



Introduction



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Presenter Instructions

“**Tackling the Heat: A Game Plan for Competing Safely**” will help you make all the right moves in educating your athletes about heat illness and dehydration. As you move through the program, you’ll find many enhancements to the learning and presenting experience.

You can navigate easily around the site by accessing content in a variety of ways: for example, from the Main Menu, you can click to the Site Map. From there, jump to any part of the program.

You can use a medley of interactive tools and resources to educate and inform your athletes:

- These include presentation slides with important information about dehydration and heat-related problems. And speaker notes to help you cover critical messages. (Click on the Resources button from the Main Menu screen.)
- There are handouts on staying hydrated and performing in the heat. Print and distribute them to your athletes.
- There’s an animated history of Gatorade. It shows how the sports drink and the science behind it, have become such integral parts of competitive sports at all levels.
- And from almost any screen, you can click a button to review the Gatorade Sport Science Institute’s ongoing research. Or, click on a link that takes you directly to the GSSI web site.

We’re confident you’ll find this program useful in helping your players stay strong when conditions on the playing field get tough. Browse through the program for familiarity before sharing with your athletes. Good luck!

GSSI



- This information is brought to you by **Gatorade Sports Science Institute**
- What is GSSI all about?

Click the **GSSI logo** at any time for GSSI info

This information is brought to you by the Gatorade Sports Science Institute (GSSI).

Established in 1988, GSSI serves to share current information and expand knowledge on sports nutrition and exercise science that enhance the well-being and performance of athletes.

Today, GSSI continues to fulfill this mission by:

- Initiating important research studies.
- Sharing findings with educational, medical, scientific, and athletic organizations.
- Hosting sports-science conferences.
- Developing educational materials and training tools.

In the process, GSSI serves as many as 110,000 members in more than 145 countries.

Scientists at the Gatorade Sports Science Institute utilize the latest technology to study the effects of exercise, the environment and nutrition on the body. GSSI has its own exercise physiology, biochemistry and exercise sensory labs and also works with leading scientists around the world to further understand exercise science and sports nutrition.

One of the primary areas of focus is on the study of rapid fluid replacement for prevention of dehydration.

- On the field, scientists use sweat patches to measure what's in sweat. They also determine sweat loss and fluid intake to estimate hydration levels.
- In a controlled laboratory, scientists monitor athletes under simulated weather conditions ranging from the intense cold of winter to the extreme heat of summer.

GSSI scientists also measure taste responses to beverages and food consumed under hot, sweaty, and thirsty conditions. They recognize that the way beverages and foods taste, look, smell, and feel impact the amount athletes will consume. This is a critical consideration in keeping players well hydrated and nourished.

GSSI scientists then take what they learn and use it to develop Gatorade sports nutrition products, and to inform athletes and their coaches how best to stay well hydrated and nourished.

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Why Worry About What You Drink?



Drinking enough of the right fluids:

- Keeps you in the game
- Lets you work harder
- Allows you to play at your best
- Helps to ward off dehydration and heat illness

Coaches and athletic trainers have told you that you need to drink plenty of fluids to avoid dehydration, but do you really know what that means? Drink when you practice or compete, drink when you're hot and thirsty, right?

No, there's more involved than that. By the time you're thirsty, it's too late. **Drinking the right amount and type of fluid not only quenches thirst, but it helps prevent dehydration and heat illness and allows you to go stronger and last longer.**

Athletes sometimes don't realize the amount of sweat they lose. If you're one of them, this puts you head-to-head with what can be your biggest competitor – dehydration. **It's critical to beat dehydration so that when the game is on the line, you can play at your best even in the final minutes of competition.**

It's Cool to Sweat!



Why You Sweat

- Working muscles produce heat
- More blood flows to the skin
- Sweat evaporates from the skin, releasing body heat

Drinking puts fluids back into the body

It's **cool** to sweat - literally. **Sweating is your body's way of cooling itself.**

During exercise, working muscles produce heat, causing a rise in body temperature. A rise in body temperature triggers the body to increase sweating and blood flow to the skin. As a result, heat is removed as sweat evaporates from the skin.

