

## *ELECTROLYTE SUPPLEMENTATION IN IRONMAN ATHLETES*



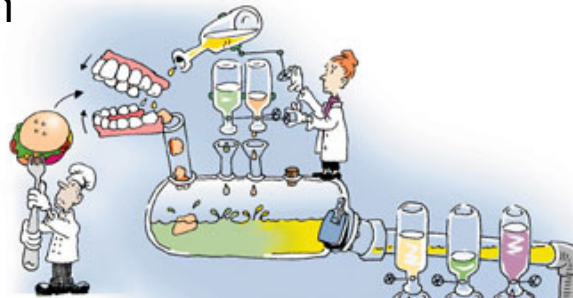
Allan Pitman 2009

# CONSIDERATIONS ELECTROLYTE INTAKE IN HEAT-AREAS TO CONSIDER

ADAPTION  
TRAINING

SALT AND FLUID  
LOADING?

Pre  
Competition



SALT  
SUPPLEMENT  
INTAKE

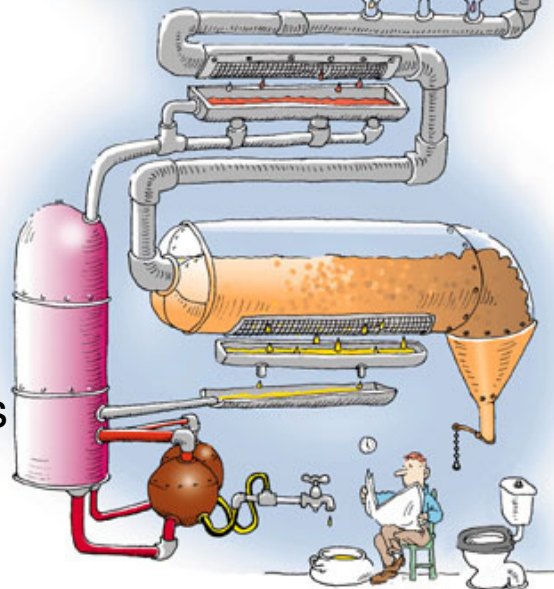
FLUID/FOOD  
INTAKE

Athlete  
Controlled- on  
Race Day  
Considerations

TEMPERATURE

HUMIDITY

Situational  
Considerations



SWEAT RATE

URINE OUTPUT

OTHER THERMAL-  
eg SKIN/Body  
Composition

Physiology  
Considerations

- How do elite ultra athletes relate to the research?
- I have examined each of these in turn

## *ELECTROLYTE SUPPLEMENTATION IN IRONMAN ATHLETES*

- Introduction
- Considerations
- Theory
- Practical Experiences
- Areas of Further Interest
- Summary and Close

## ***IN PRACTICE***

- Sweat usually contains 500-1000mg sodium loss/hr (some as high as 2500mg/hr)
- This can be “trained” down to less than 400mg per hour even in hot conditions
- Heavier athlete/saltier diet- higher sodium loss
- Very little work done to date on improving the electrolyte efficiency of elites- yet it is one of the more critical success factors in races like Hawaii World Championships
- Evidence that previous multiple winners used low salt diet (Allen/Scott/PNF/Badmann/Reid) and very strict electrolyte regimen in racing (loading and pro active consumption during racing) and actively trained their electrolyte efficiency through long blocks of heat training to reduce tendency for salt loss
- This is supported by my own study of a current elite and performance improvements during the last 3 years

### **GUIDELINES FOR ELITES**

- Hydration of average 1x bidon per hour= 600-700ml- very few reasons to exceed this if electrolytes are working well
- 400mg Na /hr in “tabs” 200-300 mg Na/hr from drinks/gels/foods =0.7g/hr Na
- Evidence it is better to exceed rather than under supplement-electrolyte- urine will remove excess in most cases
- Hawaii and hot races usually >1g/hour
- Rarely do races go wrong from too much salt- too much fluid more common
- Very few products available that match the composition of human sweat
- Pre race loading and what is drunk in first two hours of bike seem to be critical- once salt reaches deficit level it is very hard to restore

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## ***INTRODUCTION-ELECTROLYTE SUPPLEMENTATION IN IRONMAN ATHLETES***

- In 20+ years of Ironman Coaching I have found this to be one of the least well understood areas of performance at the Ultra Distances
- Hyponatremia and cramping continues to be one of the key symptoms found amongst those who fail to perform at the Ultra Distance
- The available literature from the Sports Science fraternity is widely divergent in its opinion on the role of certain electrolytes and particular salts (if any)
- Practical experience in the field is starting to converge with most if not all parties acknowledging the role of salt in particular (and not just Sodium Chloride salts) in high performance at the Ultra Distance. Greater attention is being paid to more precise use of these supplements
- In this presentation I will outline the basic theory, that I have discovered in practice and some thoughts for future areas of performance improvement



