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Sabato 23 ottobre 2010
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FEDERAZIONE ITALIANA DI ATLETICA LEGGERA
Centro Studi & Ricerche

POLIZIA DI STATO FIAMME ORO

Provincia di Padova

Variazione acuta dei parametri ematologici negli ultra maratoneti

Giuseppe Lippi MD, Gian Luca Salvagno MD,

UNIVERSITY OF VERONA

PAUL D. THOMPSON

Director of Preventive Cardiology and Cardiovascular Research, Hartford Hospital, Hartford, CT

Historical Concepts of the Athlete's Heart

MEDICINE & SCIENCE IN SPORTS & EXERCISE®

DOI: 10.1249/01.MSS.0000117117.67849.F6

D. BRUCE DILL HISTORICAL LECTURE

Pheidippides : Hero of Ancient Greece

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According to Webster (*Third New International Dictionary*) the word *marathon* as it relates to racing is either a footrace run on an open course, now usually 26 miles, 385 yards, or else a race of great length other than a footrace. The word originates from a city in Greece of the same name, where legend has it that an Athenian named Pheidippides ran from the battlefield of Marathon to Athens, a distance approximating 24 miles, to report victory over the Persians in a momentous battle fought in the year 490 B.C. As he gasped out the happy news upon his arrival in Athens, he fell dead from his exertions. The ancient evidence for this exploit is very slender indeed, and the man's name, in any case, was probably not Pheidippides.

ANNALS of THE NEW YORK ACADEMY OF SCIENCES

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DEVELOPMENT OF THE MARATHON FROM PHEIDIPPIDES TO THE PRESENT, WITH STATISTICS OF SIGNIFICANT RACES

David E. Martin

College of Allied Health Sciences
Georgia State University
Atlanta, Georgia 30303

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Marathoner's Heart?

Paul D. Thompson, Fred S. Apple and Alan Wu

Circulation 2006;114;2306-2308

The history of the Athlete's Heart mirrors the ongoing debate on the risks and rewards of vigorous exercise and of athletic training and competition, a debate existent since ancient Greece. These real and imagined risks of exertion are epitomized by the story of Pheidippides, the Athenian who in 490 BC reportedly ran 40 km (24 miles) from the battlefield at Marathon to Athens (24). He announced the Athenian victory, collapsed, and died.

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

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This story provides a dramatic introduction to the risks of exercise but is likely only partly true. Pheidippides was more likely named Philippides or Phidippus (24). His run was not solely from Marathon to Athens to announce victory, but from Athens to Sparta to solicit military aid and back to Athens with the bad news that the Spartans were not coming (Pheidippides. Internet Communication Accessed 5/2003). This distance was not 40 km, but closer to 500 km (300 miles) (24).

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Myocardial Injury and Ventricular Dysfunction Related to Training Levels Among Nonelite Participants in the Boston Marathon

Tomas G. Neilan, James L. Januzzi, Elizabeth Lee-Lewandrowski, Thanh-Thao Ton-Nu, Danita M. Yoerger, Davinder S. Jassal, Kent B. Lewandrowski, Arthur J. Siegel, Jane E. Marshall, Pamela S. Douglas, David Lawlor, Michael H. Picard and Malissa J. Wood

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

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Cardiac damage during marathon running has been described in 60 nonprofessional athletes who participated in the 2004 and 2005 Boston Marathon. Of recreational runners, 60% showed increased troponin T (TnT) after the race; NT-proBNP concentration roughly doubled. Left ventricular size and ejection fraction did not change, but a reduced left ventricular compliance was echocardiographically demonstrated. Changes of biochemical signs of cardiac damage were higher in subjects who had a low training workload (12). These data suggested that appropriate training is fundamental for limiting or avoiding possible damages.

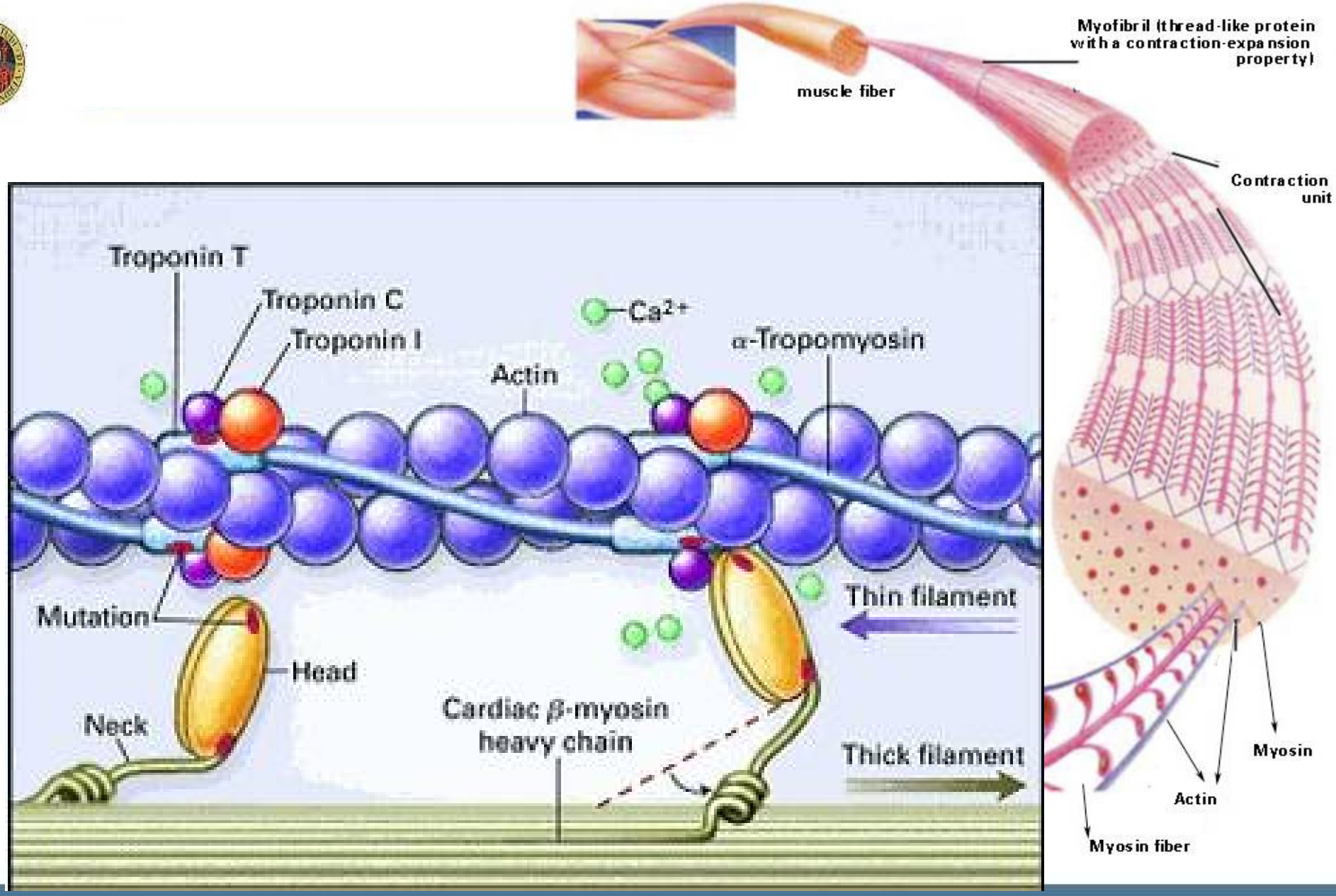
NT-proBNP Concentrations in Mountain Marathoners