While sweating is important, **if you don't replace the fluids you lose through sweat, it can lead to dehydration and fatigue. Dehydration is a risk factor for developing heat illness. That's why it's so important to drink something before, during and after exercise to recover what your body loses through sweat.**

Fluid in the Body



- Human body is 55-65% fluid
- Fluids help keep your body temperature at normal level
- Dehydration can keep you from competing at your best
 - A small amount of sweat loss can do it!

- Our bodies are 55 to 65 percent fluid. **When you realize that about half of your weight is fluid, it is pretty easy to see the significant role that water plays in the body.**
- Water gives your body the ability to stabilize body temperature through sweating. When fluid is lost through sweat and not put back, your body can't control body temperature as well.
- **Drinking enough fluids helps the body cool down from the inside out.**
- Dehydration occurs when your body does not have enough fluids to function as it should. Prevent dehydration, and chances are you can prevent its side-effects like headaches, fatigue and muscle cramps. If left unchecked, dehydration can increase the risk for developing heat illness, such as heat exhaustion and heat stroke.
- **Even a small amount of dehydration (just 2 percent of your body weight, for example a 150 pound athlete losing 3 pounds) can prevent you from competing at your best.**
- Let's calculate a few samples to understand how much fluid you need to drink to replace sweat loss.

Sweat Stats



- Body has 2 to 4 million sweat glands
- Highest concentration of sweat glands are on the bottom of the feet
- Least concentration of glands on the back
- What you lose through sweat:
 - Can lose between 2 cups to 3/4 gallon of sweat per hour
 - Electrolytes like sodium and potassium

Sweat glands make it possible for the body to lose fluid as sweat.

- **The body has 2 to 4 million sweat glands.**
- Where do you think the most sweat glands are on your body? **The most concentrated area of sweat glands is on the bottom of our feet while the least concentrated area of sweat glands is on our back.**
- **During an hour of exercise, you can lose between 2 cups (16 oz) and 3/4 gallon of fluid. That means dehydration can develop very quickly,** particularly the more intense the exercise and the warmer the playing conditions.
- Sweat comes from fluid in the blood stream, fluid inside cells, and fluid that bathes our cells, so **sweat contains minerals, such as sodium and potassium - called electrolytes.**

How Much Will You Sweat?



Ask these questions...

- What environment are you in?
- How intense is the practice or competition?
- How long will the practice or competition last?
- What equipment or gear are you wearing?
- What's your genetic make-up?
- Are you in good shape for your sport?
- Are you used to the heat?

There are a number of factors that affect how much you will sweat:

- **What type of environment are you in? - High temperatures cause you to sweat more quickly and to lose more fluids through sweat.** Humidity also affects your ability to cool down. It's harder for sweat to evaporate in hot, humid weather than in hot, dry weather.
- How long and intense is the practice or competition? - As your body works harder, your body temperature increases, which leads to greater sweat loss.
- **What are you wearing?** - Wearing minimal, loose-fitting clothing helps promote evaporation of sweat. **Heavy clothing and equipment** (e.g., football uniform and helmet) **don't allow sweat to evaporate as easily**, which increases body heat and sweating.
- What is your genetic make-up? - Genetics have some effect on your ability to sweat, but being in good physical condition is a more important factor.
- **Are you in good shape for your sport? - As you increase your fitness, you sweat sooner and you sweat more.**
- **Are you used to the heat? - Training in the heat helps your body respond to heat better,** which means it becomes 'used to' or acclimated to the heat.

What Happens When You Drink Fluids?



- Fluid is absorbed and used to replenish fluid needed in the blood
 - Speed of fluid absorption depends on the amount you drink and the carbohydrate content in the beverage
- Gatorade is scientifically formulated to:
 - Maintain fluid balance by replenishing fluid and electrolytes
 - Deliver energy to working muscles without slowing fluid absorption

What happens when you drink fluids?

