

Relation Study between the Obesity and Stones Formation in the Urinary System Using Body Mass Index (BMI) in Jeddah

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ABSTRACT

Purpose of the research: This study was done to show the influence of the obesity using BMI on the stones formation in the urinary system.

Materials and methods: The study was done for 24 h to 200 patients through the chemical analyses for the serum and diuresis and BMI calculation.

Results: The results showed that the clear reduction of the inhibitors concentration in the blood and diuresis. The stones percent in the samples analyses were 51% of uric acid stones, 29% of Calcium Oxalate, 13%, Calcium Phosphate and 7% of Magnesium Ammonium Phosphate stones. The increment of the uric acid stones, especially in the patients with overweight and obesity was attributed to the wrong nutrition nature for the patients that sedimented supersaturated salts and compose the crystals that grown to become stones. Male patients made stones than female due to the influence of the male and female hormones in the blood. Also, The acidic diuresis, as well as the fluctuation in the Creatinine level in blood reduce the functional efficiency of the kidney due to the obstruction caused by the existence of the stones in the Tubular renal in addition to the damage that occur to the kidney nephrons tissues.

Conclusion: Supporting the heavy patients for changing their life styles including controlling suitable body weight, choice and taking healthy and proper nutrition are considered the necessity for the patients that are exposed for stones formation.

INTRODUCTION

The obesity is considered one of the dangerous diseases in the recent days that resulted from malnutrition and pathologic phenomena by the changes of the meals in accordance with the reports of the WHO World Health organization^[1,2].

The obesity is one of the chronic and complicated diseases that are resulted from the fats increment which leads to accumulation of fats therein. This accumulation results from the unbalance between the energy acquired from eating food and the consumed energy by the body. It has a great influence on the infection of other diseases, such as diabetes and hypertension. The other influences made by the obesity and overweight are the composition of stones in the urinary system^[3].

The kidney stones disease is one of the main diseases of the urinary system and has a long medical history. The mechanism of the stones formation was under many experiments and research that developed over time. The stones differ in their sizes which range between the tiny as sand into the one that may fill the cavity of the kidney pelvis^[4-8].

The stones formation is considered a final result of the physiochemical processes which include the allusion of crystals in the saturated solution. The most important thing which may affect the composition of crystals is the diuresis volume, the stones components concentration, presence of focal points to compose the stones and the balance between the different physiochemical factors that inhibit and provoke the composition of the stones in blood and diuresis^[5].

The excretion the stimulators and inhibitors for the stones formation in a high concentration mainly depends on the food which the patients eat. It was also proved that the increment of the body size (length, weight, BMI) is accompanied by the high risk of the stones composition in the kidney^[6]. A study was done on the healthy persons reported that the body size increment is the main cause for the increment of the excretion of diuresis Oxalates^[7]. So, the risk of calcium oxalates formation increases. The

overweight and obesity may also be a risk factor in developing and frequency of the kidney stones, although the Mechanism of this has not been illustrated yet. Here is the question about how the nutritional nature affects the patients that were exposed for the kidney stones formation in different sides of the world in the development and frequency of the stones [8]. The research objective is studying and testing how the wrong nutrition and overweight causes frequently stones formation in the urinary system for some patients in Jeddah, in addition to the awareness of the most common kinds of stones in this area.

MATERIALS AND METHODS

The study was done on 200 patients with kidney stones; 121 of males and 79 of female patients. These patients that are excluded from the study have Hyperuricemia or Hypercalcemia such as renal tubular acidosis, sarcoidosis, primary hyperoxaluria and inflammatory bowel disease. Also, the patients didn't take any medicines that may affect the uric balance, the base acidic, the calcium representation, uric acid or oxalates such as allopurinol, thiazide or alkaline citrate medicine. The patients didn't follow any diet before participating in this study. The patient's ages ranged between 3 and 80, those who experience the frequency of the composition of kidney stones. Those patients are from the patients of King Abdul-Aziz hospital within the period from December 2015 to December 2016. The patients were diagnosed by the kidney and urinary specialists in the previous mentioned hospital, and it was found that they are experiencing frequency of compositions of stones, in light of the clinical diagnosis, symptoms, examinations and x-rays, chemical analysis.