Giuseppe Banfi,[1] Giuseppe Lippi,[2] Daniele Susta,[3] Alessandra Barassi,[4] Gianvico Melzi d'Eril,[4] Giada Dogliotti,[5] and Massimiliano M. Corsi[1,5]

[1]Institute R. Galeazzi, IRCCS, I- 20161 Milan, Italy; [2]Section of Clinical Chemistry, Department of Morphological and Biomedical Sciences, University of Verona, Italy; [3]School of Health and Human Performance, Faculty of Science and Health, Dublin City University, Dublin, Ireland; [4]Department of Medicine, Surgery and Odontostomatology, Hospital San Paolo, University of Milan, Italy; and [5]Department of Human Morphology and Biomedical Sciences "Città Studi," University of Milan, Italy

Journal of Strength and Conditioning Research

VOLUME 0 | NUMBER 0 | MONTH 2010


Myofibril (thread-like protein with a contraction-expansion property)
muscle fiber
Contraction unit
Troponin T
Troponin C
Troponin I
Ca2+
α-Tropomyosin
Actin
Mutation
Thin filament
Head
Neck
Cardiac β-myosin heavy chain
Thick filament
Myosin
Actin
Myosin fiber

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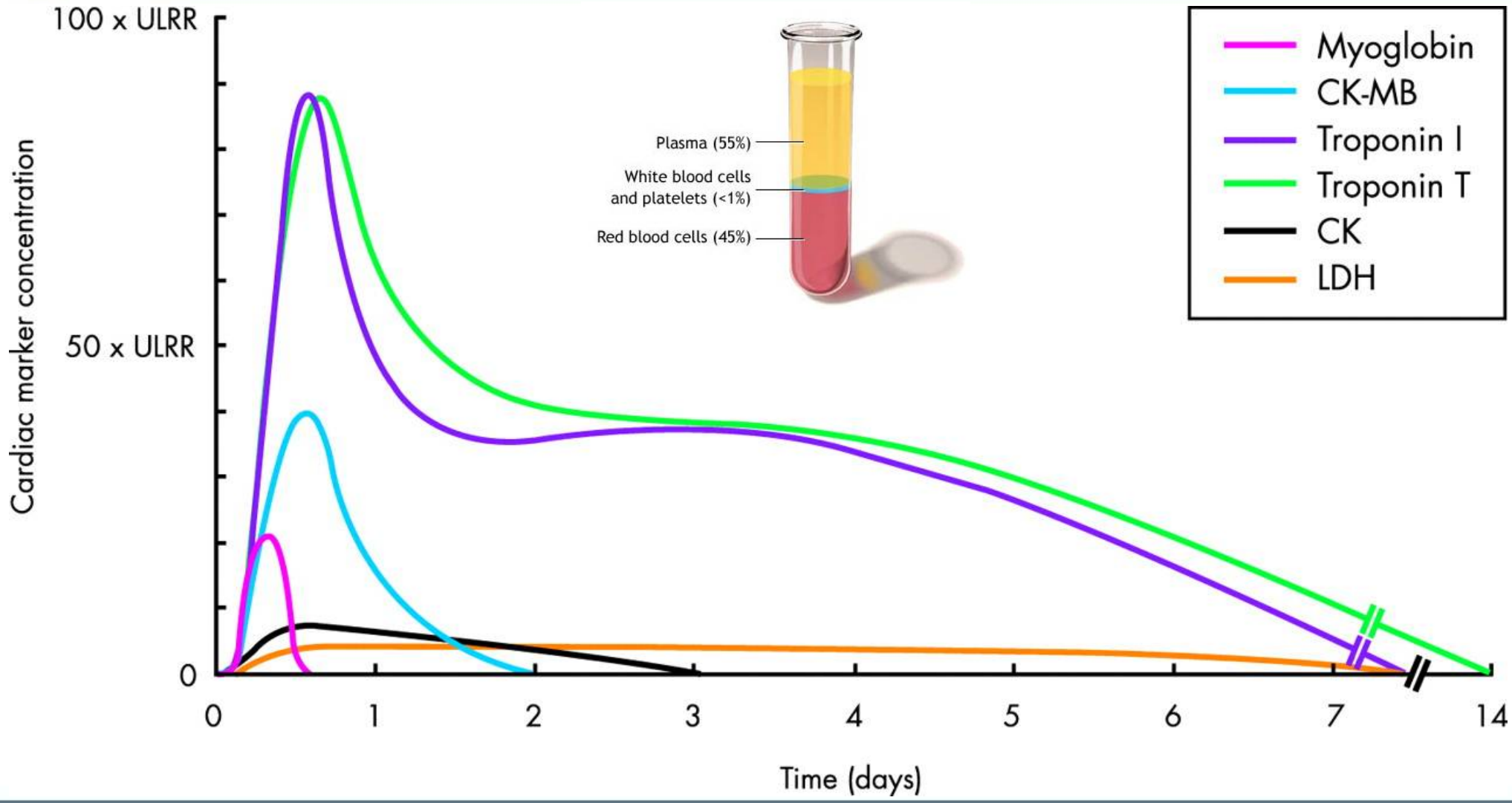
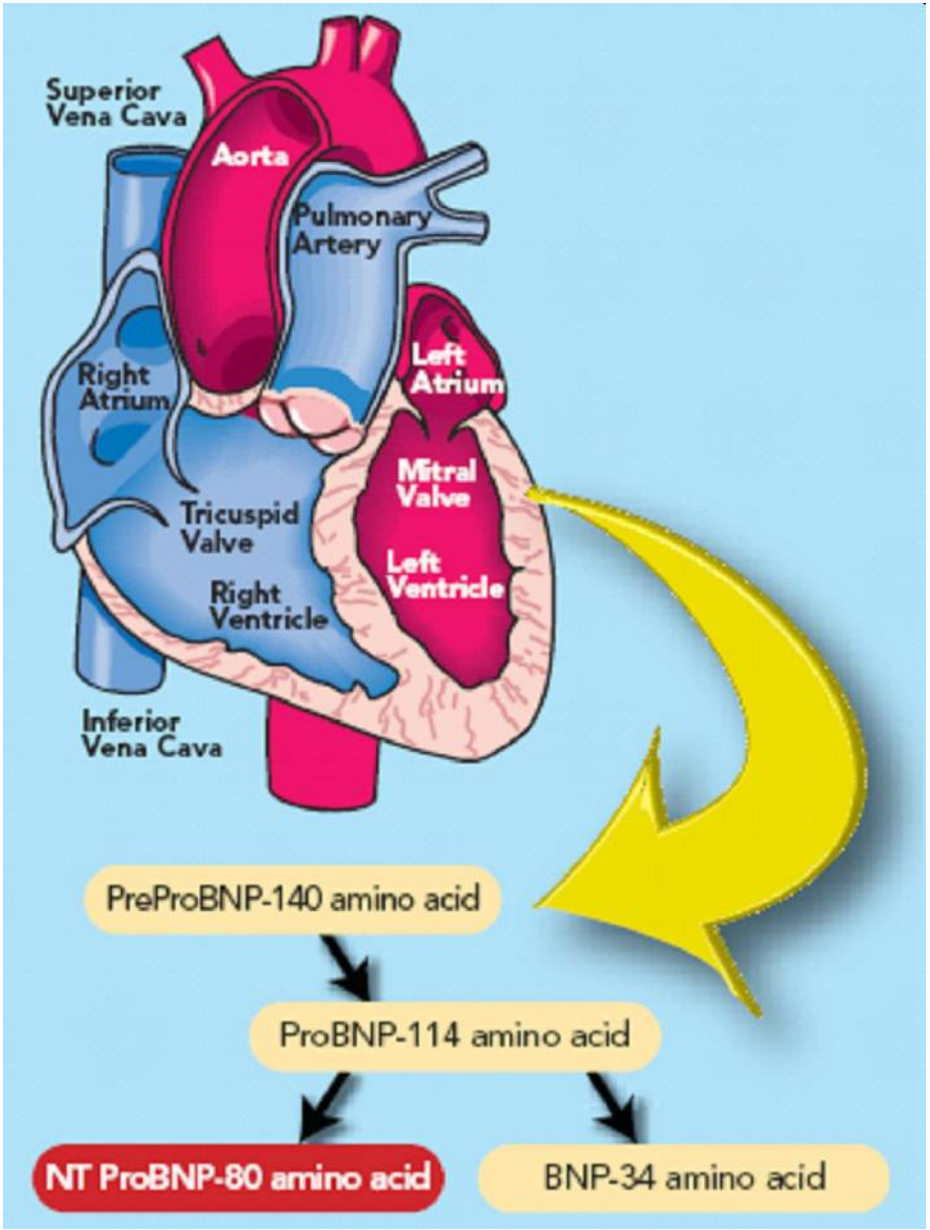
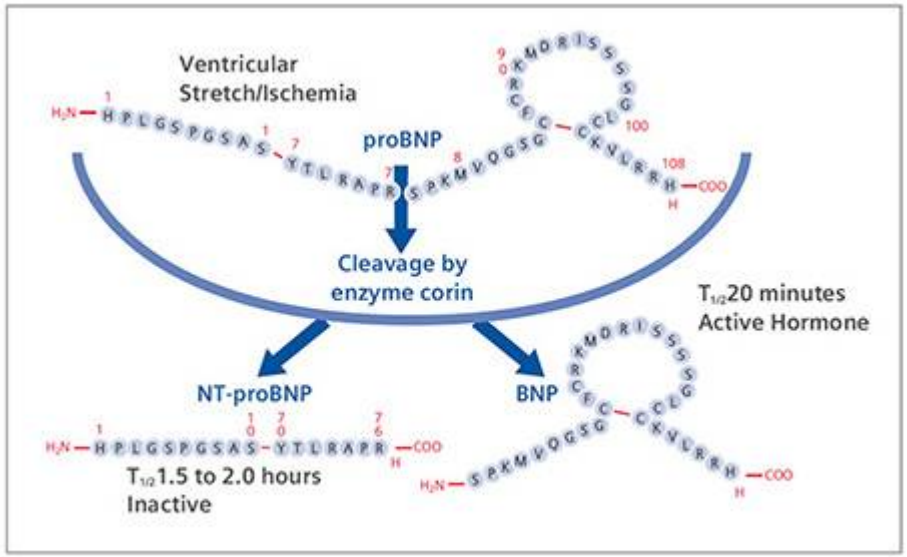
Cardiac Marker Concentration and Time