- **Once absorbed, fluids and nutrients are circulated by the bloodstream to the body's muscles and organs.**
- **The speed that a beverage travels through the gut (or absorption) depends on the amount of beverage consumed and the amount of carbohydrate energy in a fluid. Beverages with a small amount of carbohydrate speed hydration and deliver energy.** Those with a high carb content move through the gut more slowly.
- **Gatorade is scientifically formulated to deliver energy to working muscles and maintain fluid balance by replenishing fluid and electrolytes. Sports drinks are the best at rehydrating the body so it can recover from exercise.**

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**Think You're Used to the Heat?
Chances Are...You're Not.**



- You've got to allow your body to adapt to the heat so you can perform in hot, humid conditions without overheating
- To acclimate to the heat, you need MORE fluids to match increasing sweat losses and blood volume

How many times have you heard people say, "Oh, I'm used to the heat; it doesn't bother me?" But what does that really mean for your body?

Being 'used to the heat' or 'acclimated' is necessary for the body to exercise in hot, humid conditions without overheating. When exercising in the heat, your core body temperature rises more rapidly because the warm, humid air makes it harder to give off body heat and for sweat to evaporate.

- **Your body adapts to warmer weather or 'acclimates' by increasing the volume of blood in the body so it can better regulate body temperature.**
- **This can only happen if you drink enough fluids!**
- **If someone is 'used to the heat' - it doesn't mean they are protected against dehydration and heat illness.**
- **In fact, to acclimate to the heat, your body actually needs MORE fluids to match an increased sweat rate and build blood volume.**

What Happens When You Become Heat Acclimated?



Benefits to the body:

- Higher sweat rate
- Sweating starts sooner
- Sweat over more of the body
- Sweat is more dilute
- Lower core body temperature
- Lower heart rate

It is crucial to drink plenty of fluids to minimize body weight loss during exercise

The most important factor for being able to exercise safely in hot and humid climates is your ability to become acclimated to the heat.

What does being acclimated mean for your body? There are several benefits, all which help you to regulate body temperature better during exercise in the heat:

- **A higher sweat rate to cool off better.**
- **Sweating starts sooner or earlier.**
- **Sweating occurs over more of your body.**
- **Sweat is more dilute. The concentration of electrolytes, like sodium, is lower.**
- **Body temperature stays lower.**
- **Heart rate is lower.**

But it is crucial to drink plenty of fluids before, during and after exercise, as well as between practices!

How Easily Will You Get Used to the Heat?



- Fitness level
- Clothing and gear
- Length of game
- Time of day
- Exercise intensity
- Hydration status
- Infection, illness, inadequate sleep

Armstrong et al. *Sports Med* 1991

There are several factors that affect how easily and quickly you will achieve acclimation to the heat. These include:

- **Fitness level** - If you are aerobically fit, you will have an easier time acclimating to the heat.
- **Amount of clothing and equipment.**
- **Duration of exercise in the heat.**
- **The time of day exercise is performed** (early morning versus noon).
- **Intensity of exercise performed.**
- **Hydration status of the athlete.**
- **Infection, illness or inadequate sleep** all will reduce your ability to tolerate the heat.

We'll discuss how you can become acclimated in the "Heat Illness Prevention" section.

Are Bigger Athletes at Higher Risk for Heat Illness?



Being fit is the key to adapting to the heat!

- In theory, larger athletes should be able to sweat more and regulate a rise in body heat better than smaller athletes

BUT . . .

- Large athletes may be out of shape, which is why they have difficulty acclimating

Many people think that large athletes cannot release body heat as easily as smaller athletes. This is not true!

- Larger people have more surface area or skin over their bodies for sweating to occur.
- People with larger body sizes or more body fat actually experience a smaller increase in body temperature when they exercise.
- They are able to spread out any rise in body temperature due to exercise over a larger body mass.
- They also have a larger blood volume to support heat storage and sweating.

So why do larger athletes seem to be the ones who are stricken with heat illness?

- **Their level of conditioning is too low, which means they cannot acclimate to the heat nearly as well as fit athletes.**

Dehydration & Heat Illness



- Dehydration can impair performance and increase risk of heat illness
- Three levels of severity:
 - Heat cramps
 - Heat exhaustion
 - Heat stroke

Even athletes who are acclimated to the heat need to drink plenty of fluids because they will sweat more resulting in greater body fluid loss.

