

EUROPEAN INITIATIVE FOR
EXERCISE IN MEDICINE

REBRANDING MEDICAL
COUNSELING FOR HEALTH



Hydration and Active Lifestyles

Ron Maughan (UK)



european hydration
institute

Budapest 15-16 September 2014

DISCLOSURE

RJM is Chair of the Science Advisory Board of the European Hydration Institute, an independent charitable Foundation

RJM has acted as a consultant to, and received research funding from, the food and beverage industry

www.europeanhydrationinstitute.org

Why Exercise?

“Regular physical activity is associated with a reduced risk of dying prematurely”

US Department of Health and Human Services, 1995

Health benefits of regular exercise include a reduced risk of a number of diseases, including coronary disease, stroke, high blood pressure, obesity, diabetes, osteoporosis, and some cancers. There are also beneficial effects on mood.



Hydration issues to consider

1. Implications of
exercise

participation for
hydration status

2. Implications of
hydration status
for exercise
participation



How much should I drink?

Ask Google:

"How much should I drink?"

Top listed website:

WaterAid UK



Select site



Search

GO

[Home](#) | [About us](#) | [What we do](#) | [Learn zone](#) | [Get involved](#) | [Contact us](#) | [Donate now](#)

Get involved

- ▶ **Campaigns**
- ▶ **Events**
- ▶ **Corporate partnerships**
- ▶ **Community groups**
- ▶ **Speak for WaterAid**
- ▶ **Charitable trusts and foundations**
- ▶ **Volunteer**
- ▶ **Jobs**
- ▶ **Fundraising and event resources**
- ▼ **Drink more water**
 - Welcome
 - Hydration calculator
 - Hydration tips
 - Dehydration and you
 - Downloads
 - Games and Links
 - Get involved!
 - Supporters of Drink More Water
 - ▶ **World Toilet Day**
 - ▶ **World Water Day**
 - ▶ **Supporter noticeboard**
 - ▶ **Spread the word - get social**

UK \ Get involved \ Drink more water

[Forward to a friend](#) | [Print this page](#)

Drink More Water

Welcome to WaterAid's Drink More Water pages where you can find out [why drinking more water improves your health](#) and pick up some tips for [creating a better hydrated you!](#)

Drinking enough water is a key element for maintaining your health and general well-being. Increasing your daily intake of water helps keep your skin looking vibrant and younger, aids digestion, improves your concentration and helps to remove toxins from your body.

Click on the links below for fun games and tips to help you make sure that you are drinking enough. You can also gain more information on how you, and your company, can get involved with this initiative and support WaterAid's work.

[Find out how you can get involved.](#)



The WaterAid Drink More Water website was shortlisted for a New Media Age Effectiveness Award.

Please note: if you do not see the bubbles image on this page, you may need to install the [Flash player](#) onto your machine.

... announced
old an inquiry.
's hearings are

Mr Blair is expected to tell
MPs at Prime Minister's Ques-
tions today that he welcomes

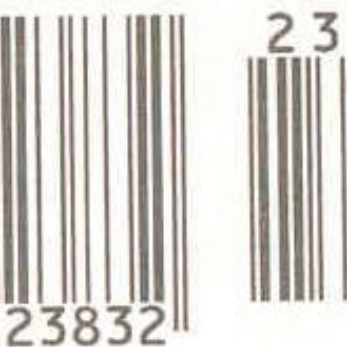
Charles Kennedy, the Lib-
eral Democrat leader, called
for the creation of a special

...
Wea
Edit

Posits

Commission
erday that the
or candidates
ary elections be
so called for
to be made
r new laws to
l fraud. *Page 2*

tegraph 4-6-03



D E F G *

Are you drinking too much water?

New research shows that people who jog, cycle or go to the gym regularly may risk severe health problems if they consume too much fluid. Experts warn that in extreme cases, the dangers include seizures and respiratory failure.



Health Page 18

C Some
along
beca
sardonic,
therefore
happy... I
from Fra
that, on b
would ha
life havin
French th
British...

Andrew Ma

We need to consider

Active lifestyles

Occupational physical activity

Recreational exercise

Sport



Environmental factors

Temperature

Humidity

Altitude



Losses and needs

Needs are dictated by the consequences of losses, but much of intake is driven by habit, taste, social factors, etc

Small losses that do not affect physiological function are of no consequence

How much do we need to replace?



Water losses (ml/d)

Sedentary Cool

Urine	800-1500
Faeces	100
Breath	300
Skin	600
Sweat	0
Total	1800-2500

Original article

Fluid losses and hydration status of industrial workers under thermal stress working extended shifts

D J Brake, G P Bates

Fluid consumption, sweat rates and hydration state of industrial workers on 10, 12, and 12.5 hour shifts under thermal stress

Average environmental conditions were severe (WBGT 30.9°C (SD 2.0°C), range 25.7–35.2°C). Fluid intake averaged 0.8 l/h during exposure (SD 0.3 l/h, range 0.3–1.5 l/h)

The average fluid consumption per shift was 6.48 litres (over this mix of different shift lengths) with a standard deviation of 2.41 litres and range of 2.40–12.50 litres. Moisture content in food was not included in this analysis

“Involuntary dehydration” did not occur in well informed workers

Measuring water balance

Water turnover can be measured using a deuterium tracer

Daily 24-h urine samples are collected for 7 days

Morning samples are analysed for D_2

From the decay in urine $[D_2]$, whole body water turnover is calculated

Non-renal loss (primarily sweat, transcutaneous, respiratory and faecal) is calculated as the difference between whole body turnover and urine output