## ***IN PRACTICE***

### **• MUCH OF THE CURRENT SUPPLEMENTATION IS BASED AROUND SODIUM CHLORIDE- CHEAP ADDITIVE**

- Eg Toppin or Saltadex 2 x600mg tabs = 60% Chloride(360mg) 40% Sodium(240mg)
- No other elements-trace or otherwise found like naturally occurring salt
- The majority of sports drinks are primarily NaCl based
- Sodium Citrate is commonly found as a preservative- some studies have shown support for this
- Compare Sodium Chloride to natural salts show below:

### **• COMPOSITION OF “NATURALLY OCCURRING” CELTIC SEA SALTS**

	<b>mg per 1/4 tsp</b>	<b>%</b>		<b>mg per 1/4 tsp</b>	<b>%</b>
Chloride	601.25 mg	50.90%	Zinc	0.03 mg	0.00%
Sodium	460 mg	33.00%	Copper	0.02 mg	0.00%
Sulfur	9.7 mg	0.82%	Erbium	0.02 mg	0.00%
Magnesium	5.2 mg	0.44%	Tin	0.02 mg	0.00%
Potassium	2.7 mg	0.23%	Manganese	0.02 mg	0.00%
Calcium	1.5 mg	0.13%	Cerium	0.02 mg	0.00%
Silicon	1.2 mg	0.05%	Fluoride	0.01 mg	0.00%
Carbon	0.6 mg	0.05%	Rubidium	0.01 mg	0.00%
Iron	0.14 mg	0.01%	Gallium	0.01 mg	0.00%
Aluminum	0.11 mg	0.01%	Boron	0.01 mg	0.00%
Praseodymium	0.04 mg	0.00%	Titanium	0.01 mg	0.00%
Strontium	0.03 mg	0.00%	Bromine	0.01 mg	0.00%

## ***INTRODUCTION-ELECTROLYTE SUPPLEMENTATION***

Tim Noakes 2004 Study:

- Hawaii IM 1999 Guidelines for hydration- 700ml-2L/hr of fluid recommended....
- Results- 20% of field Hyponatremic
- Speedy Study IMNZ 18% of field
- Sth Africa IM 2001 Guidelines for hydration-500-800ml/hr max- 1% of field Hyponatremic
- Still most one of the most common admission reasons in IM Medical tent
- Amongst DNF's in elites cramping is high amongst reasons
- Critical Dehydration very rare amongst medical admissions
- Over time amongst elite -less emphasis on HOW MUCH is drunk and more on the chemical composition
- Many current sports drinks many only suitable for races under 4hrs and very few “ultra” studies at elite level

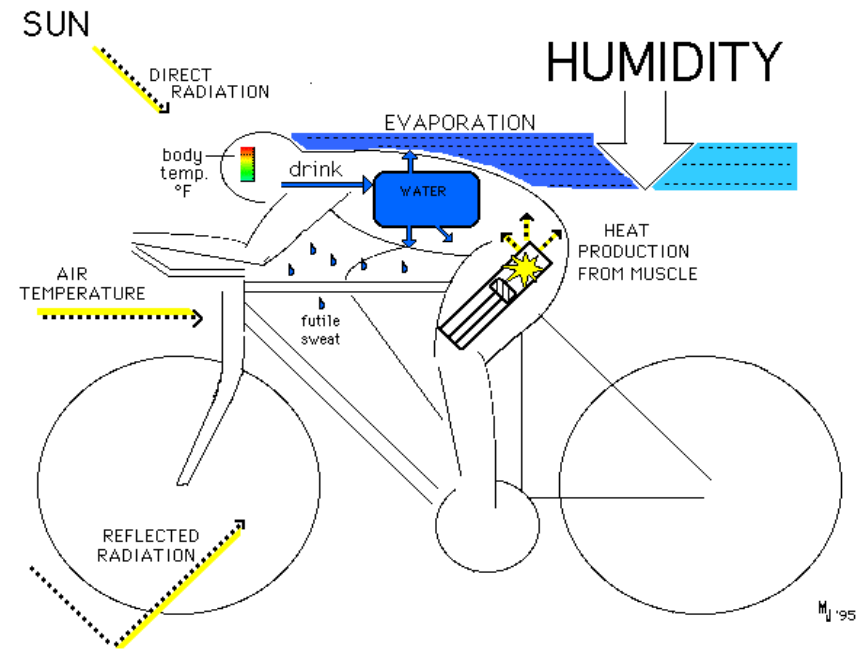


## AREAS OF FURTHER INTEREST

- Much of the traditional focus on electrolytes has been about under/overhydration-limiter of performance
- Much to be learned about performance aspects of increased blood volume through electrolyte control
- Evidence that electrolytes can be used pro actively to enhance performance instead of reactive/maintenance fashion- most of the education is preventive not performance
- Little understanding of the function of chemical salts outside of Sodium Chloride NaCl despite a myriad of elements in physiological demands