RESULTS

The study results showed that the males with a higher age rate of weight, length, BMI and the rate of experiencing the urinary system stones. In accordance with the BMI, the number of males who are overweight was 56, while the number of females was 34, and the number of males who experience obesity was 37, while the number of females was 31. These percentages are provided clearly in the **Table 1**.

Table 1. The percentages of overweight and obesity in males and females.

Body Mass Index (BMI)	Males	Females	Total
<18.5 kg/ m ²	7 (3.5%)	3 (1.5%)	10 (5%)
Between 18.5 and 24.9	21 (10.5%)	11 (5.5%)	32 (16%)
Between 25–29 (overweight)	56 (28%)	34 (17%)	90 (45%)
>30 (obesity)	37 (18.5%)	31 (15.5%)	68 (34%)

According to the variables that were studied in the blood serum, the statistical results indicated that there are significant differences between Magnesium, Potassium, uric acid, Creatinine and phosphor values which is relevant to the BMI in both genders. While the statistical analysis didn't show any significant differences ($P < 0.05$) in the values of calcium, Sodium and urea as it remained within the average values, as per the BMI, as provided in the **Table 2**.

Table 2. The studied variables in the blood serum according to BMI.

Chemical variables	Variable values of 200 patients	BMI	P-Value
Calcium (mg/dl)	5.5 ± 1.04	13.150 ± 1.65	N.S
Uric Acid (mg/dl)	4.33 ± 1.5	11.5 ± 1.2	P>0.0001
Magnesium (mg/dl)	2.21 ± 0.44	4.12 ± 1.22	P>0.002
Phosphor (mg/dl)	3.12 ± 0.64	7.21 ± 1.3	P>0.001
Potassium (mmol/dl)	3.93 ± 1.04	43.09 ± 18.8	P>0.002
Sodium (mmol/dl)	125.07 ± 25.6	134.9 ± 22.4	N.S
Urea (mg/dl)	36.1 ± 17.30	33.25 ± 7.7	N.S
Creatinine (mg/dl)	0.4 ± 1.02	0.3 ± 0.8	P>0.05

The results showed that there are significant differences for the studied samples of diuresis of 24 h for the patients showed that there is a close relationship between BMI and the excretion of some variables in the diuresis, such as Uric Acid, phosphor, Sodium and Magnesium, and the aggregate volume of diuresis. However, there was a passive relationship between the BMI and pH in both genders. However, the excretion of calcium had a significant difference in the females than the males, and the oxalates didn't show any significant difference in both genders. It was found that the Creatinine has a positive relationship with BMI, which may be due to the increment of the muscle mass in both genders and the results are shown in the **Table 3**.

Table 3. Chemical variables values in the diuresis of 24 h for the patients.

Chemical variables	Values of variables for 200 patients	BMI for patients	P-Value
Uric acid (mg/24 h)	215.6 ± 317.1	145.51 ± 76.02	P>0.05
Calcium (mg/24 h)	168.1 ± 63.1	125.41 ± 32.7	P>0.01
Citrate (mg/24 h)	226.07 ± 197.05	453.32 ± 73.12	P>0.001
Oxalates (mg/24 h)	108.59 ± 102.1	27.43 ± 14.8	N.S
Magnesium (mg/24 h)	116.98 ± 134.2	106.081 ± 110.15	P>0.002
Phosphor (mmol/24 h)	213.91 ± 108.06	128.03 ± 126.14	P>0.001
Potassium (mmol/24 h)	7.14 ± 0.7	69.84 ± 2.3	P>0.002
Sodium (mmol/24 h)	211.5 ± 200.2	185.12 ± 0.69	P>0.001
PH	6.95 ± 1.5	3.50 ± 50.69	P>0.002
Creatinine (mg/24 h)	89.9 ± 11.03	1007.5 ± 431.7	P<0.001
Creatinine filtration (ml/min)	7.74 ± 2.7	12.01 ± 2.91	P<0.01
Volume of Diuresis	1076.13 ± 480.11	181.4 ± 115.4	P<0.05

According to BMI It was also found that there is an increment in the BMI with aging, with the high risk of experiencing urinary stones. The infections are distributed in males and females according to the age, which is provided in **Table 4**.