Brain natriuretic peptide (BNP) and Congestive Heart Failure



ProBNP molecule cleaved to BNP and NT-proBNP.

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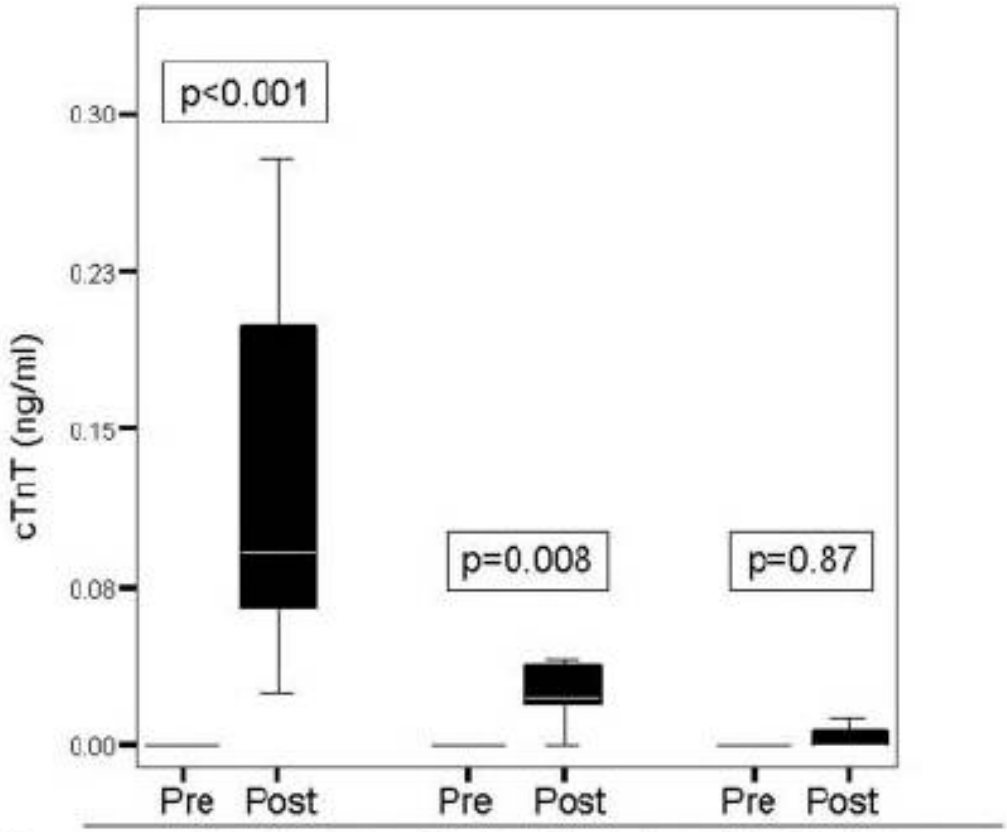

Training mileage:	≤35 miles/wk	36-45 miles/wk	>45 miles/wk
Δ in median (ng/ml):	0.09	0.02	<0.01

p<0.001 for difference in Δ median between groups

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Circulation November 28, 2006