### Track record of elites in Hawaii

- Traditionally athletes who do well have raced a lot there- adaptation
- Low salt diet
- In recent years there is evidence to suggest that this learning curve is shortening?
- This includes more sophisticated electrolyte replacement strategies- is this a factor?
- Elites should spend training for “Reduced salt loss”- via measurement



•Fig Source :Rice University

# THEORETICAL CONSIDERATIONS ELECTROLYTES-BY CATEGORY

## ADAPTION TRAINING

- 3-5 days in heat training for kidneys to store maximum Na (Hubbard)
- 10 -14 days for whole process(Armstrong)- Increased blood volume and increased sweat rate
- Blocks of training in heat seem to “stay” with athlete
- Higher VO2 Max athletes maintain blood volume and dissipate heat better (Greenhauf)
- Fatigue temperature is higher (Cheung)

## SALT AND FLUID LOADING?

- 2-3 days of Salt Loading beneficial (Noakes)
- Higher Na+ at start- higher blood volume, lower hr, longer time to fatigue (Rehrer)
- Natural store of around 100g- 50% bone stored/40% fluid/10% tissues
- Normal rate of loss 10g/day

## TEMPERATURE

- Once outside temperature reaches 37.5 C wind is less effective in providing thermal control (Toker)
- Effective VO2 max drops 10% in high temperature and up to 25% if dehydrated as well

## HUMIDITY

- In particularly humid conditions additional sweat rate does little to aid cooling- evaporation reduced(Toker)
- Maintaining Blood volume and stroke rate increase in importance

## SALT SUPPLEMENT INTAKE

- AMSC 0.5g/hr
- Hiler/Friel 1g/hr
- Athletes poor at adjusting for the day- especially elites
- Tactical decisions-adjusting the gut

## FLUID/FOOD INTAKE

- Burke/Noakes 0.5L/hr
- Speedy 0.8L/hr
- ACSM 0.6-1.2L/hr
- Gatorade SSI 1.2-1.8L/hr
- Toker 0.75L/hr
- Adjust salt to the fluid you consume on the day

## SWEAT RATE

- Average 1L /hr
- Training can increase this substantially
- Elites can produce well over 1L/hr in hot/humid conditions but loose less sodium if well trained

## URINE OUTPUT

- Maximum bladder capacity 350-500ml
- Normal urine output =60ml/hr
- Therefore up to 8hrs storage of “waste”

## OTHER THERMAL

- Some athletes markedly better-weight and skin type big factors
- Women more prone to hyponatremia and hydration influenced by hormone level
- Hawaii has “lightest” winners as compared to other events

## ***IN PRACTICE***

- Very few products that match salt losses
- Example of every half hour protocol below
- Eg “Saltstick” 2 tabs per hour + Sportsdrink- Alexander uses this protocol
- 9 out of top 15 men and 6 of top 10

<b>Product</b>	<b>Per Capsule</b>			
	<b>Sodium (mg)</b>	<b>Potassium (mg)</b>	<b>Magnesium (mg)</b>	<b>Calcium (mg)</b>
Sweat (per 315mL)	220	63	8	16
SaltStick®Caps	215	63	11	22
BackNine Lytes™	20	25	25	25
elite tablytes™	150	95	30	40
eload Zone™	43	14	9	5
Endurolytes™	40	25	25	50
Endurox Excel™	75	10	15	0
Enlyten™	13	3	0	0
Gastrolyte™	250	156	0	0
Lava Salt™	158	16	1	0
Nuun™	360	100	25	13
SportLegs™	0	0	22	44
Succeed™	341	21	0	0
Sustain™	86	8	0	0
The Right Stuff™	1625	0	0	0
Thermolyte™	150	43	6	13
Thermotabs™	180	15	0	0
Gatorade Endurance™	200	90	6	3
Gatorade Original™	110	30	0	0

## ***IN PRACTICE-CONTINUED***

### Electrolyte rules of thumb elites in ultra distances :

- 14 day pre competition in climate essential to develop good fluid loss for cooling and reduce salt loss
- Lowest practical body weight is desirable to reduce thermal mass and total electrolyte loss
- Tanned skin more effective than no tanned for heat control- consider clothing if this is a limiter
- Slight hyperhydration and loading of electrolytes 2-3 days out beneficial
- Circa 700mg salt immediately pre race beneficial-one hour
- Little evidence that elites benefit from fluids >750ml/hr even in Hawaii conditions
- Better use of broad spectrum salts can increase time to fatigue, reduce impairment of Vo2Max, improve blood volume for cooling. Reduces need to consume larger amounts of fluid- eg faster
- Athlete need to learn to “regulate on fly” –always carrying water to flush gut concentrations
- Substantial urination (stopping)s eldom proves beneficial- just causes time and further salt loss
- Many problems caused by on course electrolytes
- Traditionally elites from shorter distances stuff up electrolyte management or have no awareness of how to address it
- Poor understanding by elites of their salt losses and replacement needs- substantial performance gains can be made through carefull observation in training

*SUMMARY AND CLOSE*

