Germans Trias i Pujol Hospital

UNIVERSITY OF SOUTH CAROLINA

University of Cape Town • iYunivesithi yaseKapa • Universiteit van Kaapstad

(PD35-08)

Can the inflammatory potencial of diet rather than the individual dietary components discriminates between calcium oxalate renal stone patients and healthy controls?

Montserrat Arzoz-Fabregas*, Josep Roca-Antonio, Maria Dolade-Botías, Badalona (Barcelona), Spain; Allen Rodgers, Cape Town, South Africa; Nitin Shivappa, James R Hebert, Columbia, SC

Germans Trias i Pujol Hospital

Introduction:

- Many studies have investigated the relationship between individual food groups and the risk of urolithiasis focusing on how diet influences the urinary risk factors for CaOx supersaturation and crystallization.
- Diet also can play an important role in regulating chronic inflammation, which is one of several other processes by which stone formation can proceed.
- Since now there hasn't been used a quantitative measure for assessing the inflammatory potential of an individual's diet and whether such a measure is correlated with stone risk. The **Dietary Inflammatory Index (DII®)** is an analytical tool which provides such a measure.
- **<u>The aim of this study</u>** is to **test the hypothesis** that **the inflammatory potential of habitual diet is higher in renal stone formers than in normal controls**.

Methods

Germans Trias i Pujol Hospital

- 160 subjects included prospectively:
    - 97 calcium oxalate stone formers (SFs) and 63 controls (Cs), matched on age and sex .
    - Patients:
        - Stone episode <3 months
        - Stone composition confirmed by optical crystallography and spectroscopy
    - Controls:
        - No history of stone disease
        - No stones confirmed by medical history and ultrasound
    - Exclusion criteria:
        - <18 y, pregnancy, history of serious illness, history of duodenal ulcer, osteoporosis or its treatment,morbid obesity (BMI >40kg/m^2), bariatric surgery, previous urinary pathology and tratment with drugs having lithogenic potential.
- **Semi- quantitative food frequency questionnaire** from which nutrient composition was computed. These data were used to calculate the **Dietary Inflammatory Index (DII®)**
- To control the effect of energy intake, **energy-adjusted DII (E-DII)** scores were calculated.
- A single blood sample was obtained from each participant (n160), and two consecutive overnight (8h) urine samples were collected from a subset of these (n 59 SFs and n54 Cs) at the start of the study.
- Samples were analysed for stone risk factors
- Data were analysed using descriptive statistics and logistic and linear regression models

Inventors of the World's First Dietary Inflammatory Index

Results

Table 1. Clinical and demographic characteristics of patients and controls

	Total (160)	Controls (63)	Cases (97)	p
Age	47 (19-79)	43 (19-71)	48 (20-79)	0.22
Sex (male)	111 (69.3)	43 (68.2)	68 (70.1)	0.80
Family history of stones (n,%)	64 (40.2)	18 (9)	46 (47.4)	**0.02**
BMI (Kg/m^2)	26.4 (15.9-22.3)	26.7 (19.3-36.6)	26.1 (15.9-38.3)	0.81
HTA (n,%)	30 (18.7)	12 (19)	18 (18.5)	0.94
DLP (n,%)	31 (19.6)	11 (17.7)	20 (20.8)	0.63
Hiperuricemia (n,%)	4 (2.5)	2 (3.2)	2 (2)	0.65
Diabetes (n,%)	10 (6.4)	3 (4.9)	7 (7.3)	0.54
Metabolic syndrome (n,%)	14 (8.8)	6 (9.5)	8 (8.4)	0.78

Table 2. Dietary characteristics of patients and controls (median and range)

