PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 8 (7): 977-982, 2009
ISSN 1680-5194

Correlations Between the Composition of Moroccan Urinary Stones and the Risk Factors (Food Habit)

Laziri Fatiha[1], Rhazi Filali Fouzia[1], Amechrouq Ali[1] and Soulaymani Abdelmajid[2]
[1]Laboratoire d'Analyses Chimie Biologie Appliquees a l'Environnement,
Faculte des Sciences, Universite Moulay Ismail, B.P 12101 Zitoune, Meknes, Maroc
[2]Laboratoire de Genetique et Biometrie, Faculte des Sciences,
Universite Ibn Tofail, BP. 133, Kenitra, Maroc

Abstract: The aim of this study is to characterize and to analyze the likely factors to influence the composition of the Morocco urinary calculi, we took a study between July 2002 and June 2007 with 283 lithiasis patients that gave their sample (stone) for analyzes by infrared spectroscopy and replied to the questionnaire. Different informations were recorded: epidemiological characteristic (sex, age, residence zone and profession), food habits (tea; rich products in calcium, oxalate, animal proteins and spicy meals) and consumption. The results show: a strong liaison between the different studied factors and the stone mainly composed of Weddelite, Whewellite and uric acid; the age effect on the stone mainly composed of Weddelite and uric acid was confirmed. Significant correlations were noted, positive between the stone mainly composed of Weddelite and the consumption of oxalate and negative between the stone mainly composed of calcium phosphate or magnesium ammonium phosphate and tea and spicy meals. This research shows equally that the consumption of the rich products in oxalate is frequents and that the consumption of the rich products in calcium is weak. This nutrition type would be responsible to the preponderance of the stone calcium oxalate (Whewellite, Weddelite) observed in our country.

Key words: Urinary stone, chemical composition, infrared spectroscopy, Morocco, food

INTRODUCTION

The composition of urinary stones is very variable, >80 components were identified making lithogenesis a complicated process (Jungers *et al*., 1989), In a general way, various etiologies of the urinary stone is identified and classified into various groups, primarily the stones of origins calcic (oxalate of calcium and calcium phosphate), uric acid (purin) and infectious (struvite) (Daudon *et al*., 1993).

In the developed countries, the prevalence of the renal stone increased during 4 last decades (Jungers *et al*., 1989). This increase is due to the progression of the calcium oxalate stones to depend on the other types of stones (Ramello *et al*., 2000). This progression holds primarily related on the evolution of the socio-economic level and the modification of the way of life and the food practices (Ramello *et al*., 2000; Asper, 1984). Several nutritional factors were accused (Andersen, 1969; Borghi *et al*., 2002) but the animal protein contribution and the volume of drinks seem particularly important (Borghi *et al*., 1996; Nguyen *et al*., 2001). Many studies noted that a mode rich in animal proteins significantly increases the excretion of calcium, the uric acid, oxalate and decreases that of the citrate (Breslau *et al*., 1988). Since, a long time calcium was incriminated in the formation of the calculis, the results of long-term studies with several tens of thousands of participants showed that a poor light diet in calcium even was associated with a significant increase of the rate of formation of stone (Curhan *et al*., 1997). Of more, it was showed that the oxalate plays also an important role in the origin of the urinary calculi (Hess *et al*., 1998).

To Morocco, the realized studies on the urinary stones remain not very numerous (Joual *et al*., 1997; Oussama *et al*., 2000; Laziri *et al*., 2007). They showed the preponderance of the oxalate of calcium monohydrate as majority constituent calculi. Important differences in the frequency of the constituent others, in particular, the uric acid were noted (Oussama *et al*., 2000; Laziri *et al*., 2007).

The objective of this study is to approach the food habits of our patients and to see itself there exist the correlations between the chemical composition of the urinary stones and the food habits of the subjects recruited in this study.

MATERIALS AND METHODS

Patient recruitment was realized between July 2002 and June 2007, with the center of shock wave lithotripsy of the kidney and urinary tracts of the city of Meknes, at the level of the service of urology of the military hospital Moulay Ismail, provincial hospital Mohammed V and equally with the urologists of the city of Settat and of Fes. For every patient a card was furnished to record different information: epidemiological characteristic patient, ditto dietary one concerning the nature and the volume of

consummate water a day, the tea consumption; rich products in calcium, in oxalate, in animal proteins and some spice.

