Keeping Your Athlete Healthy

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Disclosures:

Dr. Victoria Coleman is the VP of Clinical Education for Atrium Innovations, Klean Athlete is a subsidiary of Atrium Innovations.

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This lecture will cover:

- Health not necessarily performance
- GI health and Probiotics
- Immune health
- Vit D
- Whey Protein
- Sleep
- Air pollution
- Supplement safety - NSF Certified for Sport®
What this lecture will NOT cover:

- Basic concepts on periodization and fueling
- General fuelling of macronutrients
- Nutrition for Sport Performance Enhancement (ergogenic nutrition)

We ARE looking at the bigger picture of health
Why is this topic important?

“Fit” Athlete $\neq$ Healthy Athlete

Many athletes appear fit for their sport but are not truly healthy!

we have a responsibility as
Excessive exercise can:
(>60 minutes)

**Oxidative stress**
- produce inflammation
- muscle damage and fatigue
- lipid peroxidation
- damage to cellular proteins & DNA
- depress immune function

**ROS, RNS**
- cytokines
- enzymes of breakdown
- lipid hydroperoxides
- F2 isoprostanes
- malonaldehyde
- Urinary 8-hydroxy-deoxyguanosine
- WBC
- glutathione (GSSG:GSH)

No argument in science these changes occur with excessive endurance exercise
GUT HEALTH & PROBIOTICS
GI complaints are common amongst athletes (30%-70%)

Words come in or are in random such as: GERDS, gastritis, ulcers, Crohns, colonic bleeding, diarrhea

In general: (the obvious)

23 studies, 1917 participants, probiotics with infectious diarrhea:

- **reduced risk** of diarrhoea
- **reduced mean duration**

Cochrane Database Syst Rev. 2010, Probiotics for treating acute infectious diarrhoea

Meta-analysis of 12 trials

“**probiotics reduced the occurrence of traveler’s diarrhea**”

McFarland LV. Meta-analysis of probiotics for the prevention of traveler's diarrhea.
Travel Med Infect Dis 5: 97-105, 2007
“Probiotics such as Lactobacillus species have been shown to **decrease the incidence of diarrhea in travellers**. Probiotics are a more natural approach to prophylaxis of TD. Probiotics colonize the gastrointestinal tract and theoretically prevent pathogenic organisms from infecting the gut”
What happens to the athletes gut with training?

- Gastritis
- Ulcerations
- GI bleeds
- Diarrhea
- GERD’s
- Ischemic colitis
- **Intestinal Permeability**
How does ‘Leaky Gut’ occur?

- Physical stress
- Psychological stress
- SIBO
- Antibiotics
- NSAIDs
- Alcohol
- Calcium deficiency
- Vit. A deficiency
- Zinc deficiency
- Magnesium deficiency
- Vit. D deficiency
- High fructose diet
- Western Diet

https://thevreelandclinic.wordpress.com/tag/gut-health/
Contributing Factors:

- mechanical forces
- altered GI blood flow (reduced splanchnic blood flow)
- neuroendocrine changes
- temperature extremes (heat)
- dehydration
- NSAID use
What happens to the athlete’s gut with training?
In summary with athletes

Intestinal permeability may result from exercise induced reduction of blood flow and thermal damage to the intestinal mucosa leading to:

- endotoxemia
- immune activation
- inflammatory response increasing susceptibility to infectious and autoimmune diseases

Lamprecht et al. Probiotic supplementation affects markers of intestinal barrier, oxidation, and inflammation in trained men; a randomized, double-blinded, placebo-controlled trail *Journal of the International Society of Sports Nutrition* 2012,9:45
Probiotic supplementation affects markers of intestinal barrier, oxidation, and inflammation in trained men; a randomized, double-blinded, placebo-controlled trial *Journal of the International Society of Sports Nutrition* 2012,9:45

**RCT STUDY:**
- 23 endurance trained men
- 30-45 years of age, non smokers
- 14 weeks consumed a multi-species probiotic (10 billion CFU)
- performed a three part triple step test, total duration 90min
Outcome measures:

