of developing kidney stones.

Some studies in this field have reported decrease in the risk of kidney stone formation associated with physical activity that is in line with the results of the present study [4, 6, 18, 33, 44]. Feng and colleagues almost like our research showed that individuals with urinary calculus showed a lower level of physical activity than people who reported that they'd not passed a kidney stone [6]. Physical activity was an independent protective factor for kidney stones and physical activity levels were inversely related to kidney stones all of the participants. In a cohort study of 84225 postmenopausal women tested within the Women's Health Initiative in the USA, after adjusting for risk factors, like age, race and dietary intakes of water, sodium, animal protein and calcium, greater physical activity was related to a lower risk of developing kidney stones [33]. A later cross-sectional study performed in Guangxi, China also found that physical activity was an independent protective factor for kidney stones [4].

These previous results are in step with our findings, and there are several possible explanations. First, exercise stimulates sweating, leading to increased water and sodium loss [9, 35]. a reduction in blood sodium activates the renninangiotensin-aldosterone system, stimulates the reabsorption of water and sodium by the distal convoluted renal tubule and collecting duct [13], and produces angiotonin, which causes thirst and might result in the drink consumed exceeding the number lost during exercise [11, 12], At the identical time, these neurohumoral modulations stimulate increased blood volume [5, 35, 36], resulting in increased renal perfusion blood flow, thereby diluting the urine. Second, physical activity contributes to bone calcium deposition and reduces urinary calcium excretion [31]. Finally,

exercise may cause local vibration of the stones at their deposition site, thereby promoting excretion.

However, the results of some previous studies don't support our conclusions. in an exceedingly study involving three large prospective cohorts (Health Professionals Follow-up Study, Nurses' Health Study I and Nurses' Health Study II), the authors adjusted for about 20 covariates and located no association between physical activity and kidney stones in any of the three cohorts [7]. However, this negative result may need been because of the authors adjusting for too many covariates so on mask the association between physical activity and kidney stones, as supported by them finding a big indirect correlation in an age-adjusted analysis [7]. Other possible reasons include differences in sample sizes and therefore the average ages of the included populations between the studies.

Body mass index, waist circumference, weight was positively related to the chance of renal calculus formation in both men and ladies. Research results have shown that that body size is independently related to the event of incident kidney stones. Because lean body mass is positively correlated with percent body fat [37, 38, 41] and will play a crucial role in stone formation [20], it's possible that greater lean body mass is a minimum of partly answerable for the observed association between higher BMI and increased risk. However, the strong association between weight gain since early adulthood and also the risk of incident stone formation suggests that adiposity plays a central role within the relation between body size and nephrolithiasis. The mechanism where by obesity increases the chance of incident stone formation is uncertain. However, hyperinsulinemia is related to obesity and features a significant effect on urine composition [19].

There have been few studies investigating the relationship between physical activity and kidney stone. In some studies, that have examined this relationship, they need concluded that patient's over exercising and maybe not hydrating sufficiently, their urine would be concentrated and this might potentially increase the danger of crystallization and stone formation. This is often supported by earlier studies that found marathon runners to be at greater risk of concretion [14]. On condition that prolonged immobility and therefore the resultant bone mineral loss are related to nephrolith [17], it serves that moderate exercise should be recommended for concretion patients.

Conclusion .Finally, according to the results of the study and their comparison with a number of studies that examined the role of physical activity for preventing kidney stones, we found that regular exercise effective in preventing kidney stones. In addition, people who have had kidney stones before are also advised to consider exercise in their lifestyle to prevent getting kidney stones again.

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