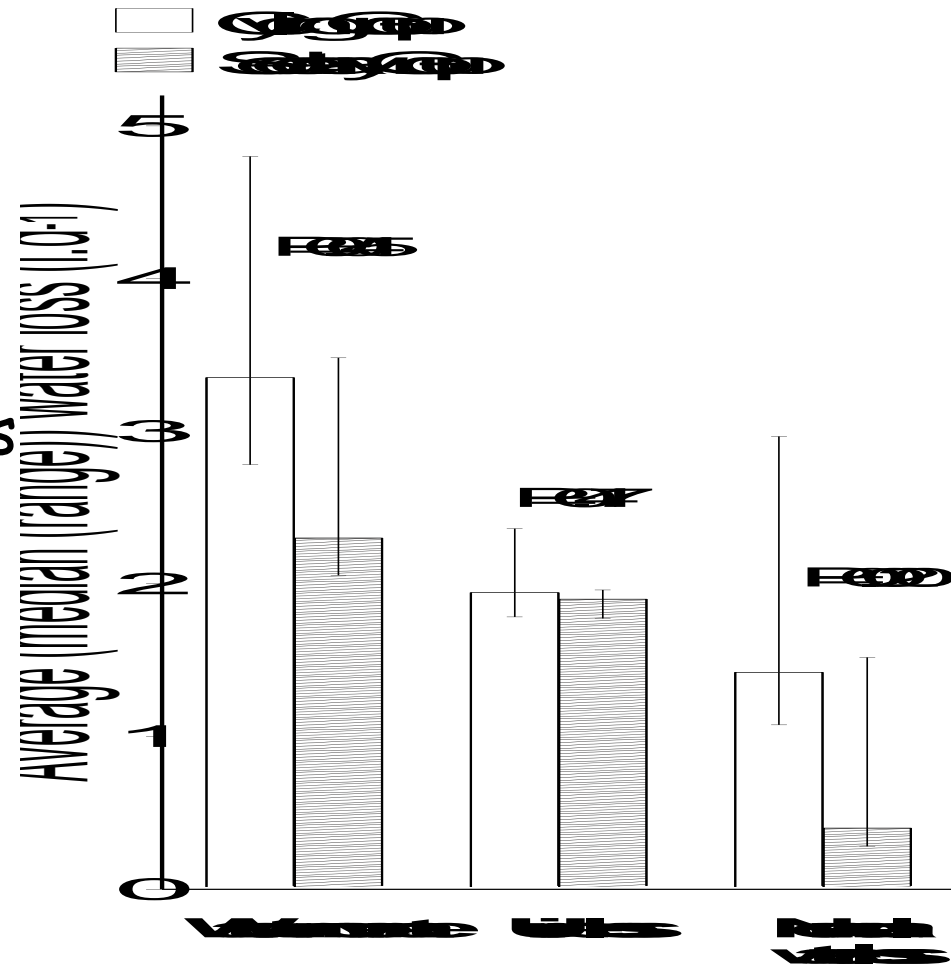
How much do cyclists drink?

6 recreational cyclists who covered an average of 50 km/day in training and a matched control group

Max daily temperature was 4-18°C

Water turnover of the cyclists was higher than that of the sedentary control group

The difference was due entirely to non-renal losses, presumably sweat loss



How much do runners drink?

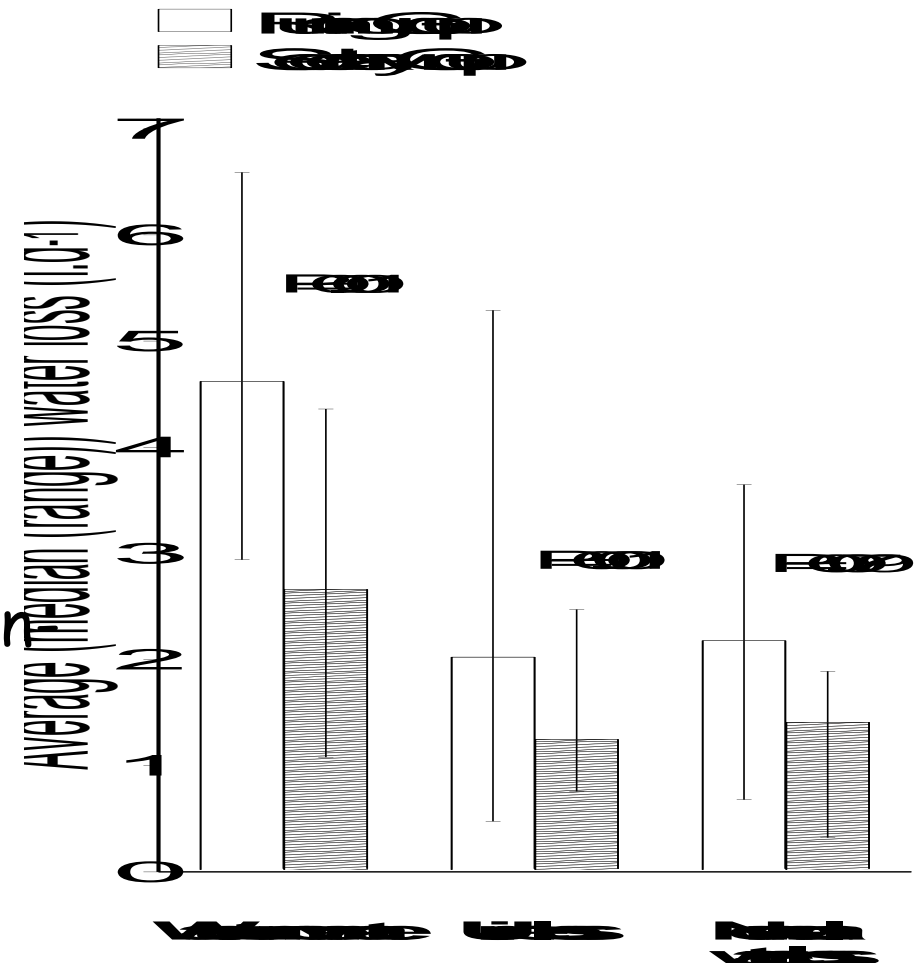
6 runners (average 15 km/day)
and 6 matched sedentary
controls