The stone samples: The stones and the collected fragments were analyzed by infrared spectroscopy Transformed Fourier (FT /IR-4100) according to the technique of preparation of pellets (Jungers *et al*., 1989). This is a physical technique of analysis that presents multiples advantages: sensitiveness, simplicity, rapidity and precision (Jungers *et al*., 1989).

Analyze statistics: The methodology statistics bases itself on a descriptive study of the population for the different studied parameters and a more deepened analysis of the degree of liaison between the studied characters and the Constituent majority of stone.

The studied variables concern the parameters linked to the patient (age, sex, profession (P), geographic origin, personal antecedents (R) and family etc), the parameters linked to its food habits [water Consumption in liters a day.

The type of consummate water, the tea consumption expressed by the number of glasses a day (CT), rich Products in Calcium (PC), in Oxalate (PO), in animal Protein (PA) and/or of spicy meals (RE)). These different parameters were encoded and divide up in class of which, will give us the detail in the party results.

The methodology of analysis statistics used based itself on the Analysis while, Composing Principal (ACP) that allows reducing a complex system of correlations in a smaller number of dimensions. We used this method to evaluate the correlation of the different factors linked to the food habits on one hand and the Constituent majority of stone on the other hand. At the level of the ACP, the distance between the different variable points (food habits) gives a general idea on the degree of correlation between these parameters.

For student the force of liaison between the studied variables as well as the meanings, we calculated the correlation coefficients (r). A coefficient of positive correlation means that the variables are proportional, while, a negative coefficient implies that these variables are inversely proportional.

RESULTS

The study covers a period of 5 years during, which 283 patients gave their sample (calculi or fragments) for analyzes and replied to the furnished questionnaire. The used codes for the food investigation are the following ones:

- For the volume of consummate water in liter a day : three categories of response. Consumption of inferior water to 1.5 L, between 1.5 and 2 L and > to 2 L
- For the type of consummate water: five categories of response: faucet water, well water, source water, clogged water and other
- For the Tea Consumption (CT): one retrieves directly the number of glass of consummate tea a day
- For the rich Products in Calcium (PC): four varieties were proposed: milk, yogurt, Cheese, dry fruit
- For the rich Products in Oxalate (PO), four varieties were proposed: watercress, epinards, bread with his, chocolate
- For the Animal Proteins (PA), four varieties were proposed: eggs, chicken, red meat, fish
- For the spicy meal (RE), the responses are encoded 1 for yes, 0 for no

Epidemiological profile of the studied population: The characteristic statistics of the studied population are recorded on the Table 1.

Male to female ration is The sex ratio is 1.55. Mean age is 44.45±12.9. The minimum is of 14 years and the maximum is of 90 years. About 11% of the investigations declared having one of their close one that already eliminated a stone and in 25,8%, it is a matter of a calculi relapsing (Table 1).

The distribution of this investigated population according to the geographic zone of origin is given in the Table 1.

The distribution according to the profession is the following one, 42% of the respondents are without research, 12% are military officers, 7.1% research in the agricultural sector, 6.6% are in the commerce, 6.2% in the sector automation office, 5 .7% in the teaching, 4.4% of the retired, 3.5% are workers, 2.2% are craftsmen, 2.2% as security agent, 2.6% are technicians, 1.3% in the sector of the restoration and for the same frequency in the health sector.

The population distribution according to the constituent of calculi shows that the Whewellite is the principal component (51.6%) followed by the uric acid (19%), in third row, one finds the Weddelite with 17.6% then calcium phosphates and magnesium Phosphate (PH) with 9,8% of the cases.

The counting of votes of the data of the questionnaire and the analysis statistics of the recorded data allowed us to approach the food habits of the Moroccan stone formed patient. For example, for the water consumption, 17% consume an inferior volume to 1.5 L a day and 26.2%, some consume between 1.5 and 2 L and 56.8% of respondents declare drinking >2 L a day (Table 1).