	Total (n = 160)	Controls (n = 63)	Cases (n = 97)	p-value
Energy (Kcal)	2484.4(722-7189)	2425.7(788-4991)	2543 (722-7189)	0.41
Water_(g)	3341.7(996-8547)	3263.1(996-8547)	3420.3(1683-8441)	0.42
TotalProtein_(g)	129.2 (51-293)	125.9 (51-230)	132.5 (53-293)	0.30
Vegetal Protein_(g)	32.3 (3-86)	32.1(3-74)	32.6(10-86)	0.81
Animal Protein_()	96.2 (35-248)	93.9 (35-189)	99,9 (42-248)	0.24
Total Lipid_(g)	102.2 (24-308)	97.5 (28-207)	106.9 (24-308)	0.14
Saturated FattyAcids_(g)	36.8 (6-124)	34.8 (6-99)	38.7 (10-124)	0.15
Monounsaturated Fatty Acids(g)	40.4 (9-116)	38.8 (11-76)	42 (9-116)	0.23
Polyunsaturated Fatty Acids_(g)	15.5 (3-42)	14.7 (5-33)	16.4 (3-42)	0.09
Cholesterol_(mg)	438.4 (145-1111)	424.2 (154-1018)	452.7 (187-1111)	0.26
Glucides_(g)	248.4 (35-1068)	246 (35-655)	250.8 (74-1068)	0.79
DigestibleSugars_(g)	124.7 (11-834)	123.5 (19-368)	125.9 (11-834)	0.85
Polysaccharides_(g)	123.7 (10-384)	122.5 (10-384)	124.8 (40-257)	0.78
Fiber_(g)	29.6 (2-114)	29.2 (2-70)	29.8 (5-114)	0.78
Ethanol_(mg)	7.1 (0-51)	7.8 (0-51)	6.3 (0-29)	0.26
Sodium_(mg)	3249.2 (586-9724)	3203 (586-8049)	3295.5 (741-9724)	0.68
Potassium_(mg)	4361.2 (703-15306)	4303.1 (955-8793)	4419.4 (703-15306)	0.68
Calcium_(mg)	1130.9 (158-3389)	1108.7 (158-2156)	1153.2 (235-3389)	0.55
Magnesium_(mg)	419.4 (117-1225)	417.8 (125-908)	420.9 (117-1225)	0.90
Phosphore_(mg)	1831.3 (198-4152)	1799.9 (198-3633)	1862.7 (595-4152)	0.53
Iron_(mg)	16.5 (5-44)	16.2 (5-35)	16.8 (5-44)	0.54
Zinc_(mg)	13.4 (4-31)	16.1 (4-31)	13.7 (4-31)	0.42
VitaminA_(mcg_er)	1458.2 (101-5730)	1452.2 (327-5730)	1464.2 (101-4384)	0.93
Retinoid_(mcg)	644.6 (76-5670)	642.7 (76-5670)	646.5 (93-3222)	0.97
Carotenoid_(mcg)	4881.5 (48-16657)	4857.2 (294-13417)	4905.9 (48-16657)	0.92
VitaminD_(mcg)	7.9 (1-35)	7.8 (1-33)	8.1 (1-35)	0.75
VitaminE_(mg_et)	12.3 (1-42)	12.2 (4-34)	12.4b (1-42)	0.78
VitaminB1_(mg)	1.9 (0-5)	1.9 (0-4)	2 (0-5)	0.92
VitaminB2_(mg)	2.5 (0-6)	2.5 (0-5)	2.5 (1-6)	0.91
Niacin_(mg)	32 (11-73)	31.5 (13-63)	32.5 (11-73)	0.52
VitaminB6_(mg)	2.8 (1-9)	2.8 (1-6)	2.9 (1-9)	0.49
FolicAcid_(mcg)	418.2(39-1343)	416.7 (70-982)	419.8(39-1343)	0.87
VitaminB12_(mcg)	11.3(2-42)	11.4 (2-42)	11.2 (3-28)	0.76
VitaminC_(mg)	216.1 (8-940)	219.9 (8-712)	212.3(8-940)	0.72
DII	-1.7 (-4.5-3.73)	-2.6 (-4.5-2.7)	-0.7 (-4.2-3.7)	**<0.0001**
E-DII	-0.8 (-4.7-3.65)	-1.7 (-4.7-3.6)	-0.3 (-1.8-3.5)	**<0.0001**

Germans Trias i Pujol Hospital

Table 3. Blood concentrations and urinary parameters of patients and controls (median and range).