Table 4. Distribution of the patients according to age category.

Age category	Males	Females	Total
1-20	37	21	58
21-40	38	31	69
41-60	37	20	57
61-80	9	7	16
Total	121	79	200

The results of the chemical and qualitative analysis for the stones collected from the patients of the study.

The stones shapes and sizes differ from a patient to another; the stones weight were ranged from 10 mg to 32 mg and the qualitative and quantitative analysis of the stones showed that the higher percentage of the uric acids stones and the other types of stones had uneven percentages in the patients. **Table 5** represents the rate of the stones types in the studies samples.

Table 5. The stones ratio in the studied samples.

Types of stones	Males	Females	Total
Uric acid	64 (33%)	38 (19%)	102 (51%)
Calcium Oxalate	35 (17%)	24 (12%)	59 (29%)
Calcium Phosphate	14 (7%)	12 (6%)	26 (13%)
Ammonium magnesium phosphate	8 (4%)	5 (3%)	13 (7%)

These percentages represent 80-90% of the total weight of the stones, while the remaining portion is proteins and water. The quantitative analysis reduces or excluded any probability for any fault that may happen due to the inaccurate, which provide an evidence for the appropriate medicine for each case. As the composition of stones occurs frequently to the patients, so knowing the components of the stones will give a description for the easy estimation and accurate treatment to prevent the frequency.

DISCUSSION

One of the reasons the required to perform this research is the widespread of the urine stones diseases in general, and the kidney stones in particular in the middle east, as the risk of infection with this disease is 25% in the middle east, however it decreases in the western and cold areas to 15%, then the infection returns again to the patients with the percentage of 50%. This may be due to the weather's nature for this area in addition to the nature of the water content that affects the concentration of salts in the body significantly, so this may provide an appropriate environment for the composition of stones. Many studies made in this area about this disease and studied it from different aspects ^[9-14].

According to the study results, the BMI estimation showed that the composition of stones disease spread widely with those who have overweight and obesity significantly. The obesity and overweight were accompanied by the increment of the diseases affected by food, such as hypertension, diabetes and cardiology. This occurs significantly due to the nature of food which is eaten by the patients ^[14-16] as the foods which are rich in energy such as fats, proteins, and Carbohydrates has a significant role in composing the stones. These results support the study, which showed that the low-fat food reduces the risks of having the urinary and kidney stones.

Metabolic assessment which includes the diuresis components invoke the composition of stones indicated to the positive relationship between the BMI and Urea extra excretion, uric acid, Phosphor, Sodium, Magnesium, the total volume of the diuresis, however there is an inverse relationship between the BMI and the PH in both genders, while there was a significant difference in the excretion of calcium in females than the males and the oxalates didn't show any significant difference in both sexes.

According to the quantitative and qualitative chemical analysis of stones, it appeared that the highest percentage is for the uric acid stones, which is 51% and the Calcium Oxalates stones are 30%. The quantitative analysis of the stones gives accurate information about the main components of each stone, which assist in its categorization more easily. The hyper excretion of uric acid in diuresis was taken into consideration, when the level exceeds 800 mg/24 h in males and 750 mg/24 h in females, unlike calcium. There is no difference in the excretion of uric acid between the patients of the composition of stones for the first time and the patients whose bodies compose stones frequently.