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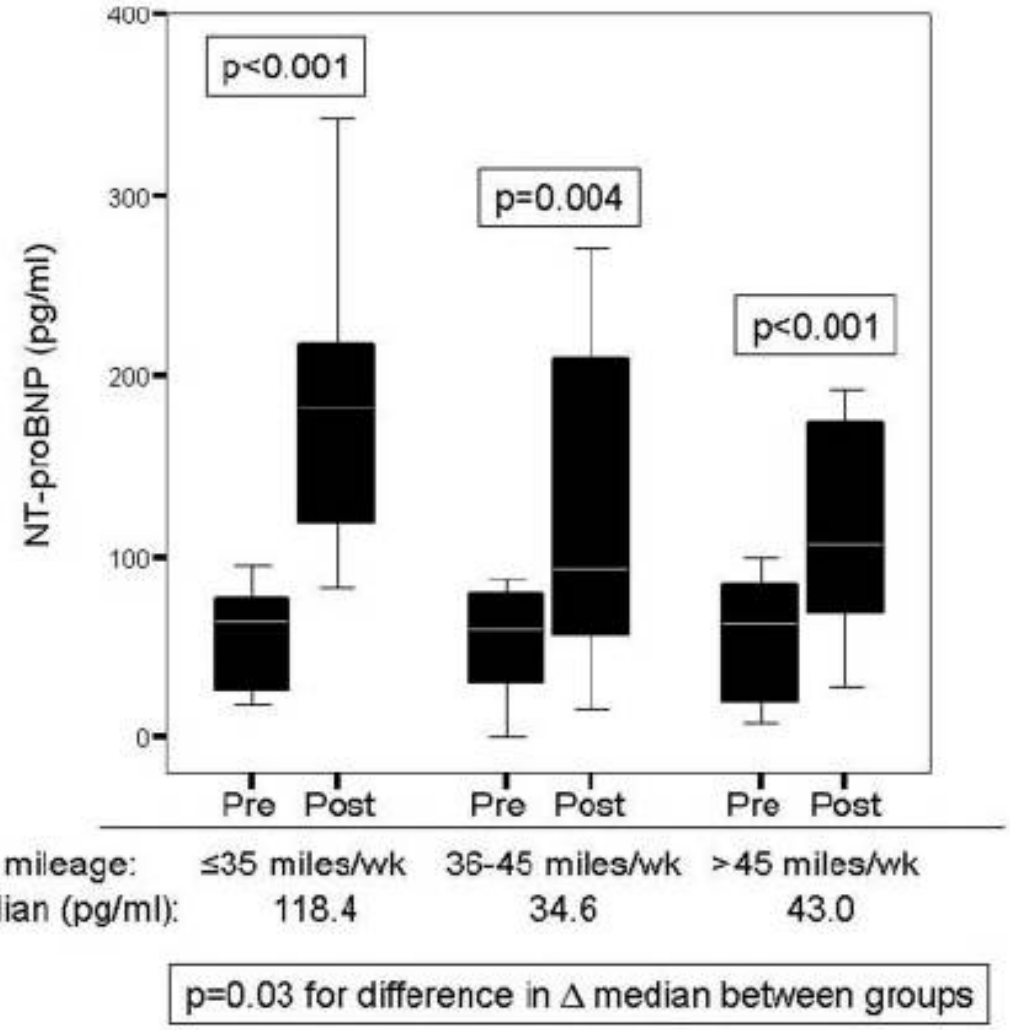

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Journal of Strength and Conditioning Research
VOLUME 0 | NUMBER 0 | MONTH 2010

NT-pro BNP and Tn-I

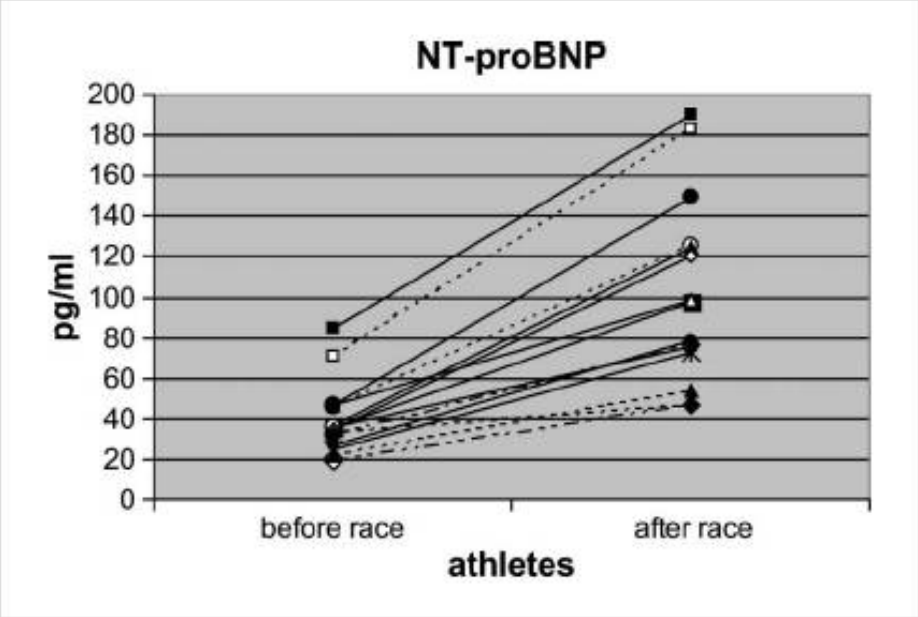

Figure 1. Concentration of N-terminal proB-type natriuretic peptide (NT-proBNP) before and after the race, expressed as pg/mL.

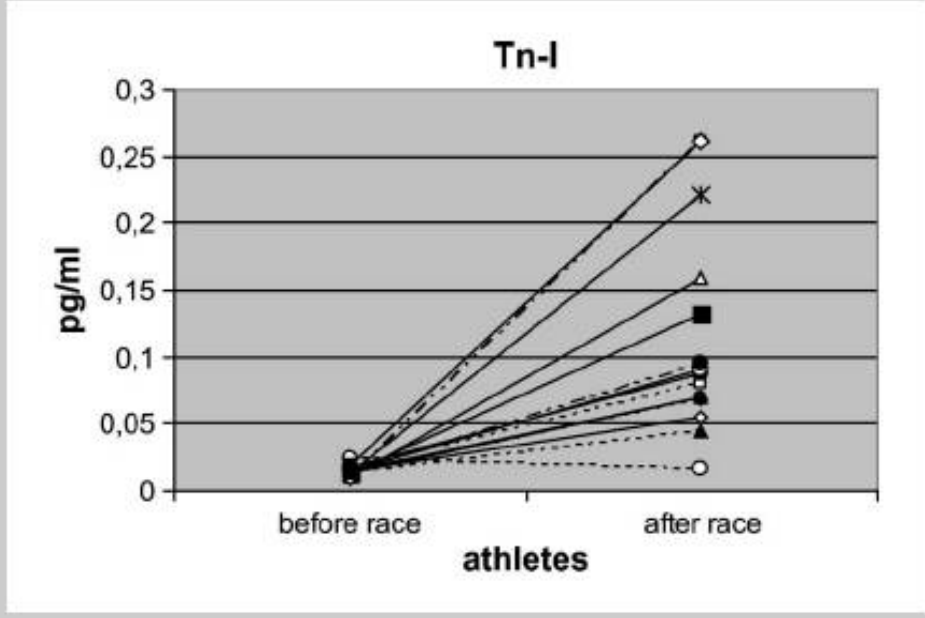

Figure 2. Concentration of troponin I (TnI) before and after the race, expressed as ng/mL.

Clin. Lab. 2008;54:XXX-XXX

SHORT COMMUNICATION

Influence of a Half-Marathon Run on NT-proBNP and Troponin T.

GIUSEPPE LIPPI[1], FEDERICO SCHENA[2], GIAN LUCA SALVAGNO[1], MARTINA MONTAGNANA[1], MATTEO GELATI[1], CANTOR TARPERI[2], GIUSEPPE BANFI[3], GIAN CESARE GUIDI[1].

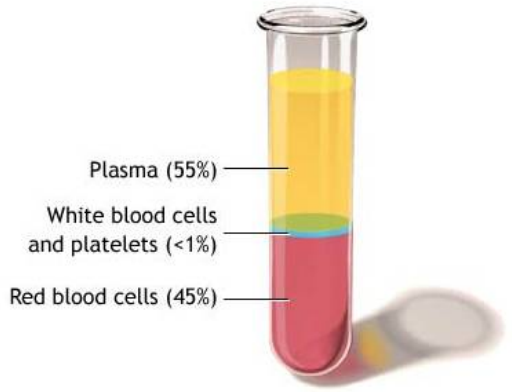

Table 1: Variation of plasma volume, troponin T (TnT) and N-terminal proB-type natriuretic peptide (NT-proBNP) values before (pre), immediately after (post), 3, 6 and 24 h after a 21-km half-marathon run in 17 healthy, trained males. Values are presented as geometric mean ± the standard error of the mean. Differences from the pre-marathon values are evaluated by Mann-Whitney U test.