Primary Outcome: probiotics affect on intestinal permeability measured Zonulin - surrogate marker of impaired gut barrier

Secondary Outcome: probiotics affects on oxidative stress and inflammation measure: Carbonyl Proteins (CP), Malondialdehyde (MDA), Total oxidation status (TOS), IL-6, TNFα
Results:

Primary outcome: Zonulin was reduced to normal physiologic range in the probiotic group

Note: the athletes all started with a higher than normal level prior to treatment

Why: the trained cohort already suffered from a mild increase in intestinal permeability at baseline due to chronic training
probiotic supplementation could be of high practical relevance for athletes - improved intestinal barrier reduces athlete’s susceptibility to endotoxemia and associated cytokine production.

(image: entry of luminal antigens with disruption of tight junctions; Suzuki, 2013).
Secondary Outcomes:

Oxidative stress markers (CP = Carbonyl Proteins)

CP level decreased with probiotics, and post-exercise increase typically seen, no longer reached significance.
Secondary outcome:

Inflammation

TNFα - pro-inflammatory cytokine, central mediator of systemic inflammation

Exercise challenge did increase TNFα above normal.
Probiotics reduced values by 20% but not to significance.

Note: both groups had significantly increased values of TNFα at all time points measured (baseline included).

Possible Conclusion: Probiotics reduce this systemic low-grade inflammation indirectly via improved gut barrier function.
Conclusions:

Probiotic supplementation can improve intestinal barrier function, redox hemostatis and low grade inflammation in trained men undergoing sustained exercise stress.

Lamprecht et al. Probiotic supplementation affects markers of intestinal barrier, oxidation, and inflammation in trained men; a randomized, double-blinded, placebo-controlled trial *Journal of the International Society of Sports Nutrition* 2012,9:45
Gut Health & NSAIDS

NSAID use is common in athletes and reported to be as high as 90% use in some sports

https://thvreelandclinic.wordpress.com/tag/gut-health/
"If I can take 400 mgs of Ibuprofen, and I do that three times a day so my shoulder doesn't hurt so I can perform, can I lose sight of what that does long-term?" Ray asked. "It's kind of natural that you would do that." Tracy Ray, Sports Physician

"If I was pitching in three days, I'd take two. Tomorrow, I'd take four. On game day, I'd take two in the morning, then two in the afternoon." Al Leiter, schedule for taking Advil

Pitchers on anti-inflammatories must beware of liver trouble
Updated May 31, 2010, Newsday
By Ken Davidoff
Are NSAIDs really a problem?

Aggravation of exercise-induced intestinal injury by Ibuprofen in athletes.

Aim: assess effect of oral Ibuprofen before exercise on GI integrity and barrier function in healthy men

Study:

- 9 healthy trained men
- 400mg Ibuprofen twice before cycling
- 400mg Ibuprofen twice at rest

- Assess: *small intestinal injury* via plasma Intestinal fatty acid binding protein I-FABP

- Assess: *GI permeability* via urinary multi sugar probe (lactulose/rhamnose)
Results:

- I-FABP levels were significantly higher in the Ibuprofen group

- Ibuprofen consumption also increased levels of small intestinal injury at rest

- urinary L/R ratio increased in the ibuprofen group after cycling and also increased at rest

- levels of intestinal injury (I-FABP) correlated with the levels of intestinal permeability (L/R)
Study Conclusions:

NSAID consumption can aggravate exercise-induced small intestinal injury and induce loss of gut barrier function

utmost importance to increase the awareness of athletes and trainers toward the potential negative effects of NSAIDs
Gastrointestinal permeability during exercise: effects of aspirin and energy-containing beverages. *Journal of applied Physiology* June 2001 Vol.90 no. 6, 2075-2080

**Study:**

- 17 subjects, 6 experiments
- ingested 1,300mg of aspirin
- ingestion of either:
  - water placebo, CHO drink, CHO + Glutamine(G)
- running 60min, 70% V02max
- assessed multi sugar probe
Results:
- increased GI permeability when combining aspirin with exercise
- there was more than a doubling of intestinal permeability compared with aspirin ingestion at rest