Faucet water is consumed by 84% of the answering machines. The tea consumption is variable, 56,3% informers to consume between 0 and 2 glasses of tea a day, 28% consume 3-4 glasses a day and 13% informers to consume 5 glasses and more. For the other foods of the questionnaire, One notices that the habitual consumption of calcium is little frequents (Table 1), 16,4% not consuming any rich food in calcium

Table 1: Characteristic statistics of the studied population

Les caracteristiques	Variables	Moyenne ou effectif (%)
Epidemiologiques	Age moyen	44.45±12,90 ans
	Sexe	
	Masculin	172
	Feminin	111
	Sexe ratio (M/F)	1.55
	Region	
	Atlas	31 (11%)
	Nord-Est	21 (7.4%)
	Fes	35 (12.3%)
	Meknes	136 (48.0%)
	Settat	25 (8.8%)
	Sud	35 (12.3%)
	Antecedents familiaux	
	Avec	25 (11%)
	Sans	203 (89%)
	Recidive	
	Avec	60 (25.8%)
	Sans	172 (74.2%)
Habitudes	**Consommation d'eau**	
alimentaires	≤ 1.5 l/j	42 (17%)
	[1.5 – 2]	65 (26.2%)
	> 2 L par jour	141 (56.8%)
	Type d'eau consomme	
	Eau de robinet	202 (84,5%)
	Eau de puits	6 (2.5%)
	Eau embouteillee	10 (54,8%)
	Eau de source	9 (3.7%)
	Autre	13 (5.4%)
	Nombre de produits	
	-Riche en oxalate	
	0 07 (03.2%)	
	1 22 (10.1%)	
	2 81 (37.2%)	
	3 80 (36.7%)	
	4 28 (12.8%)	
	-Riche en calcium	
	0 37 (16.4%)	
	1 80 (35.6%)	
	2 37 (16.4%)	
	3 69 (30.7%)	
	4 02 (00.9%)	
	-Riche en proteines animales	
	0 01 (00.4%)	
	1 09 (03.9%)	
	2 25 (11.0%)	
	3 61 (26.8%)	
	4 131 (57.7%)	
Constituants	WH	146 (51.6%)
lithiasiques	WD	50 (17,6%)
majoritaires	AU 54 (19%)	
	PH 28 (9.8%)	
	Autre	5 (1.7%)

against 0.9% of the respondents habitually consume the 4 rich foods in calcium (milk, yogurt, Cheese, dry fruit). Concerning the oxalate, about 74% of the answering machines habitually consume 2-3 products, 12.8% the four products and 3,2% not consuming any rich product in oxalate.

For the consumption of the animal proteins, 46.3% of the respondents declare consuming habitually the four protein categories against 3,6% not consuming or consume a single category. Besides, the consumption of spicy meals is raised, 79,1% of the respondents to this question declare consuming habitually this type of meal.

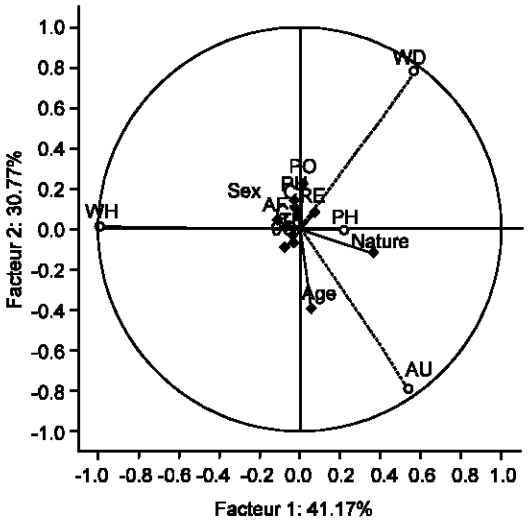

Fig. 1: Analyze of the composing principal between the various studied and constituent factors majority of stone

Analyze factors influencing the principal constituent of stone: In order to analyze the likely factors to influence the principal couponed of stone, we proceeded previously to an analysis of the composing principal of which, the results are represented on the Fig. 1.

These results show a strong liaison between the different studied factors on the Constituent majority of stone with a weight of 71.94%, particularly for the Weddelite (WD) and the Whewellite (WH), followed by the Uric Acid (AU). The liaison with the somes mainly composed of Phosphates calcium or magnesium (PH) seems rather weak. This brings back us to elucidate these results by a correlation study between the studied factors and the constituent majority of stone that we put back on the Table 2.

These results allow us to see that only the factors age, the tea consumption, rich products in oxalate and the spicy meals influence the composition of the calculi (Table 2).

