Urinary KIM-1 but not urinary NGAL is increased after short maximal exercise.

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INTRODUCTION

Urinary NGAL (uNGAL) and urinary KIM-1 (uKIM-1) are markers of acute kidney injury.
The albuminuria is a well–known abnormality after an intensive physical exercise.
The aim of this study was to investigate changes in uNGAL and uKIM-1 after intensive exercise causing albuminuria.

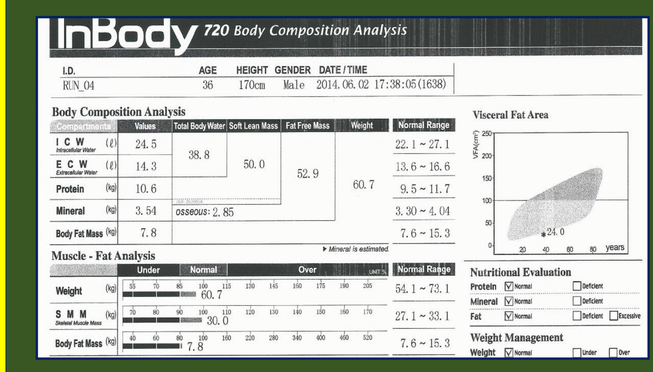
Bruce protocol

Stage	Minutes (min)	Speed (km/h)	Grade (%)
0	0-3	0	0
1	3-6	2.7	10
2	6-9	4.0	12
3	9-12	5.5	14
4	12-15	6.8	16
5	15-18	8.0	18
6	28-21	8.8	20
7	21-24	9.6	22

METHODS

18 participants (9 males and 9 females, mean age 37,08 ± 7.66) took part in the study.
All were fit amateur runners; the mean BMI and WHR were 22.7 and 0.82 in females; 23.07 and 0.79 in males, respectively.
Subjects underwent a two graded treadmill exercise tests (GXT) according to Bruce protocol (table).
Maximal oxygen consumption (VO2max) was measured.
Immediately before and after test urine was collected.
Creatinine (CREA), albumin (ALB) , uNGAL, and u KIM-1 were mesured.
ALB to CREA (ACR); KIM-1 to CREA (KCR) and NGAL to CREA (NCR) ratios were calculated.
Wilcoxon matched pairs test was used in statistical data analysis. This protocol was approved by an Institiutional Ethics Committee.

Body composition analysis

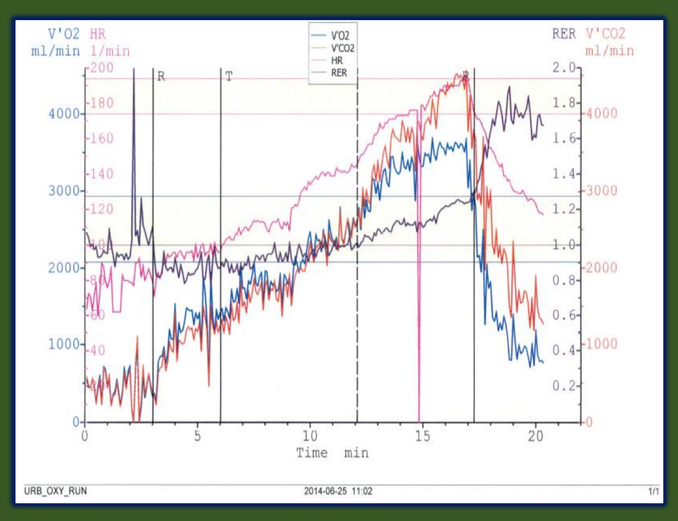


RESULTS

The mean VO2max was 54.29 in females and 60.83ml/min/kg in males.
For amateurs in this age there are excellent results, showing that exercise was really very intensive.
ALB, ACR, uKIM-1 were significantly higher after exercise.
KCR was increased without statistical significance.
All results are shown in a table.