Conclusions:
- Prolonged used of NSAID increased permeability which is exacerbated by exercise

Present Study:
- CHO beverage and CHO + G were equally protective against aspirin + exercise induced permeability
Glutamine & Intestinal Permeability

**Study:** aim to see if 7 day Glutamine supplementation reduced exercised-induced intestinal permeability

- 8 subjects
- treadmill running, 60 min, 70% V02max
- assessed urinary L/R for int.permeability
Results:
- oral glutamine supplementation *prevented* exercise-induced intestinal permeability, permeability was significantly higher in the placebo group.

In Vitro Experiment arm:
- Glutamine supplementation increased activation of HSF-1 and HSP70 inducing occludin protein expression (possible mechanism for protection).

Occludin: a key paracellular tight junction protein.
Immune Function & Probiotics
Fatigue and impaired performance in athletes is well recognized and loosely linked to ‘overtraining’

Immune dysfunction and reduced salivary IgA and increased shedding of Epstein Barr virus has been associated with intense training in athletes


intense training can cause:

- suppression of immune function
- suppression of salivary IgA
- re-activation of Epstein Barr virus
  - which is associated with increased upper respiratory tract infections
- T cell dysfunction, less IFN γ secretion
What is already known on this topic:

Intense training in elite athletes has been linked to a reduction in IgA concentration in saliva, and this, along with an increase in shedding of EBV, predicts more frequent episodes of upper respiratory tract illness. Containment of EBV is thought to be mediated by T cell dependent mechanisms, not IgA.
Study:

to assess if a probiotic preparation could reverse any detectable abnormality in the fatigue cohort

24 trained recreational athletes

- fatigue
- recurrent sore throats
- impaired performance
- Daily capsule of 20 billion *L. acidophilus* or placebo
What this study adds:

- Fatigued athletes showed significantly less secretion of IFNγ from blood CD4 positive T cells than healthy controls, the first evidence of a T cell defect.

- A month of daily administration of L acidophilus significantly increased secretion of IFNγ from T cells in fatigued athletes to levels found in healthy athletes, and increased the concentration of IFNγ in saliva of control athletes.

Note: Salivary IgA is surrogate marker of protection; its suppression after intense exercise is a probable consequence of altered T cell function.

Vitamin D
How does ‘Leaky Gut’ occur?

Vit D-role in Int. Perm. and more…

https://thevreelandclinic.wordpress.com/tag/gut-health/
Involved in vital processes including:

- protein synthesis
- hormone synthesis
- immune response
- cell turn over and regeneration
- growth and maintenance of bone

Possible role in:

- cancer
- CVD
- T2D
- autoimmune disease
- infectious disease
and

over 77% of the population is insufficient
this includes athletes
Assessment of vitamin D concentration in non-supplemented professional athletes and healthy adults during the winter months in the UK: implications for skeletal muscle function. *Journal of Sport Sciences* 2013 Vol.31, No. 4, 344-353

**Study:**
- 61 non vit D supplemented athletes
- 30 aged matched healthy non athletes
- 5000IU Vit D daily for 8 weeks
- 62% of the athletes, 73% of the controls were <50nmol/ L
  - hence considered ‘deficient’ by this group or insufficient
Results:

- significant increase in sprint times and vertical jump in the Vit D group but not placebo
- 60% of the supplemented group had Vit D levels move into optimal (>100nmol/L)
- trend for improved bench press and back squat

How does Vit D affect muscle?
Mechanisms:

- Vit D modifies the transport of calcium in the sarcoplasmic reticulum by increasing the efficiency or number of calcium binding sites involved in muscle contraction

- Direct role of the VDR within muscle cells

- Size and amount of type II (fast twitch muscle fibers associated with Vit D supplementation
  - (Type II fibers are first recruited in power, anaerobic activities and in preventing falls)

- Vit D role in increasing IGF-1

Considerations:

What is optimal range for Vit D?