It is to signal that the liaison is inversely proportional between the majority calculations in Weddelite (WD) and the age and between the majority calculations some calcium phosphates and magnesium Phosphate (PH) and the habitual consumption of tea and spicy meals. On the other hand, the liaison is proportional between the uric acid mainly couponed of calculi and the age and between the Weddellite (WD) mainly composed of calculi and the consumption of oxalate (Table 2).

DISCUSSION

The preliminary analysis of the data of the conducted investigation with the 283 lithiasis patients, we allowed confirming that the urinary stone is under the dependence of intrinsic factors (age, family and

Table 2: Correlations between the various studied and constituent factors majority of stone

	Sexe	Age	Milieu	TE	CT	PL	PO	RE	CA	AF	P	CE
WH	0.01	-0.05	0.06	0.03	0.07	0.03	0.00	-0.08	0.04	0.10	0.09	-0.03
WD	-0.02	-0.24	-0.16	-0.08	0.01	0.10	0.19	0.14	0.07	-0.07	-0.09	0.11
AU	-0.01	0.41	0.15	0.03	0.01	-0.12	-0.15	0.05	-0.05	-0.07	0.06	-0.07
PH	-0.05	-0.10	-0.11	0.05	-0.17	-0.04	-0.06	-0.17	-0.05	0.09	-0.07	-0.06

Correlations significatives au seuil de 5% (en Gras)

personal antecedents) and extrinsic (food habits, water consumptions, environment and residence region) (Table 1).

The results coming from this study are numerous. They show on one hand that the epidemiological profile of the urinary collected stones and analyzed by infrared spectroscopy comes close to itself the one of the industrialized countries (Daudon *et al*., 2004), characterized by a male dominance, the peak of frequency of the manifestation is situated to the fourth decade, preponderance of the calcium oxalate monohydrate as component principal. Nevertheless, this certain present profile characteristics:

- A big prevalence of the majority calculations in uric acid (19%), superior to the one of the industrialized countries and to the one observed in Algeria (Djelloul *et al*., 2006). This uric prevalence also, was found student with the woman, which is in keeping with the data of our study on the epidemiological profile of the collected stones to Meknes (Laziri *et al*., 2007). This uric prevalence can explain by factors of common risk with the two sexes (climate, nutrition, obesity, metabolic syndromes, genetic factors)
- The prevalence of stones of infection (struvite) is weak comparatively to the one observed by our Algerian neighbors (Djelloul *et al*., 2006). This can be explained by the difference of the taken one in charge of the urinary infections between the two countries or by the method of recruitment of the stones samples

On the other hand, we were able, for the first time through this study to approach the food habits with our patients. The daily or weekly quantity for food every category (oxalate, calcium, animal proteins) is difficult to evaluate by the patient, we proposed for each of these categories four products that we judged rich in these foods and we counted for every patient, the number of consummate products habitually. Thus, we raised the following results:

- The habitual consumption of calcium is found little frequents on the other hand the habitual consumption of oxalate and animal proteins are more frequent (Table 1)
- The consumption of spicy meals is frequents, 79,1% of the respondents declare consuming habitually this type of meal

Besides, the analysis of the composing principal between the various studied Factors and the majority composition of the stones (Fig. 1) confirms the literature data on the origin of formation of these stones (Jungers *et al*., 1989). The first ones are in 60% of metabolic origin or nutritional, the second type is in most of the cases of infectious origin (Jungers *et al*., 1989).

In this series of 283 stones, 18 on 28 calculis of calcium phosphate contain the struvite. The correlation study between the studied factors and the mainly composed of stones confirms certain results of the literature (Daudon, 2005). The age is a factor determining in the composition, the stone mainly composed of Weddellite observe themselves with the young and the uric acid observe themselves more with the elderly subjects. Several reasons were evoked to explain this age influence on stones mainly composed of uric acid and Weddelite (Daudon, 2005). In the matter of the relations between the majority composition of the calculis and the food habits of our patients, we observed a positive significant correlation between the stones mainly composed of calcium oxalate dihydrate (Weddellite) and a rich nutrition in oxalate. We counted in this category the pure stones in weddellite (21 stones of type IIb according to the classification of Daudon *et al*. (1993) and the mixed stones whewellite / weddellite but majority in weddellite (29 stones of type IIa+Ia). We were not able to show a relation between the rich stones in weddellite that are calcium depending according to the works of Daudon and coll (Daudon *et al*., 1993) and a rich nutrition in calcium. But we noted according to this study that the consumption of the rich products in calcium is little frequents on the other hand the one of the oxalate is a lot more important one. The oxalate is located in the spinach, the watercress and especially of others plant green local production. These vegetable ones constitute a very important source of oxalate to which, adds certain condiments as the pepper and the parsley that are used frequently in the culinary preparations in our country. Thus, a vegetable often rich nutrition in oxalate and poor in calcium favors the intestinal absorption of the ions oxalic free that are thus, eliminated by the kidney (Zarembski and Hodgkinson, 1969). The excess of food provision of oxalate can produce itself in our population in a seasonal way and one can notice that this consumption s abundant during the spring but equally in Summer as it was observed in India (Jungers *et al*., 1989). The normal food provisions in oxalate are very variable. They go of 100 mg to >1 g a day with of very wide individual variations and of a day to