	Pre	Post	3 h	6 h	24 h
Plasma volume change (%)	-	6.8±1.1‡	1.8±1.0	-1.0±3.1	-4.4±1.0‡
NT-proBNP (pg/mL)	28.8±4.8	56.6±9.2‡	50.2±8.1‡	50.0±6.7‡	41.9±6.5†
TnT (ng/mL)	<0.03	<0.03	<0.03	<0.03	<0.03

† $p < 0.05$ and ‡ $p < 0.01$ (versus the pre-run sample).

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Highly Sensitive Cardiac Troponin T Is Not Increased by Strenuous Eccentric Exercise

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Franco Impellizzeri, MD
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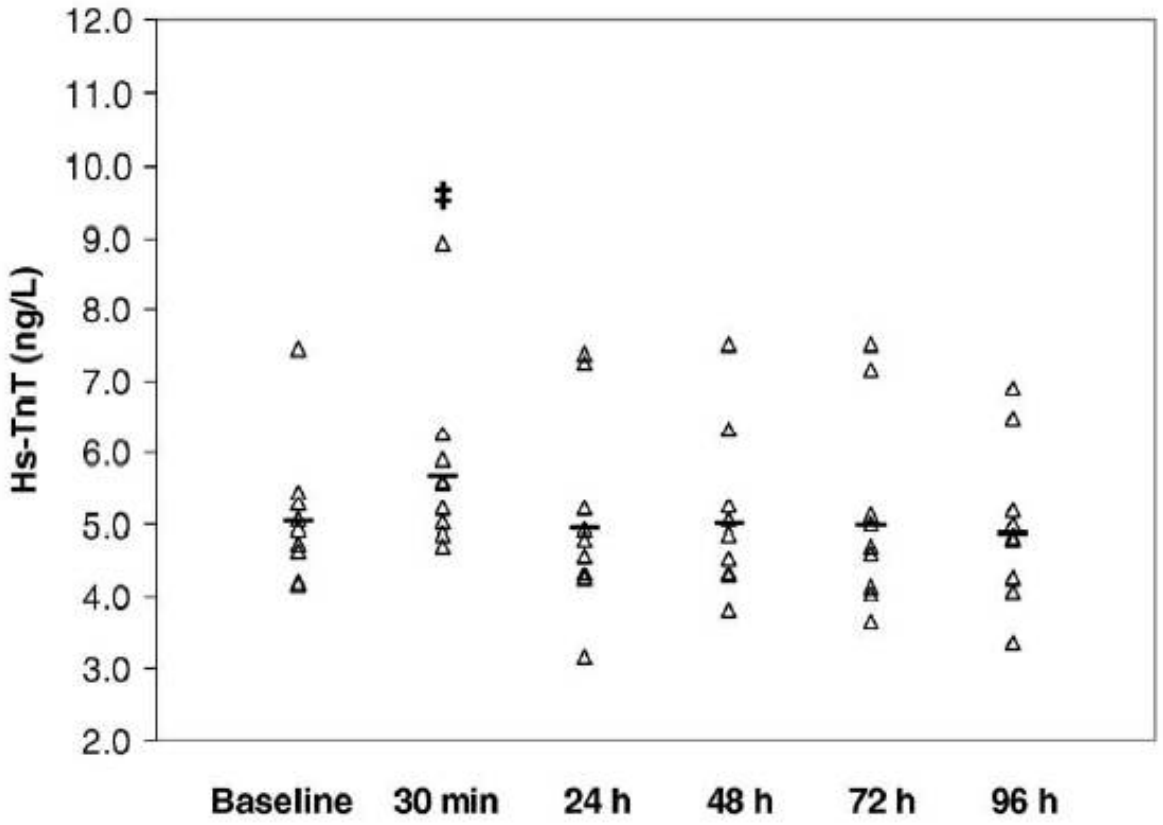
Verona, Italy



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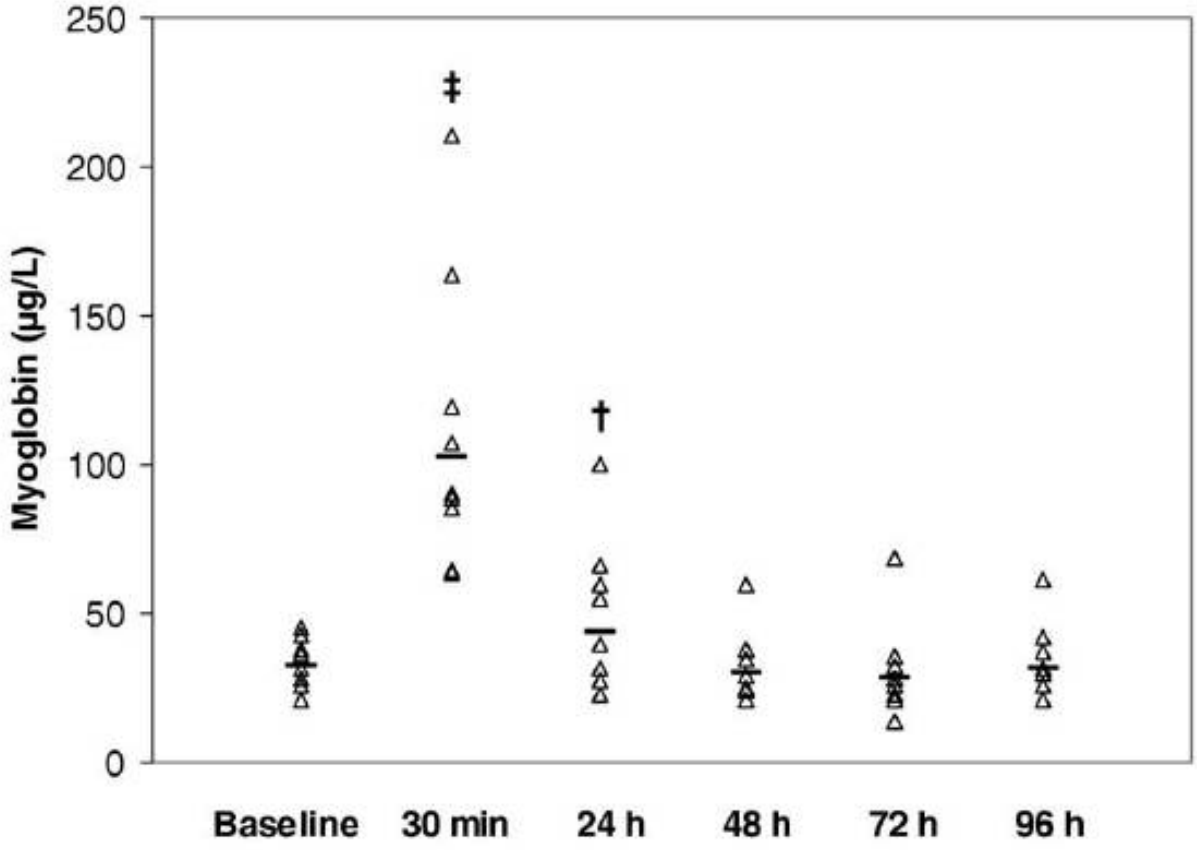

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The Scandinavian Journal of Clinical & Laboratory Investigation, 2008; (First Article): 1–6

ORIGINAL ARTICLE

Acute variation of biochemical markers of muscle damage following a 21-km, half-marathon run

G. Lippi[1*], F. Schena[2], G. L. Salvagno[1], M. Montagnana[1], M. Gelati[1], C. Tarperi[2], G. Banfi[3] and G. C. Guidi[1]

Table I. Variation of biochemical markers of muscle damage before (pre), immediately after (post), 3 h, 6 h and 24 h after a 21-km half-marathon run in 15 recreational male athletes. Values are presented as geometric mean ± standard error of the mean. Differences from the pre-marathon values are evaluated using the Mann-Whitney U-test.