Max daytime temperature 7-
21°C (Aberdeen May-June)

Water turnover (and urine
output) of runners was higher
than control group

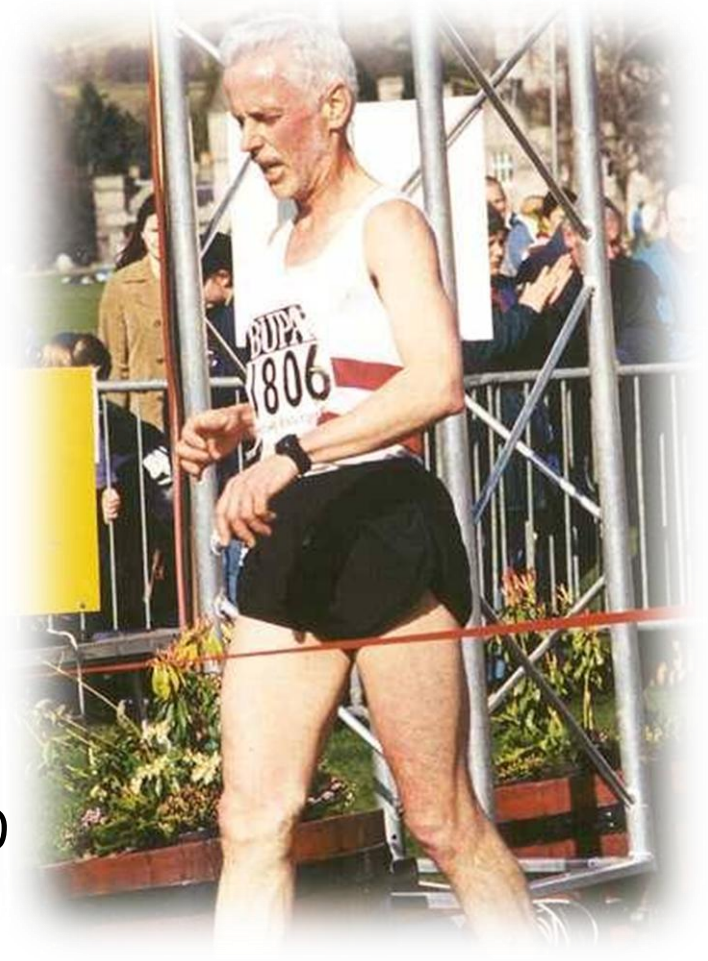
No significant difference in non-
renal loss

It may be that they have been
educated to drink in excess of
their requirement



Sweat rates in running

Exercise type	Sex	Intensity	Sweat rate (kg/h)
Running 10 km	f	12.8 km/h	1.49
	m	14.6 km/h	1.83
30 km	-	-	1.25
2 hours	m	63% VO_{2max}	1.41
42.2 km	f	9-12 km/h	0.54
	m	9-12km/h	0.81
42.2km	m	8.7-16.1 km/h	0.96
56 km	-	0.4-14.8 km/h	0.96-1.00
80 min	-	70% VO_{2max}	1.43



Sweat rates in football

Sweat rates

f	Competition	0.8 L/h
m	Competition	1.2 L/h
m	Competition	1.0 L/h
f	Training	0.8 L/h
m	Training	1.0 L/h
m	Training	0.7 L/h