the other. It exists equally big variations of bioavailability of the oxalate in the foods according to that it is contained in the form of a soluble or insoluble salt (Massey, 2007). The contained oxalate in the spinach is considered as particularly absorbable, on the other hand, the one contained in black tea weakly is absorbed (Liebman and Murphy, 2007).

Besides, the majority calculis apply phosphates to some calcium and magnesium are correlated in a manner negative with the consumption of tea and with the consumption of spicy meals. It is necessary to signal that in this stone category, we counted the rich stone in struvite, which the origin is linked to the bacteria presence to urease and the typical others of apply phosphates to calcium (carbapatite, brushite and witlockite and amorphous carbonated calcium phosphate calcium, of which the origin is secured be at the hypercalciuria (majority stone in brushite and in Weddellite) be at the disturbances of IV2a) (Daudon *et al*., 1993), be at the infection (majority stone in witlockite or in associated carbapatite to the struvite) (Daudon *et al*., 1993). The study evaluating the metabolic report of the subjects that make this stone type retrieved a hypercalciuria with most of the subjects of masculine sex having calculi of struvite or mixed calculis, associating the struvite and oxalate or applies phosphates to calcium (Jungers *et al*., 1989). On the other hand, this study showed that the hypercalciuria was noted only with the women having mixed calculis, while, the calciuria was normal with most of the women having calculi of struvite (Jungers *et al*., 1989).

On the other hand, no significant correlation was observed between the consumption of the animal proteins and the majority composition of the calculi. 57% of the investigated patients declared consuming habitually the four rich products in animal proteins (meat, chicken, eggs and fish), but the daily quantity or weekly consummate was difficult to evaluate. Now, the international literature strongly implied the proteins as lithogenic factor (Breslau *et al*., 1988). Of more, one did not observe any significant correlation between the nature and the volume of consummate water habitually by the investigations and the majority composition of their stones. It is admitted since a long time that the water volume reduced is an essential factor in the urinary stone origin by urine concentration in lithogenic factors (oxalate, calcium, urate). In fact, the study of Borghi on the effect of the water provision and the lithiasis risk showed two important facts. The formed stone patient have a dieresis significantly lower to the basic state than the witnesses (Nguyen *et al*., 2001), the, relapses it stone is clearly less frequents with the patients having a superior dieresis's to 2 L a days in comparison with those not having modified their habits (12,1% against 27%; p = 0.008). Now according to our investigation, 57% of the answering machines declare drinking >2 L a day. They confuse between the volume of consummate water habitually before the declaration of the disease and the recommended volume and prescribed by the doctor. This shows equally that the patients are conscious of the necessity of an abundant dieresis.

Conclusion: This research shows that the majority composition of the Moroccan urinary stones is under the dependence of intrinsic and extrinsic factors and that the food habits play an important role in the stone origin. We retrieved that our nutrition characterizes itself by a taken weak one in rich products in associated calcium to a taken one increased in rich products in oxalate. The stone mainly composed of Weddelite positively is correlated with the consumption of oxalate. The stone mainly composed of calcium or magnesium phosphate are found correlated negatively with the consumption of tea and the consumption of spicy meals. Supplementary investigations are necessary to confirm and explain these associations. A nutritional investigation using a car questionnaire frequency is necessary to approach the weekly quantitative consumption of the implied nutriments according to the international literature in the origin of the urinary calculations (oxalate, calcium, animal proteins, sweetens refined and salt).