Results of treadmill exercise tests

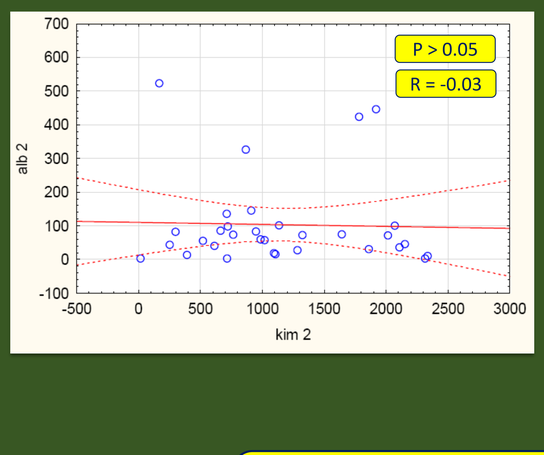
	Date:	2014-06-02			Protocol:	RUN RADEK BRUCE		
	Time:	18:37:15			Ergometer:	Bicycle		
Summary		Resting	Ref.	AT Vslope	MaxVO2	Max Watts	Recov 60 sec	Recov 180 sec
Time averaging 5 Seconds								
Time	min	03:00	06:00	12:05	16:50	16:50	18:15	20:15
Phase time	min	02:56	03:01	06:05	10:51	10:51	00:59	02:59
Load	W	0	0	0	0	0	0	0
Relative workload	W/kg	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rotations/min	1/min	0	0	0	0	0	0	55
Ventilation	L/min	11	32	65	117	117	77	42
Tidal volume-ex	L	1.552	1.252	1.774	2.239	2.239	2.075	1.553
Breathing freq	1/min	7	26	37	52	52	37	27
Breathing reserve	%	93	79	57	23	23	49	72
O2 uptake	ml/min	327	1424	2599	3769	3769	1454	792
O2 uptake/kg	ml/min/kg	5.4	23.5	42.8	62.1	62.1	23.9	13.1
V'O2/V'O2max	%	9	38	69	100	100	39	21
V'O2/V'O2pred	%	13	57	104	150	150	58	32
VO2 slope	ml/min/Watt	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heart rate	1/min	80	96	146	196	196	148	118
O2 pulse	ml	4.1	14.8	17.8	19.2	19.2	9.8	6.7
HR slope	1/ml/kg	14.8	4.1	3.4	3.2	3.2	6.2	9.0
Heart rate reserve	1/min	104	88	38	-	-	36	66
CO2 production	ml/min	361	1244	2643	4560	4560	2517	1329
Breath. equiv. CO2		28.3	24.5	23.6	24.8	24.8	29.5	30.3
Breath. equiv. O2		31.2	21.4	24.0	30.0	30.0	51.0	50.9
Respir. exchange ratio		1.10	0.87	1.02	1.21	1.21	1.73	1.68

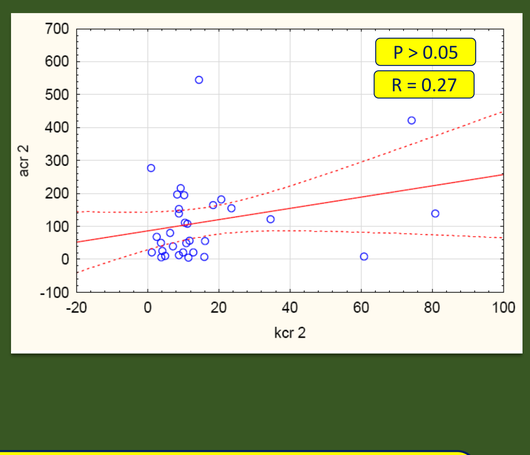


Albuminuria and markers of acute kidney injury

	Alb (mg/L)	ACR (mg/g)	KIM-1 (pg/mL)	KCR (ng/g)	NGAL (ng/mL)	NCR (mikrog/g)
Pre-GTX	4.28	8.82	849.02	1239.12	6.375	14.35
Post-GTX	103.37	114.35	1243.26	1725.9	6.310	13.38
p	<0.01	<0.01	<0.01	P=0.07	ns	Ns

There was no correlation between uKIM-1 and albuminuria





CONCLUSIONS

uKIM-1 is a very sensitive marker of kidney dysfunction.
In our study uKIM-1 was significantly increased after a very short exercise.
Albuminuria was also significantly increased, which is a normal finding after exercise and was expected in this study.
There was no correlation between ALB and uKIM-1.
Probably albuminuria was not causing uKIM-1 increase.
There was no change in uNGAL after short intensive exercise.

Authors

First three authors completed several marathons and ultramarathons.
W. Ratkowski won a Polish Championship in Marathon in 1984.
Foto: Two authors - W.R. and W.W. during 78-km mountain marathon in Bieszczady Mountains.

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