	Pre	Post	3 h	6 h	24 h
Plasma volume change (%)		−8.0 ± 1.0‡	−0.4 ± 1.0	+1.2 ± 1.1	+3.8 ± 1.0‡
Weight loss (%)		8.8 ± 0.7‡	1.6 ± 0.7	−0.1 ± 0.8	−1.7 ± 0.7‡
Aspartate aminotransferase (U/L)					
Values	29 ± 2	32 ± 2‡	33 ± 2‡	32 ± 2†	32 ± 2†
Subject with values above the reference range	1 (7 %)	1 (7 %)	1 (7 %)	2 (14 %)	1 (7 %)
Creatine kinase (U/L)					
Values	127 ± 25	176 ± 32‡	199 ± 30‡	217 ± 31‡	227 ± 29‡
Subject with values above the reference range	3 (20 %)	5 (33 %)	8 (53 %)	10 (67 %)	10 (67 %)
Creatine kinase MB (ng/mL)					
Values	3.5 ± 0.3	4.0 ± 0.3‡	4.8 ± 0.3‡	5.3 ± 0.4‡	5.5 ± 0.4‡
Subject with values above the reference range	1 (7 %)	1 (7 %)	3 (20 %)	5 (33 %)	6 (40 %)
Lactate dehydrogenase (U/L)					
Values	291 ± 12	357 ± 16‡	370 ± 15‡	350 ± 21‡	319 ± 13‡
Subject with values above the reference range	0 (0 %)	0 (0 %)	0 (0 %)	1 (7 %)	0 (0 %)
Myoglobin (ng/mL)					
Values	36 ± 3	102 ± 13‡	104 ± 14‡	100 ± 16‡	47 ± 5‡
Subject with values above the reference range	0 (0 %)	11 (73 %)	11 (73 %)	10 (67 %)	4 (27 %)
Troponin T (ng/mL)					
Values	<0.03	<0.03	<0.03	<0.03	<0.03
Subject with values above the reference range	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)

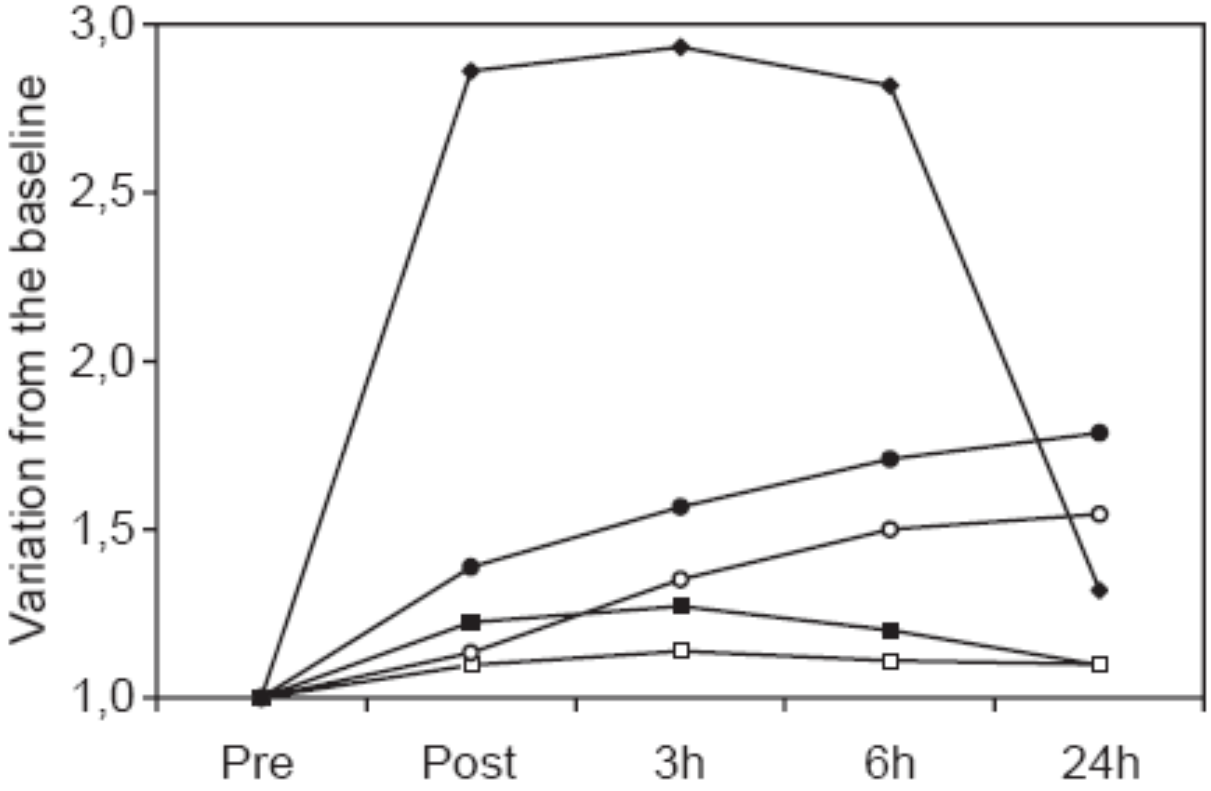

Figure 1. Variation of biochemical markers of muscle damage (□=aspartate aminotransferase, ALT; ●=creatine kinase, CK; ○=creatine kinase isoenzyme MB; ■=lactate dehydrogenase, LDH; ◆=myoglobin) following a half-marathon running in 15 recreational male athletes.

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SHORT REPORT INTERNATIONAL JOURNAL OF LABORATORY HEMATOLOGY

Acute variation of leucocytes counts following a half-marathon run

G. LIPPI*, G. BANFI†, M. MONTAGNANA*, G. L. SALVAGNO*, F. SCHENA‡, GIAN CESARE GUIDI*

Table 1. Variation of haematological parameters before (pre), immediately after (post), 3, 6 and 24 h after a 21-km half-marathon run in 17 recreational male athletes

	Pre	Post	3 h	6 h	24 h
Weight loss, %	–	6.8 ± 0.4‡	0.8 ± 0.8	−0.5 ± 0.8†	−2.5 ± 0.7†
Plasma volume change, %	–	−7.6 ± 0.9‡	−1.0 ± 1.4	+0.9 ± 1.7	+3.2 ± 0.9†
Haematocrit	44.9 ± 0.5	46.5 ± 0.5‡	45.0 ± 0.7	44.2 ± 0.6†	43.9 ± 0.6†
Haemoglobin (g/l)	152 ± 2	159 ± 2‡	153 ± 2	149 ± 2‡	148 ± 2‡
Red Blood Cells count (10^{12}/l)	4.8 ± 0.1	5.1 ± 0.1†	4.9 ± 0.1	4.8 ± 0.1	4.7 ± 0.1†
White blood cells count (10^6/l)	5.6 ± 0.3	9.8 ± 0.6‡	11.5 ± 0.6‡	9.8 ± 0.4‡	5.6 ± 0.2
Neutrophils (10^6/l)	3.0 ± 0.2	6.7 ± 0.6‡	9.3 ± 0.6‡	7.1 ± 0.4‡	2.9 ± 0.2
Lymphocytes (10^6/l)	1.9 ± 0.1	2.2 ± 0.1†	1.5 ± 0.1‡	2.0 ± 0.1	1.9 ± 0.1
Monocytes (10^6/l)	0.31 ± 0.02	0.42 ± 0.03‡	0.46 ± 0.03‡	0.43 ± 0.02‡	0.32 ± 0.01
Eosinophils (10^6/l)	0.15 ± 0.02	0.09 ± 0.01‡	0.02 ± 0.01‡	0.06 ± 0.01‡	0.15 ± 0.02
Basophils (10^6/l)	0.03 ± 0.01	0.05 ± 0.01†	0.06 ± 0.01†	0.05 ± 0.01†	0.04 ± 0.01
Platelets (10^9/l)	219 ± 16	279 ± 13‡	222 ± 11	225 ± 13	214 ± 14