- <25 nmol/L = deficient (UK Nutrition and Food Standards)
- <50 nmol/L = deficient US IoM
- 50-80 nmol/L = insufficiency
- optimal? 75-125 nmol/L by others


- only at >100nmol/L does Vit D get stored in muscle and fat for future use
- at levels <100nmol/L is just enough circulating for immediate metabolic needs

Is this the key to optimal levels? more studies needed!
Recommendations on Vit D supplementation:

- assess serum levels
- consider optimal ranges
- loading 50,000IU weekly for 8 weeks, drop to maintenance dose of 1000-2000 IU daily

*Nutrients* 2013,5,1856-1868
WHEY PROTEIN ISOLATE

Whey past muscle anabolism!
“Individual amino acids and bioactive compounds isolated from whey may also improve immune function and GI health…”

Recall chronic exercise training can reduce salivary IgA which has been correlated with increased in URTI

Glutamine levels are also depressed after intensive exercise

Whey is naturally enriched with immunoglobulins and glutamine
Whey also has other immune-nutrients including:

- lactoferrin - shown to have strong antimicrobial activity in animal models
- Beta-lactoglobulin
- Beta-lactalbumin
- Cysteine rich proteins needed for acute phase response
Whey as an antioxidant

- cysteine rich proteins are key in the synthesis of glutathione
- Glutathione is a potent intracellular antioxidant
- Study by Lands et al showed a group supplemented with Whey for 30 days has significantly higher lymphocyte GSH and improved muscle performance

suggested the intracellular GSH and its antioxidant activity was the mechanism behind this improvement

Ha E, Zemel M. Journal of Nutritional Biochemistry (2003);14:251-258
Whey protein precludes lipid and protein oxidation and improves body weight gain in resistance-exercised rats


**Study**: looked at liver antioxidants and muscle growth in rats in resistant training with or without Whey Protein

**Results**: reduction in lipid and protein oxidation, AND a significant increase in hepatic GSH content...this may have been the mechanism for the reduced lipid and protein oxidation
Other benefits to improved glutathione

**Detoxification**

Glutathione also regenerates Vit C and Vit E

SLEEP

Hopefully you are not now!
Sleep deprivation has significant effects on athletic performance especially on sub maximal prolonged exercise
Compromised sleep may affect:

- learning
- memory
- cognition
- pain perception
- immunity
- inflammation
- glucose metabolism
- protein synthesis
It has been suggested Slow Wave Sleep (delta wave) is important for recovery for athletes.

Growth hormone release during SWS suggest optimal conditions for anabolism.

What can we do?

Sleep Extension
studies show faster sprint times, increased free throw accuracy, reaction time, turn time and mood with ‘extra’ sleep (extra sleep = goal was min 10h)

Napping for Sleep Deprived
Following a 30min nap reported improvement:
- sprint performance
- alertness
- cognitive performance

Halson S. Sleep in Elite Athletes and Nutritional Interventions to Enhance Sleep. *Sports Med* 2014 44:S1
Tryptophan needs a transport carrier, and competes with other AA. It can bypass this using 5 HTP to produce melatonin.
Tips to eating to improve sleep:

- Eat some CHO with meal (stimulates insulin, move LNAA into skeletal muscle, leaving more free tryptophan for the brain!)

Jury is still out on the ratio of macronutrients in diet however we do know:

- Diets higher in CHO reduce the time to fall asleep
- Diets higher in protein may improve sleep quality
- Diets high in fat negatively affect total sleep time

Halson S. Sleep in Elite Athletes and Nutritional Interventions to Enhance Sleep. *Sports Med* 2014 44:S1
eg. Foods high in tryptophan include:

- turkey (300mg)*
- pumpkin seeds (200mg)*
- spirulina
- oat or wheat bran
- dairy
- soy beans
- soy protein
- meats
- chocolate