Total losses in match play

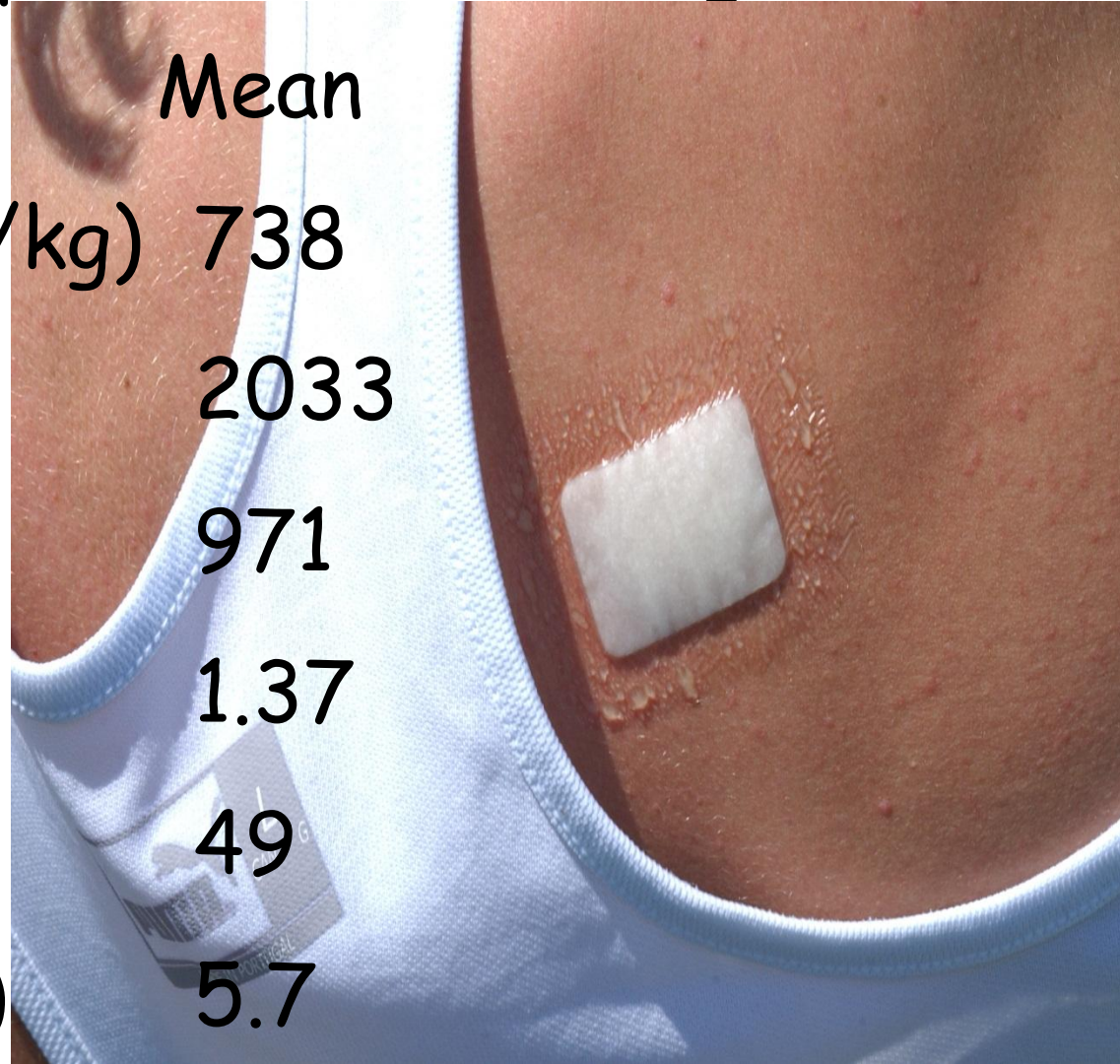
m	2.1 L
m	0.8 L
m	2.0 L
m	1.3 L



English football players

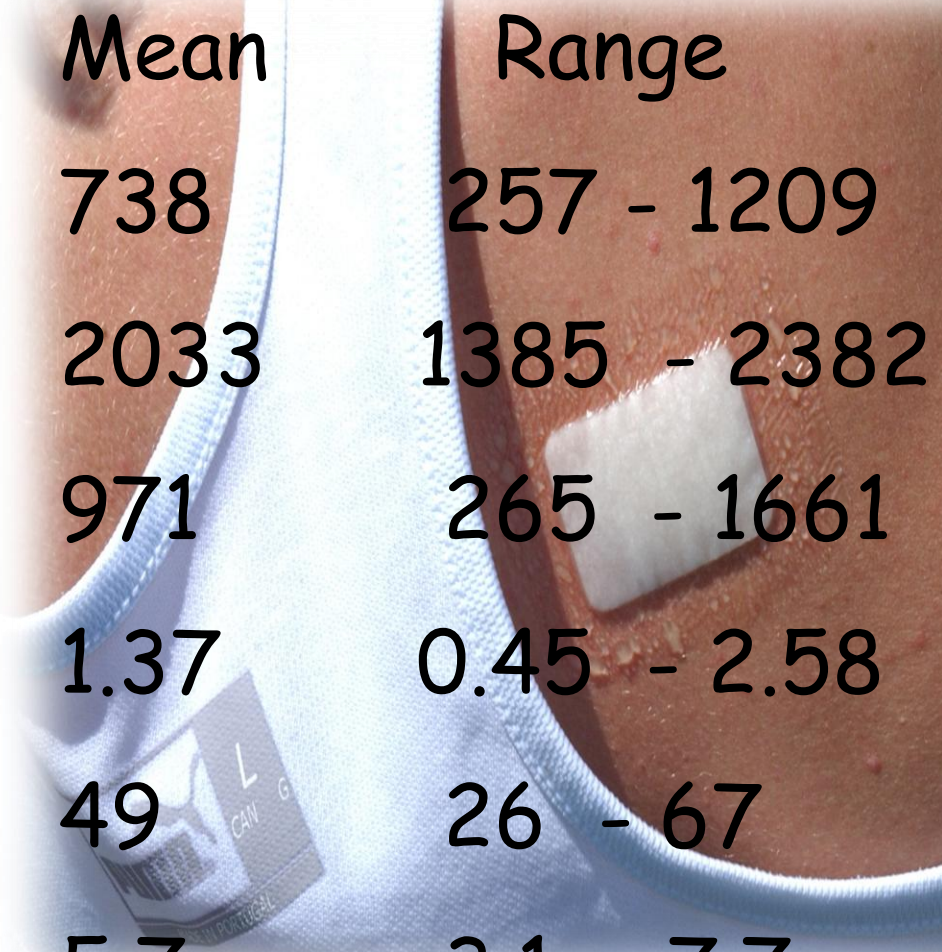
24 players: 90 min pre-season training 24-28°C

	Mean
Urine osm (mosmol/kg)	738
Sweat loss (ml)	2033
Fluid intake (ml)	971
Dehydration (%)	1.37
Sweat Na (mmol/l)	49
Sweat NaCl loss (g)	5.7



English football players

24 players: 90 min pre-season training 24-28°C



	Mean	Range
Uosm (mosmol/kg)	738	257 - 1209
Sweat loss (ml)	2033	1385 - 2382
Fluid intake (ml)	971	265 - 1661
Dehydration (%)	1.37	0.45 - 2.58
Sweat Na (mmol/l)	49	26 - 67
Sweat NaCl loss (g)	5.7	3.1 - 7.7

We should consider:

Effects of starting exercise in a hypohydrated state

Effects of progressive development of hypohydration during exercise

Consequences of not restoring water losses



Why is hydration important?