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Table 2 Changes in Hb, Hct, red cell parameters and platelet count before and after the race

	Pre-race	0 h post-race	2 d post-race	9 d post-race
Red cell count ($\times 10^{12}$/L)	4.71±0.25[ce]	4.71±0.45	4.07±0.27	4.42±0.21
Hb (g/dL)	14.63±0.91[ce]	14.58±1.17	12.52±0.86	13.81±0.69
Hct (%)	42.34±2.73[ce]	42.37±3.82	37.33±3.15	40.27±1.84
Mean cell volume (fl)	89.91±3.11[e]	90.05±3.37	90.29±3.50	91.15±3.19
Mean cell Hb (pg)	31.09±1.23	31.02±1.44	30.90±1.29	31.22±1.34
Mean cell Hb Concentration (g/dL)	34.59±0.45[e]	34.44±0.60	34.24±0.47	34.25±0.64
Red cell distribution width (%)	12.84±0.60	12.94±0.88	12.69±0.57	12.80±0.65
Platelet ($\times 10^9$/L)	235.45±47.27[ace]	248.91±46.95	209.82±58.28	280.27±67.23

[a]$P<0.05$ *vs* statistically significant when pre-race compared with 0 h post-race. [c]$P<0.05$ *vs* statistically significant when pre-race compared with 2 d post-race. [e]$P<0.05$ *vs* statistically significant when pre-race compared with 9 d post-race.

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World J Gastroenterol 2004;10(18):2711-2714
World Journal of Gastroenterology
 ISSN 1007-9327

• CLINICAL RESEARCH •

Effects of 24 h ultra-marathon on biochemical and hematological parameters

Huey-June Wu, Kung-Tung Chen, Bing-Wu Shee, Huan-Cheng Chang, Yi-Jen Huang, Rong-Sen Yang

Table 4 Comparisons of parameters related to iron metabolism before and after the race

	Pre-race	0 h post-race	2 d post-race	9 d post-race
Ferritin (μg/L)	64.45±27.95[ae]	117.00±52.66	70.18±44.88	103.36±42.15
TIBC (μmol/L)	361.00±31.38[ae]	372.18±30.93	357.64±35.43	356.36±30.75
Transferrin saturation (%)	17.73±8.05[ae]	31.09±13.32	19.27±11.62	29.18±11.70

Table 6 Changes in parameters related to lipid metabolism before and after the ultra marathon race

	Pre-race	0 h post-race	2 d post-race	9 d post-race
TG (mmol/L)	0.95±0.27[a]	0.67±0.28	0.84±0.32	1.09±0.55
CHO (mmol/L	4.87±1.06[c]	4.63±1.09	4.13±0.57	4.51±0.50
HDL-C (mmol/L)	1.92±0.47	2.02±0.50	1.68±0.24	1.77±0.32
LDL-C (mmol/L)	2.51±0.78[ac]	2.30±0.72	2.02±0.49	2.24±0.39
CHO/ HDL-C	2.50±0.48[a]	2.30±0.37	2.40±0.38	2.60±0.43

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• CLINICAL RESEARCH •

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Table 5 Serum enzyme activity before and after the ultra marathon race

	Pre-race	0 h post-race	2 d post-race	9 d post-race
BIL-T (μmol/L)	11.63±2.91[a]	25.65±9.75	13.68±7.70	12.14±4.10
BIL-D (μmol/L)	2.57±0.68[a]	7.01±2.91	3.25±1.54	2.74±1.20
TP (g/L)	72.51±4.70[ce]	72.50±6.21	66.14±3.90	67.00±4.91
Albumin (g/L)	44.82±2.83 [ce]	45.42±2.92	38.55±5.83	42.43±2.84
Globulin (g/L)	27.53±2.51[c]	27.25±3.74	25.56±2.01	27.53±2.42
ALP (U/L)	132.85±56.50[a]	160.55±33.00	131.36±34.00	134.27±34.40
AST (U/L)	37.10±19.10[ac]	536.70±311.10	271.30±227.80	34.30±8.70
ALT (U/L)	35.10±13.10[ace]	118.40±75.10	126.00±68.30	50.50±18.90
γ-GT (U/L)	20.18±6.23	24.18±14.30	19.18±9.00	20.91±8.00
LDH (U/L)	367.50±105.60[ace]	1 420.50±598.50	1 120.30±605.10	582.70±207.90

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• CLINICAL RESEARCH •

Effects of 24 h ultra-marathon on biochemical and hematological parameters

Huey-June Wu, Kung-Tung Chen, Bing-Wu Shee, Huan-Cheng Chang, Yi-Jen Huang, Rong-Sen Yang

UNIVERSITY OF VERONA

Giuseppe Lippi[1*]
Federico Schena[2]
Martina Montagnana[1]
Gian Luca Salvagno[1]
Giuseppe Banfi[3]
Gian Cesare Guidi[1]

Acute Variation of Osteocalcin and Parathyroid Hormone in Athletes after Running a Half-

Clinical Chemistry 54:6 (2008)

Table 1. Variation of osteocalcin and parathyroid hormone before (pre), immediately after (post), and 3, 6 and 24 h after a 21-km, half-marathon run, in 15 male recreational athletes.[a]

	Pre	Post	3 h	6 h	24 h
Plasma volume change, %	—	–8.0 (1.0)[b]	–0.4 (1.0)	1.2 (1.1)	3.8 (1.0)[b]
Weight loss, %	—	8.8 (0.7)[b]	1.6 (0.7)	–0.1 (0.8)	–1.7 (0.7)[b]
Osteocalcin, μg/L	22.0 (2.5)	27.3 (3.0)[b]	21.6 (2.6)	20.2 (2.9)	22.3 (2.5)
Parathyroid hormone, pmol/L	3.1 (0.3)	6.4 (0.7)[b]	3.1 (0.3)	3.1 (0.5)	3.2 (0.3)

[a] Values are presented as geometric mean (SE). Differences from the premarathon values were evaluated by the Wilcoxon signed-rank test.
[b] $P < 0.01$, vs the pre-run sample.

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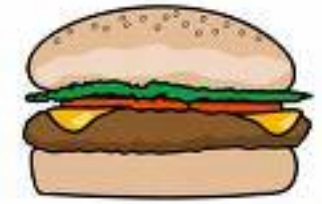
A-51



Influence of a regular, standardized meal on hematological testing.