Blood (mg/dl)	Concentrations		
	Controls (63)	Cases (97)	p-value
Creatinine	0.92 (0.6-1.8)	0.91(0.5-1.3)	0.25
Uric acid	5.1 (0.7-9.4)	5.4 (2.6-7.6)	0.95
Calcium	9.4 (8.8-10.1)	9.4 (8.3-10.8)	0.90
Phosphate	3.6 (2.5-5.4)	3.2 (2.2-4.8)	**<0.001**
Magnesium	2.1 (1.7-2.5)	2.1(1.6-2.9)	0.19
Total Cholesterol	190 (116-290)	194 (122-298)	0.74
HDL Cholesterol	52.4 (25.2-145)	51.1 (29-80.1)	0.06
LDL Cholesterol	110 (34.8-200)	111 (44-192)	0.66
Triglicerides	96 (36-483)	108(33-966)	0.56
Glucose	92 (70-150)	94 (65-213)	0.08
Parathormone (pg/ml)	35.9 (12.3-89.8)	46.9 (5.3-138)	**<0.001**
Urinary parameters			
	Controls	Patients	p-value
Calcium concentration (mmol/L)	3.3 (0.2-10.3)	4.4 (0.8-14.6)	**0.008**
Phosphate concentration (mmol/L)	25 (4.6-68.2)	27.3 (6.6-64.1)	0.43
Magnesium concentration (mmol/L)	3.3 (0.3-9.2)	3.1 (0.5-10.6)	0.81
Citrate concentration (mmol/L)	1.7 (0.2-4.2)	1.5 (0.2-3.3)	0.27
Oxalate concentration (mg/L)	21.3 (5.1-76.8)	20.7 (3-50.4)	0.29
Uric acid concentration (mmol/L)	1.9 (0.2-5.5)	2.2 (0-6.3)	0.84
pH	6 (5-7.5)	6 (5-7)	0.70
Volume (ml)	425 (50-1900)	450 (50-1700)	0.81
SS (CaOx)	4.7 (0.5-20.4)	5.8 (0.4-15.5)	0.83
SS (Bru)	1.8 (0.06-28.18)	3.6 (0.18-19.05)	0.16
SS (UA)	1.8 (0.03-9.3)	1.7 (0.01-10.9)	0.10
SS:supersaturation; CaOx: calcium oxalate; Bru: brushite (calcium hydrogen phosphate); UA: uric acid			

Table 4. Correlations between blood and 24h urine concentrations and excretions and E-DII.

	Correlation coeficient	p-value
Blood concentrations		
Creatinine (mg/dl)	0.01	0.20
Uric acid (mg/dl)	-0.006	0.64
Calcium (mg/dl)	0.0009	0.54
Phosphate (mg/dl)	-0.012	0.07
Magnesium (mg/dl)	-0.0013	0.71
Total Cholesterol (mg/dl)	-0.006	0.36
HDL Cholesterol (mg/dl)	-0.02	**0.03**
LDL cholesterol (mg/dl)	0.01	0.30
Triglicerides (mg/dl)	-0.003	0.87
Glucose (mg/dl)	-0.01	0.09
Parathormone (pg/ml)	0.02	0.18
Urine parameters		
Calcium concentration	0.25	**0.02**
Phosphate concentration	0.48	**<0.0001**
Magnesium concentration	0.33	**<0.0001**
Citrate concentration	0.04	0.34
Oxalate concentration (mg/L)	0.11	0.21
Uric acid concentration	0.27	**0.004**
pH	-0.08	0.16
Volume (ml)	-0.25	**0.003**
SS (CaOx)	-0.09	0.23
SS (BRU)	-0.02	0.38
SS (UA)	0.16	0.21
SS:supersaturation; CaOx: calcium oxalate; Bru: brushite (calcium hydrogen phosphate); UA: uric acid		

Results

- DII and E-DII values were significantly more positive (i.e., more pro-inflammatory) in cases (-0.7 and -0.3) than in controls (-2.6 and -1.7), $p<0.0001$ and $p<0.0001$ respectively.
- In blood, a significant negative correlation was seen between E-DII and HDL cholesterol ($p=0.03$).
- In urine, significant positive correlations were seen between E-DII and each of calcium ($p=0.02$), phosphate ($p<0.0001$), magnesium ($p<0.0001$) and uric acid ($p=0.004$) concentrations.
- A significant negative correlation was seen between E-DII and volume ($p=0.003$).

Conclusions

Germans Trias i Pujol Hospital

Our results show that, the **evaluation of the inflammatory potential of the whole diet** rather than that of individual dietary components, **can differentiate between SFs and Cs**, thereby demonstrating the importance of pro-inflammatory diets in stone pathogenesis.

Thus, our study provides a compelling argument for **determining DII/ E -DII scores in lithogenic patients** on presentation and after dietary intervention, as part of their **routine work-up**.