Dehydration, if sufficiently severe can cause:

Reduced exercise performance

Reduced blood volume

Increased heart rate

Reduced skin & muscle blood flow

Impaired thermoregulation

Increased perception of effort

Headache, nausea, insomnia

Impaired mental function

Increased risk of heat illness



Why is hydration important?

Dehydration, if sufficiently severe can cause:

Reduced exercise performance

Reduced blood volume

Increased heart rate

Reduced skin & muscle blood flow

Impaired thermoregulation

Increased perception of effort

Headache, nausea, insomnia

Impaired mental function

Increased risk of heat illness



Why is hydration important?

Overhydration, *if sufficiently severe* can cause:

Reduced exercise performance

Headache, nausea, insomnia

Impaired mental function

Coma

Death



Hydration and Muscular Performance

Does Fluid Balance Affect Strength, Power and High-Intensity Endurance?

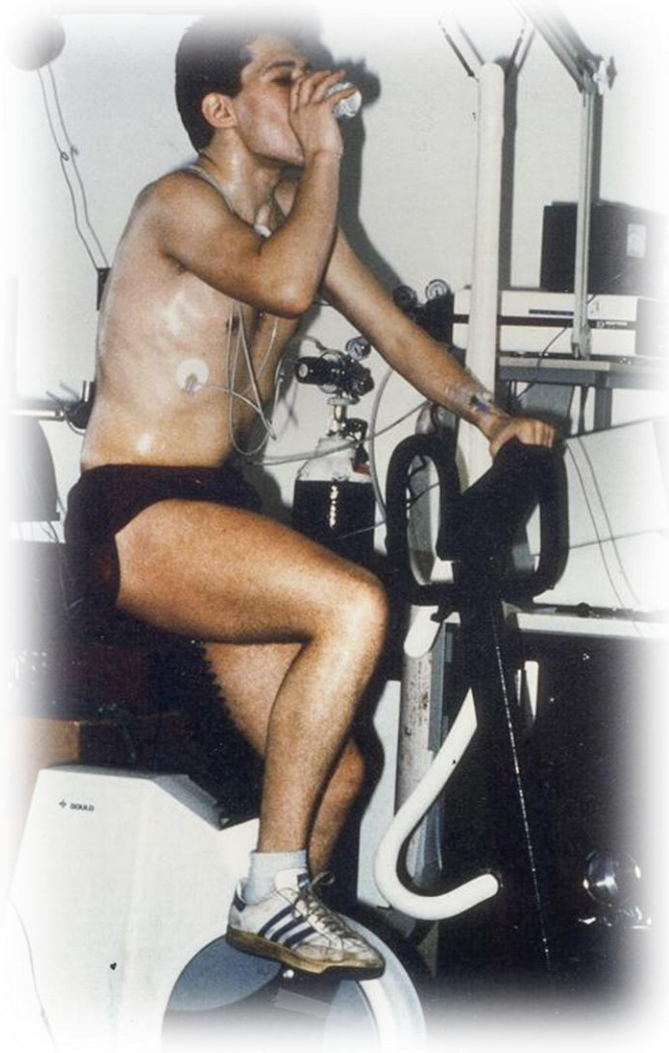
*Daniel A. Judelson,^{1,2} Carl M. Maresh,¹ Jeffrey M. Anderson,¹
Lawrence E. Armstrong,¹ Douglas J. Casa,¹ William J. Kraemer¹ and Jeff S. Volek¹*

1 Human Performance Laboratory, Department of Kinesiology, University of Connecticut, Storrs, Connecticut, USA

2 Department of Kinesiology, California State University, Fullerton, California, USA

"hypohydration appears to consistently attenuate strength (by $\approx 2\%$), power (by $\approx 3\%$) and high-intensity endurance (by $\sim 10\%$)"

Effects of fluid intake



Time to fatigue

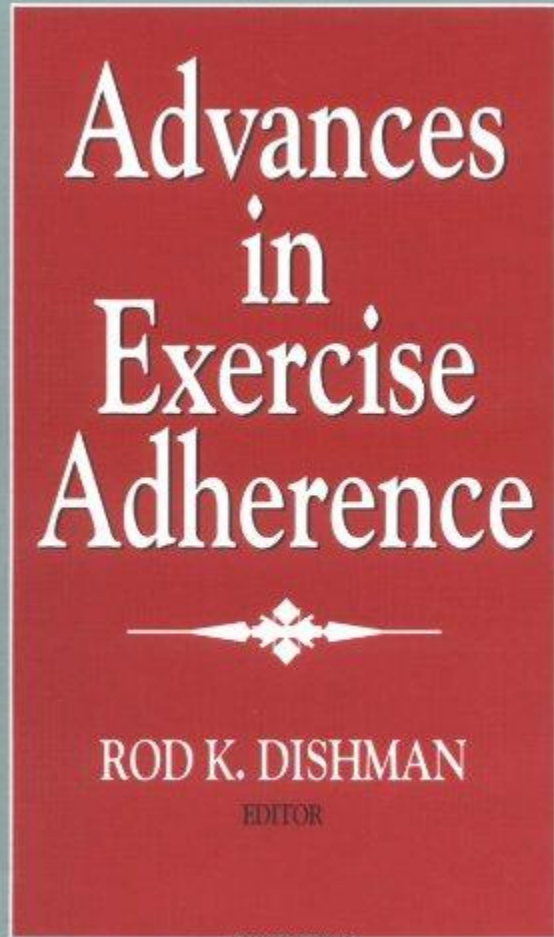
No drink 70.2 min

Water 76.2 min

Glucose 79.0 min

ORS 90.8 min

Promoting active lifestyles



Drop-out rates in excess of 50% are typically reported in 10-12 weeks

Long-term adherence is low

Some individuals succeed

Physical activity produces results that can encourage or discourage subsequent participation