So, we depend on these values in the case of the frequent composition of stones. This increase in the uric acid between the patients occurs due to the nature of the food eaten which is rich with the Purine material, which is the main component of uric acid. This material exists mainly in meat and Protein, as well as the amount of the food and liquids, which lead to the increment of the urine diuresis to the materials of which the stones are composed, have a significant influence on the occurrence or the prevention of the occurrence of the composition of uric stones. This is shown in many studies, as having large amounts of animal proteins, calcium, phosphate, etc. increase the hyper excretion of these materials in the diuresis.

The hyper excretion of uric acid occurs due to the increment of the acidity of the diuresis, with the reduction in its volume. These results of this study showed that there is a positive relationship between the BMI and the change in the volume of diuresis in the patients who experience obesity than those who have natural or less weight. The reason of the decrement of the diuresis volume within the samples of this study is the exposure to the hot weather or working in the hot areas, without drinking adequate amounts of water, to replace the large amounts of liquid which the body loses with sweating. As well as the Diarrhea cases which increase the loss of the liquids. This is a common reason in children. The reasons for losing water include the inability of the kidney to absorb and reabsorb water through the renal tubule, and it returns it to the blood circulation. This may occur due to the shortage of the potassium level in blood, or the shortage of the excretion of ADH Antidiuretic hormone, there is a consensus that the amount of water which the person drinks is adequate by which the result of the daily diuresis is not less than 1.5 to 2 L. Some of the reasons of the genetic hyperthyroidism may lead to the increment of the production of uric acid in the blood, or to be accompanied by hyperuricosuria of uric acid in the blood.

This study showed that the percentage of the calcium oxalates stones comes at the second class after the uric acid stones. These results differed with the results of other studies which are made in Iraq, where the higher percentages in these studies were for the calcium oxalates stones. The current study showed that there is hyperexcretion of calcium in diuresis, while its value in the blood serum remained within the natural values. This case is called as the hyper excretion of calcium, which is considered, has no reason. This case occurs due to the quality of the food eaten by the patients. However, it indicates that there is no evidence for the influence of eating food which is rich in calcium in the increment of the risk of the composition of stones. One of the studies for random samples showed that the specified foods of proteins and salts, as well as those of natural amount of calcium, affects in the frequent composition of stones more than those of low calcium diets, in case of the vague hyper excretion of calcium [15-19]. Whereas, there is no relation between the excretions of the materials which inhibit the composition of stones and the BMI, the risks of the frequent composition of stones increases by the increment of the BMI in both males and females, but it is more frequent in males than females. It appeared that the inhibitors of the composition of stones, especially the citrates, decreased in the females clearly, especially in those of older ages. The reason thereof is the reduction of the estrogen hormone in females with the getting older, which work on increasing the excretion of the citrate hormone in the diuresis. This is supported by what was achieved there from as the reduction of the excretion of citrate in the diuresis of the females is more significantly if the composition of stones is frequent than the composition for the first time. The test for the level of urea and Creatinine in the blood serum and diuresis lead to confirm the occurrence of the disturbance of the function of the urinary system and kidney in the patients of overweight, as the increment of the urea level in blood occurs due to eating more animal proteins in food and the decrement of the Creatinine levels in the patients in this study indicate that the damage occurred by the stones for the barnchemic fabrics of the renal tubules' walls. The period from 20 to 40 years old, is the period in which the infection increases between patients. In a study made in this field, it was proved that the stones became less in the age category of 55-65, however, the risks of the composition of stones increase in the age category of 25-35.

CONCLUSION

From all the above, it was proved that the obesity and overweight is accompanied closely with the risks of the composition of stones in the kidney and the urinary system, and the frequent composition of stones in both sexes because of the hyper excretion of the stimulators of the composition of stones and the reduction of the inhibitors for its composition. The unhealthy nutrition norms, such as eating too much meat, especially red meat and the foods which are rich in protein. The least drinking of water and liquids is one of the most important reasons of the increment of frequent occurrences of this disease, so the first thing recommended to the patients whose bodies compose stones with overweight is to change their nutrition norms and apply a healthy diet to control the disease.

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