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	WBC	NEU	LYMP	MONO	EOS	BASO	RBC	RDW	HGB	HCT	MCV	MCH	PLT	MPV
Desirable Bias (%)	5,6	9,0	7,4	13,2	19,8	15,4	1,7	1,7	1,8	1,7	1,2	1,4	5,9	2,3
Baseline specimen														
Mean value (SEM)	6,97 (0,63)	3,89 (0,43)	2,24 (0,18)	0,36 (0,04)	0,13 (0,02)	0,04 (0,00)	4,72 (0,10)	13,11 (0,27)	13,64 (0,29)	39,66 (0,71)	83,96 (1,39)	28,87 (0,60)	271,20 (16,46)	8,27 (0,12)
1 h after meal														
Mean value (SEM)	6,76 (0,56)	4,18 (0,42)	1,85 (0,15)	0,33 (0,03)	0,12 (0,02)	0,04 (0,00)	4,69 (0,09)	13,06 (0,26)	13,68 (0,29)	39,27 (0,70)	83,73 (1,37)	29,18 (0,62)	269,70 (15,36)	8,35 (0,10)
Mean % Difference	-3	7,4	**-17,4**	-6,9	-6,8	4,2	-0,7	-0,4	0,3	-1	-0,3	1,1	-0,6	1
p	0,129	**0,009**	**0,000**	**0,014**	0,085	0,413	0,068	**0,007**	0,247	**0,035**	**0,011**	**0,000**	0,284	0,112
2 h after meal														
Mean value (SEM)	6,80 (0,53)	4,19 (0,41)	1,82 (0,16)	0,35 (0,03)	0,11 (0,02)	0,04 (0,00)	4,60 (0,09)	13,15 (0,26)	13,49 (0,28)	38,62 (0,70)	83,98 (1,37)	29,32 (0,59)	277,58 (15,78)	8,23 (0,14)
Mean % Difference	-2,4	7,6	**-18,7**	-3,0	-15,4	-6,2	**-2,6**	0,3	-1,1	**-2,6**	0,0	**1,6**	2,4	-0,4
p	0,205	**0,043**	**0,000**	0,128	**0,001**	0,159	0,073	0,069	**0,021**	**0,000**	0,454	**0,000**	0,113	0,387
4 h after meal														
Mean value (SEM)	7,27 (0,45)	4,31 (0,33)	2,13 (0,17)	0,37 (0,03)	0,10 (0,02)	0,04 (0,00)	4,57 (0,10)	13,10 (0,27)	13,40 (0,32)	38,08 (0,76)	83,41 (1,34)	29,35 (0,63)	273,86 (15,56)	8,07 (0,12)
Mean % Difference	4,3	**10,7**	-4,9	4,4	**-23,2**	0,3	**-3,3**	-0,1	-1,7	**-3,9**	-0,6	**1,6**	1,0	**-2,3**
p	0,326	0,114	0,097	0,500	**0,003**	0,403	**0,001**	0,304	**0,021**	**0,000**	**0,000**	**0,000**	0,325	**0,015**

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Results 1

Variation of haematological parameters before (pre), immediately after (post), a 60-km ULTRA-marathon run in 18 recreational athletes

	Pre-Marathon	Post-Marathon
Haematocrit (%)	44.7±0.5	43.9±0.6
Haemoglobin (g/l)	14.3±0.2	14.3±0.3
Mean Corposcula Valume (MCV)	91±0.9	89.6±1.0
Mean Corpuscolar Hemoglobin (MCH)	29.2±0.3	29.2±0.3
Red Blood Cells count (10^{12}/l)	4.9±0.1	4.9±0.1

†, †† $p<0.05$ responders against non-responders between the beginning of the altitude training and the end

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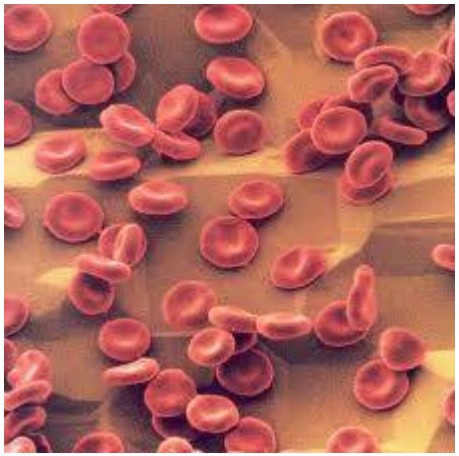
Results 2

	Pre-Marathon	Post-Marathon
White blood cells count (10^6/l)	6.0±0.4	16.3±1.0†
Neutrophils (10^6/l)	3.3±0.3	13.3±0.9
Lymphocytes (10^6/l)	1.8±0.1	1.7±0.2
Monocytes (10^6/l)	0.4±0.0	0.9±0.1†
Eosinophils (10^6/l)	0.2±0.0	0.1±0.0†
Basophils (10^6/l)	0.0±0.0	0.1±0.1 †
Platelets (109/l)	276±14.5	356.6±20.1 †



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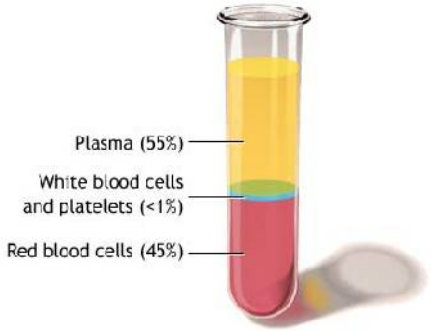
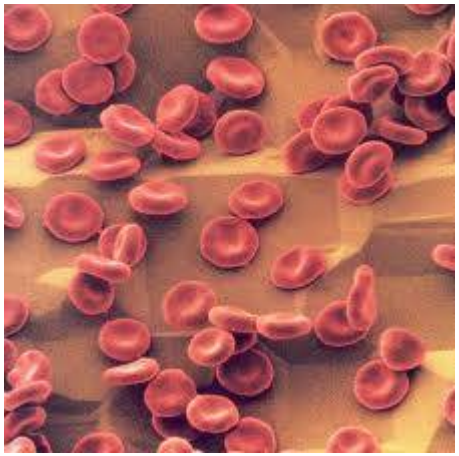
Results 3



	Pre-Marathon	Post-Marathon
Prothrombin Time (s)	10.7±0.2	11.6±0.2†
Activated Partial Thromboplastin Time	27.3±0.4	23.5±0.4 †
Fibrinogen (mg/dL)	291±8.5	270.6±8.3
Protein C (%)	103±5.7	99±54
Protein S (%)	97±3.7	101±3.1
Antothrombin (%)	111±2.1	118±1.8 ‡
Protac-Induced Coagulation Inhibition Percent (PcCi%)	89.7±0.9	75.4±2.4†



Conclusions

Ultra-marathon running is associated with a wide range of significant changes in hematological parameters. The haematological changes associated with high-intensity physical exercise must be recognized and taken into consideration to prevent misinterpretation and to improve the **usefulness of haematological investigations in the professional athelets**.

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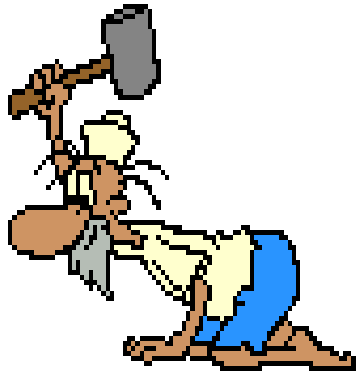
To our knowledge, our study is the first to successfully correlate participation in endurance sports with biochemical and echocardiographic evidence of cardiac injury and dysfunction and to demonstrate a strong relationship between extent of training and the presence and magnitude of such cardiovascular abnormalities after marathon running. However, there are no data to suggest that there are long-term sequelae to the increase in biomarkers and echocardiographic evidence of injury in this setting. In contrast, many studies suggest that endurance exercise is associated with a reduction in cardiovascular risk and an increased life expectancy.[7,8] Our study does suggest that, to protect against elevations in cardiac biomarkers and echocardiographic evidence of cardiac dysfunction associated with endurance exercise, appropriate preparation is important.


...and I am ready to start!



The End