Dishman et al. (1985) Public Health Rep 100: 158-71

THEORETICAL MODELS OF EXERCISE ADHERENCE

Developing an understanding of the factors associated with exercise participation is an important challenge to undertake. This understanding can allow exercise programs to be individualized so that exercise adherence is maximized. There are several psychological models that are applicable to the study of exercise adherence.

Three are briefly described below:

*** Psychobiologic Screening Model**

This model proposes that body weight, percent body fat, and level of self-motivation serve as predictors for an individual's likelihood to adhere to an exercise program.

*** Locus of Control**

This model suggests that people are either internal controllers who believe that they can control the outcomes in their lives, or external controllers who believe that their destinies are controlled by chance or by others.

*** Adherence As a Process**

This model focuses on the idea that adherence is an on-going process. It suggests that the behavior of people changes in sequences instead of all at once.

An examination of each of these models should assist in developing an understanding of the processes leading to adherence.

Other factors in adherence

There seems to be a reluctance to discuss the simple fact that:

Exercise often feels uncomfortable

Especially in those not accustomed to activity



Hydration and RPE

NUMERICAL

VERBAL

6

7

VERY, VERY LIGHT

8

9

VERY LIGHT

10

11

FAIRLY LIGHT

12

13

SOMEWHAT HARD

14

15

HARD

16

17

VERY HARD

18

19

VERY, VERY HARD

20

Hypohydration and RPE

Exercise at 65% of VO_{2max} . No fluid or a volume that replaced 20, 50, or 80% of the fluid lost in sweat after 120 min of cycling

(%BML)	RPE	
1.1	13.4 ± 0.5	somewhat hard
2.3	14.1 ± 0.6	somewhat hard to hard
3.4	15.6 ± 0.8	hard
4.2	17.6 ± 0.3	very hard

Hydration Status and Functional Capacity

Hypohydration may affect cognitive function, skilled performance, and subjective sensations of wellness