REFERENCES

Andersen, D.A., 1969. Historical and geographical differences in the pattern of incidence of urinary stones considered in relation to possible aetiological factors.In:Hodgkinson A, Nord in BE, editors. Renal stone research symposium. London: Churchill Livingstone.

Asper, R., 1984. Epidemiology and socioeconomic aspects of urolithiasis. Urol. Res., 12 : 1-5.

Borghi, L., T. Meschi, F. Amato, A. Briganti, A. Novarini and A. Giannini, 1996. Urinary volume, water and recurrences in idiopathic calcium nephrolithiasis: A 5-years randomized prospective study., J. Urol., 155: 839-843.

Borghi, L., T. Schianchi, T. Meschi, A. Guerra, F. Allegri and U. Maggiore, 2002. Comparison of two diets for the prevention of recurrent stones in idiopathic hypercalciuria. N. Engl. J. Med., 346: 77-84.

Breslau, N.A., L. Brinkley, K.D. Hill and C.Y.C. Pak, 1988. Relationship of animal protein-rich diet to kidney stone formation. J. Clin. Endocrinol. Metab., 66:140-146.

Curhan, G.C., W.C. Willett, F.E. Speizer and M.J. Stampfer, 1997. Comparaison of dietary calcium with supplemental calcium and other nutriments as factors affecting the risk for kidney stones in women. Ann. Int. Med., 126: 497-504.

Daudon, M., 2005. Epidemiologie de la lithiase urinaire en France. Annales d'Urologie, 39: 209-231.

Daudon, M., B. Bounxouei, F. Santa cruz, S. Lette Da Silva, B. Diouf, B.F. AngwafooolII, J. Talati and G. Desrez, 2004. Composition des calculs observes aujourd'hui dans les pays non industrialises. Prog. Urol., 14: 1151-1161.

Daudon, M., C.A. Bader and P. Jungers, 1993. Urinary calculi: Review of classification methods and correlations with etiology. Scanning Microsci., 7: 1081-1104.

Djelloul, Z., A. Djelloul, A. Bedjaoui, Z. Kaid-Omar, A. Attar, M. Daudon and A. Addou, 2006. Lithiase urinaire dans l'Ouest algerien: Etude de la composition de 1354 calculs urinaires en relation avec leur localisation anatomique, l'âge et le sexe des patients. Prog. Urol., 16: 328-335.

Hess, B., J. Claudia, L. Zipperle, R. Takkinen and P. Jaeger, 1998. High-calcium intake abolishes hyperoxaluria and reduces urinary crystallization during a 20-fold normal oxalate load un humans. Nephrol Dial Transplant., 13: 2241-2247.

Joual, A., H. Rais, R. Rabii, M. El Mrini and S. Benjelloun, 1997. Epidemiologie de la lithiase urinaire. Ann. Urol., 31: 80-83.

Jungers, P., M. Daudon and A.Le Duc, 1989. Lithiase urinaire. Paris. Flammarion Medecine Sciences.

Laziri, F., F. Rhazi Filali, A. Amechrouq and H. Bendifi, 2007. Exploration des calculs urinaires collectes a Meknes par spectrophotometrie infrarouge a transformee de Fourier. Phys. Chem. News., 34: 79-84.

Liebman, M. and S. Murphy, 2007. Low oxalate bioavailability from black tea. Nutr. Res., 27: 273-278.

Massey, L.K., 2007. Food oxalate: factors affecting measurement, biological variation and bioavailability. J. Am. Diet Assoc., 107: 1191-1194.

Nguyen, Q.V., A. Kalin, U. Drouve, J.P. Casez and P. Jaeger, 2001. Sensitivity to meat protein intake and hyperoxaluria in idiopathic calcium stone formers. Kidney Int., 59: 2273-2281.

Oussama, A., F. Kzaiber, B. Mernari, A. Hilmi, A. Semmoud and M. Daudon, 2000. Analyse des calculs urinaires de l'adulte dans le moyen Atlas marocain par spectrophotometrie infrarouge a transformee de Fourier. Prog. Urol., 10: 404-410.

Ramello, A., C. Vitale and M. Marangella, 2000. Epidemiology of Nephrolithiasis., J. Nephrol., 13: S45-S50.

Zarembski, P.M. and A. Hodgkinson, 1969. Some factors influencing the Urinary excretion of oxalic acid in man. Clin. Chim. Acta., 25: 110.