* will liberate approx. 1 gram of tryptophan
Magnesium

**Study:**
- 46 elderly subjects
- 500mg Magnesium oxide

**Results:**
Statistically significant increases:
- sleep time
- sleep efficiency
- serum concentration of melatonin

**Decreases in:**
- sleep onset latency
- serum cortisol
Deep sleep is a parasympathetic activity

Ways to reduce sympathetic drive

- yoga
- breathing
- decrease stimulants - caffeine
- sleep in a cool, dark room
Take a moment to breathe…
and think foundational

Remember… Fletcher and Fairfield
Vitamins for chronic disease prevention in adults
JAMA, 2002, Jun 19;28(23):3127-9
How does ‘Leaky Gut’ occur?

All affect Foundational Nutrition

https://thevreelandclinic.wordpress.com/tag/gut-health/
Mitigating the negative effects of training

Proper Nutrition via food - avoid a processed inflammatory inducing diet
(refined CHO, high glycemic foods, processed trans fat, low protein = inflammatory diet) AVOID SAD!

Supplements - exactly that to “supplement” an already good diet
why bother?
studies show supplementation is crucial and necessary where any deficiency is noted

note: MOST PEOPLE ARE DEFICIENT in one or several areas
51% of Americans consume a MVI yet still:

- 35% below EAR for Vitamin A
- 74% below EAR for Vit D
- 39% below EAR for Calcium
- 46% below EAR for Magnesium
- 67% below EAR for Vitamin E
- 31% below EAR for Vitamin C

Still low in vitamins and minerals despite half of Americans taking a MVI.

Replete deficiency

Nutrient Deficiency is common in the ‘normal’ population (needs of exercising body are greater)

Study looking at vitamin/mineral intake in younger population (ages 19-28)

RESULTS:

Reported intakes of vitamins A, B6, E, D, and C, folacin, magnesium, iron, zinc, and calcium were inadequate compared with the Recommended Dietary Allowances (RDA); with more females than males reported nutrient intakes less than two thirds of the RDA.

Deficiencies of the vitamins B$_{12}$, B$_6$, C, E, folate, or niacin, or of iron or zinc mimic radiation in damaging DNA by causing single- and double-strand breaks, oxidative lesions, or both. The percentage of the population of the United States that has a low intake (<50% of the RDA) for each of these eight micronutrients ranges up to 20+ percent.

Other Concerns: Exercising in polluted air

- Ambient ozone, NO2, CO, SO2, PAH, VOC’s …etc
- WHO estimates 2.7 millions deaths annually from air pollution
- Cyclists in urban area elevated serum /urine benzene, toluene, xylenes after 2 hr ride
- higher in the urban riders vs rural riders

Short term increases in particulate matter (PM) associated with:

- Acute coronary syndrome
- Stroke
- Venous thrombosis
- Arrhythmia
- Alterations in heart rate variability
- Lipid changes

Despite decreases, millions in US are still exposed to levels of PM higher than the current US EPA standards
Exercise induced bronchoconstriction (EIB)

- 20% of all athletes (including Olympic athletes)
- Transient airway obstruction
- Often brought on by environment (pollution)

Prim Care Respir J 2013;22(1):122-125
eg. Ozone as one pollutant

- reduced antioxidants in the respiratory tract
- macrophage levels also dropped after ozone exposure

Occup Environ Med 1999;56:473-481
Urban joggers exhibit markers of chronic ozone-induced respiratory inflammation

- 2.6 decline in FEV, 2.2% decline in FVC

The Positive:

**Cyclist who took:**

15 mg beta carotene, 75 mg of Vit E, 650 mg of Vit C

**Results:**

Those who took the supplements showed NO effect of ozone on any respiratory parameters, those who did not take supplements suffered the changes


Possible solution: A multivitamin, an antioxidant
Can supplements blunt any adverse effects or offer protection?

Study by Tong H., Rappold., et al.