The method of inducing hypohydration may influence the outcome

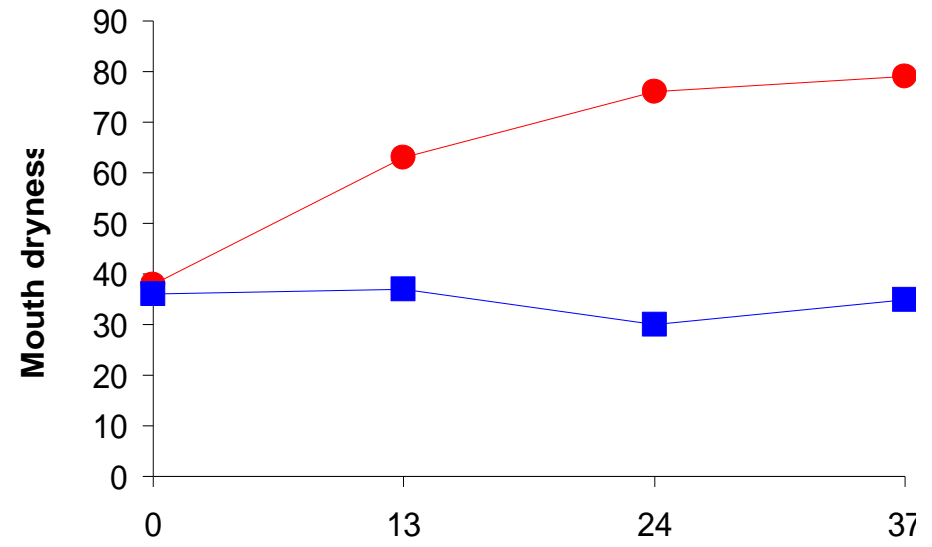
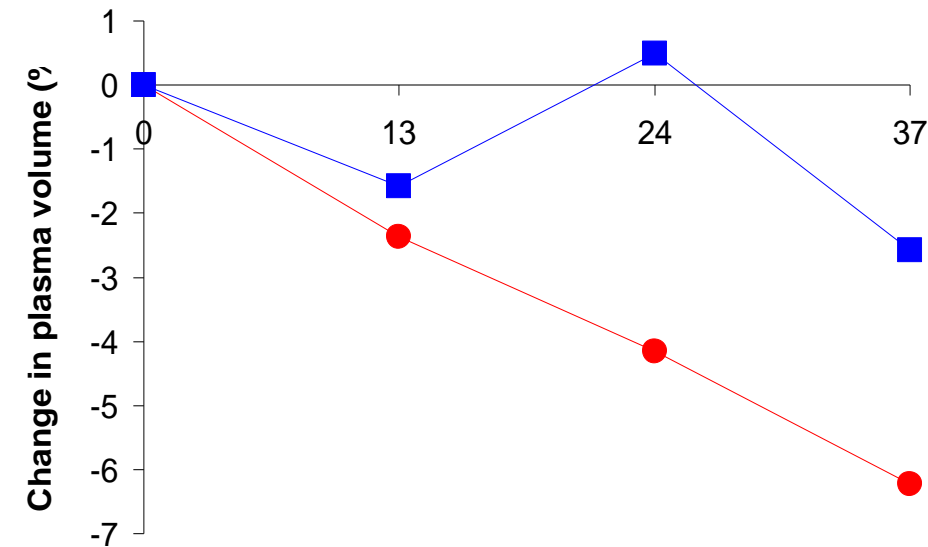
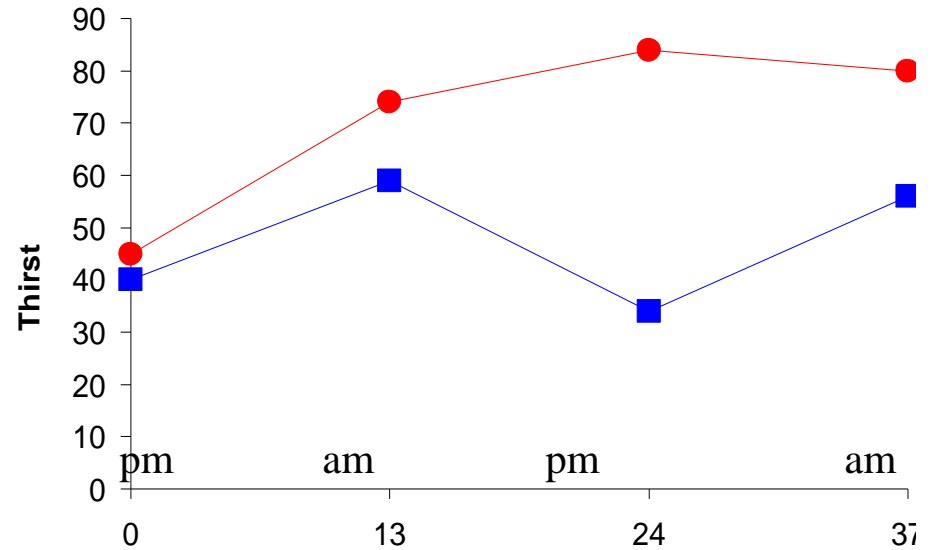
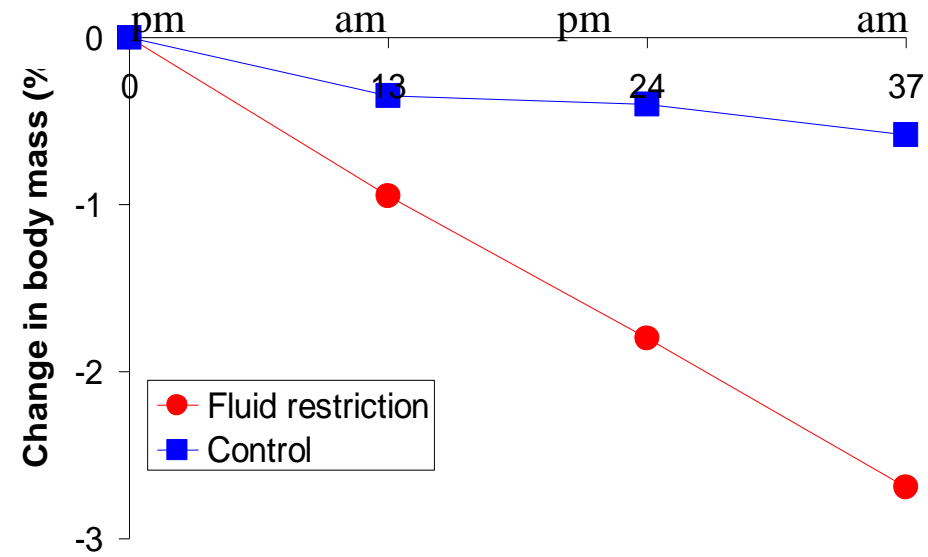
15 healthy adults participated in 2 trials:

In one trial, fluid intake was restricted for 37 h and normal drinking was allowed in the other trial

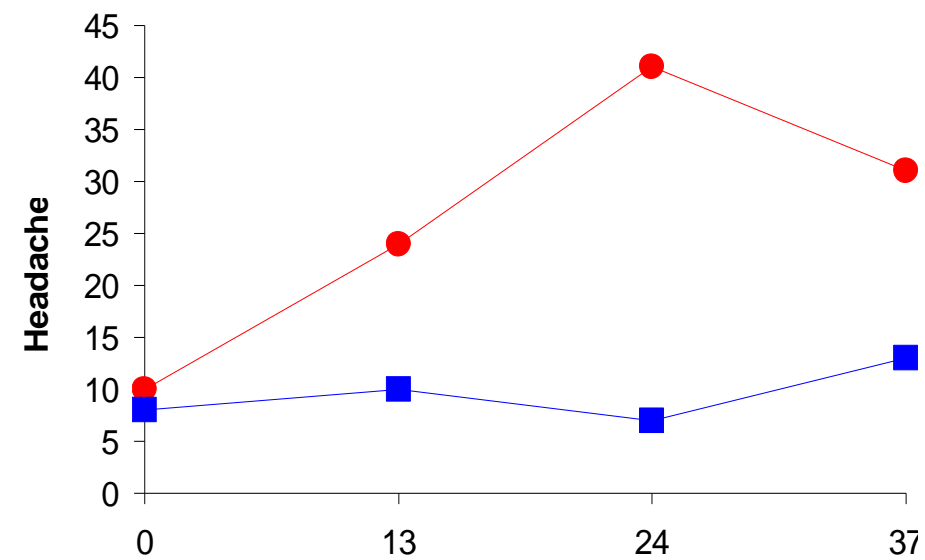
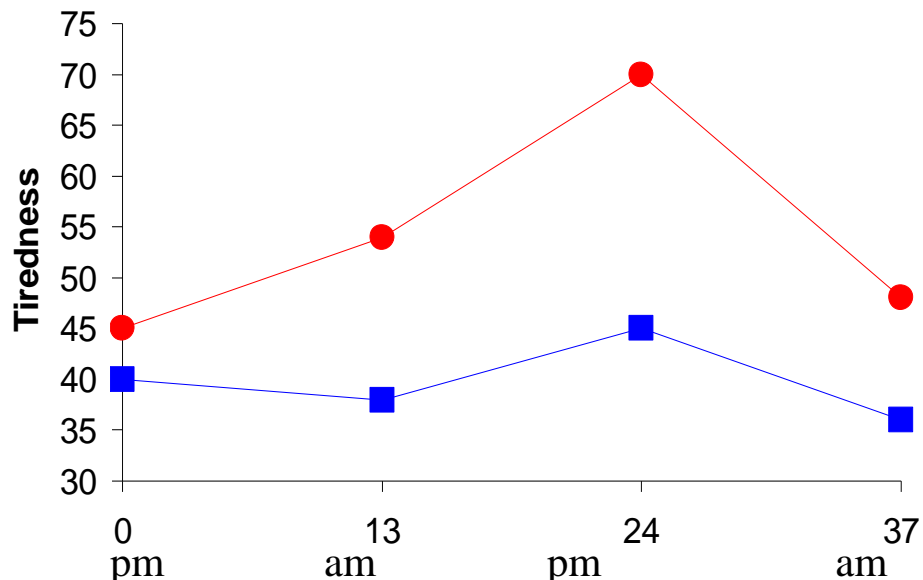
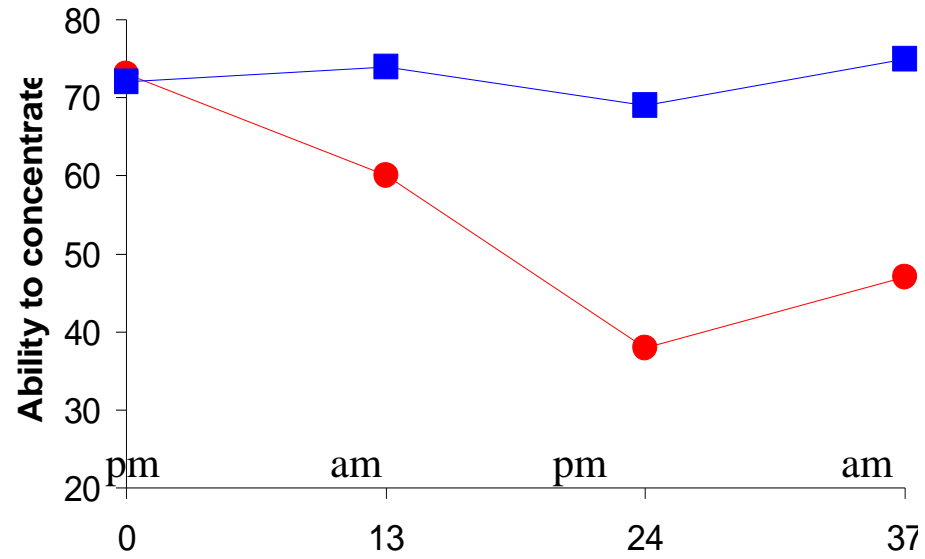
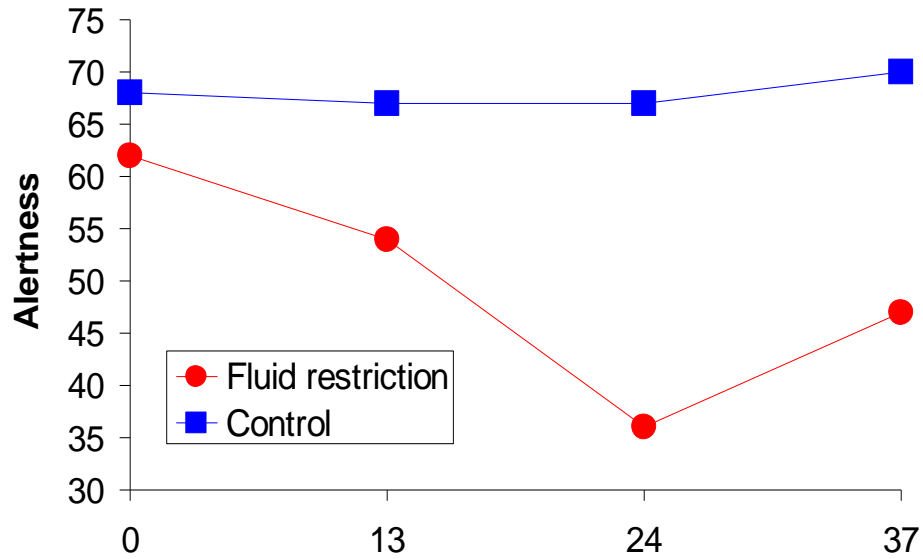
Body mass loss was 2.68% in the fluid restriction trial and 0.58% in the control trial

Shirreffs et al, 2004

Symptomatic responses



Symptomatic responses



Hydration and Active Lifestyles

Dehydration - if sufficiently severe - reduces exercise performance

Relevance to physical activity in general population is questionable

BUT

Dehydration of more than 1-3% of body mass will increase subjective perception of effort

Increased sense of effort will reduce exercise participation



european hydration
institute

Thank you!