Results: Omega 3 fatty acid supplements (684mg) offer protection against adverse cardiac and lipid effects associated with air pollution
Environ Health Perspec. vol 120:7 July 2012

Other studies linking air pollution to depression mechanism-increased oxidative stress

Implications to athletes? long term effects? preventative strategies?
So should we supplement?
Science is not yet clear - may suggest yes, not for performance enhancing but for overall health

Needs may vary with intensity and goals:

**Considerations:**

- rehydration
- electrolyte management
- muscle glycogen restoration
- repair and rebuild muscle
- GI health and healing
- immune function
What are athletes using?

Study of 326 triathletes (ironman and olympic distance)
89% felt they could not get the nutrients they needed from food alone

What did they use?

- carbohydrate beverage = 98%
- multivitamin = 93%
- electrolyte (beverage) = 90%
- Fish oil = 60%
- antioxidant = 56%
- endurance = 52%

Why?

- 82% felt they had more energy
- 73% to perform better
- 62% for general health
- 61% to better recovery
- 28% to prevent disease

Shawn Talbott, PhD. Dietary Supplement Use Among Endurance Athletes. running.competitor. Sept. 2013
Recommendations

For improving overall health of anyone and more so in the exercising individual:

The Basics:

- Multivitamin-mineral
- Vit D
- EFA
- Probiotics
- Protein sources - whey, salmon protein
- Glutamine
Federal authorities consider sports nutrition one of the top three problematic dietary supplement market segments.
NSF Certified for Sport®

- NSF is a 3rd party cert. organization founded in 1944

- The NSF Dietary Supplements Cert. Program tests for: label claims, toxicology, and contaminants (NSF/ANSI 173)

- They offer a special product certification “NSF Certified for Sport®” (in addition to the NSF/ANSI 173)

- Screens products for more than 200 substances banned by most major athletic organizations

- NSF Certified for Sport® is recognized by the NFL, NFL Players Association, MLB, MLB Players Association, PGA, LPGA and Canadian Centre for Ethics in Sports

- MLBPA partnership with Klean Athlete®
NSF DIETARY SUPPLEMENTS
Program Architecture

WHAT?
Screen for 180+ WADA Banned Substances

WHY?
Decrease Risk of Positive Doping Test

WHO?
Athletes, Coaches, Sports Med Professionals

WHAT?
Toxicological Review, Label Claims Testing, Environmental Contaminant Screen

WHY?
Public Health and Safety

WHO?
Moms and Dads, Health Care Professionals, Everyday Consumers

WHAT?
Annual Inspection/Audit Program

WHY?
Quality Assurance: Since June 2010 FDA requires all Suppliers, Manuf actures, Packagers, and Distributors of Dietary Supplements to follow 21 CFR 111

WHO?
Industry, Manufacturers and Ingredient Suppliers

STEPS 1, 2 & 3: EACH LEVEL BUILDS ON THE OTHERS

CERTIFIED FOR SPORT®

PRODUCT/INGREDIENT CERTIFICATION

GMP REGISTRATION
The **NSF Certified for Sport®** program tests products on a lot-by-lot basis to verify label claim, test for athletic banned substances and harmful levels of contaminants.

**This includes testing for:**

- Label claim accuracy
- Contaminants
- 200+ athletic banned substances from The World Anti Doping Agency (WADA), NFL, MLB and NCAA lists
Safety of Supplements

- Athlete is responsible for what goes into their body - they trust YOU! (WADA/USADA)

- Contaminated supplements are a TRUE concern

- 2001 IOC study of 634 supplements from 13 countries
  - 14.8% of samples worldwide contained anabolic steroids (not on the label)
  - 18.8% of US samples were positive

- Herbal supplements for weight loss, sexual performance and muscle and energy promoting are highest risk
In summary:

- Multivitamin/mineral and Antioxidant support most biochemical pathways, detox pathways, reduce ROS effects, foundational support
- Probiotic
  gut integrity, immune function
- Vit D
  so many areas! but role in muscle and metabolism
- Whey Protein
  muscle health and via glutathione antioxidant and detoxification
- Glutamine
  GI health and muscle recovery
What is the goal?

A healthy and ‘safe’ athlete now

A healthy athlete in years to come
Thank You