Dehydration can happen to anyone! It impairs performance and increases the risk of heat illnesses.

Heat illness is best understood in three separate degrees of severity: heat cramps, heat exhaustion and heat stroke.

Heat illness does not necessarily occur in this progression, but heat stroke is the most serious form. It is possible to have heat stroke without ever experiencing heat cramps and heat exhaustion.

Dehydration



Some Warning Signs:

- Thirst
- Irritability
- Fatigue
- Loss of performance
- Muscle cramps
- Nausea
- Vomiting

Treatment:

- Stop activity
- Rest in a cool, shaded area
- Drink fluids

Dehydration is 100% preventable! All athletes should be able to avoid heat-related problems. **Know the signs of dehydration:**

- **Thirst** • **Irritability** • **Fatigue**
- **Nausea** • **Vomiting** • **Muscle cramps**
- **Loss of Performance**

You may not experience all these signs.

Thirst is not a reliable indicator of hydration status. By the time you are thirsty during exercise, you have already become dehydrated.

Speak up if you experience any of these signs or you are not feeling well, so that treatment can begin immediately:

- **Stop activity and rest in a cool, shady area** (or preferably in air conditioning).
- **Drink a sports drink containing electrolytes**, like sodium. Sodium helps your body retain needed fluid.

Muscle Cramps



Some Warning Signs:

- There may not be a warning sign
- Painful, involuntary muscle spasms

Treatment:

- Warm-up and stretch before exercise
- Keep drinking!
- Eat some salty foods
- Stretch out cramped muscles

Muscle cramps are painful, involuntary muscle spasms that can be caused by a number of factors. Possible causes are dehydration, fatigue and sodium loss. **Dehydration is one cause that can be eliminated when you drink enough fluids.** It's also possible that forceful, repetitive contractions of muscles used in sports might trigger cramps.

Here are some tips on how to avoid muscle cramps:

- **Stretch before exercising.** Do several repetitions of stretches to increase flexibility of muscles and reduce the risk of injuries. Always warm-up prior to stretching.
- **Stay hydrated.** Dehydration can have been linked to muscle cramps. Be sure to drink plenty of fluids before, during and after activity.
- **Consider adding sodium (salt) to your diet.** If you lose a lot of fluid through sweat due to intense training in the heat, such as during football two-a-day practices, you may need to add extra sodium and fluid to your diet. This can be done by consuming pretzels, sports drinks and extra table salt or a few processed foods at meals.
- **If cramping still occurs, gently stretch cramped muscles** to relieve some of the pain.

Whole-body muscle cramps are a more serious condition, related to fluid and electrolyte imbalances.

Whole-body Cramps



Some Warning Signs:

- Eats a low-salt diet
- Sweats early and heavy
- Poor hydration habits
- Sweat stings eyes, tastes salty
- Visible salt on body after sweat dries
- Not used to heat/humidity

Treatment:

- Replenish electrolytes and fluids
- Eat some salty foods
- Drink sports drinks

If you suffer from whole-body cramps, you may have these symptoms:

Whole-body muscle cramping is different from typical muscle cramps, which are usually contained in one area. The pain is also more intense. Athletes who suffer from whole-body muscle cramping sometimes curl up on the sidelines, drop to the ground and crumple from the pain.

Recent research suggests that **these athletes are prone to excessive electrolyte depletion due to heavy sweating and high concentrations of salt in sweat. Electrolyte replacement can be an effective preventive measure.** That's why athletes prone to whole-body cramps benefit from consuming salty snacks, sports drinks, extra table salt or a few processed foods at meals.

Heat Exhaustion



Some Warning Signs:

- Headache
- Nausea
- Vomiting
- Weakness
- Dizziness
- Rapid pulse
- Profuse sweating or clammy skin

Treatment:

- Rest in cool, shaded area
- Drink fluids
- Loosen or remove clothing and equipment

There are many warning signs of heat exhaustion, including weakness and cool, clammy skin. The body is still able to sweat during heat exhaustion.

- **Heat exhaustion should be dealt with immediately to avoid further complications.** Eventually, fatigue and exhaustion occur because the body - specifically the cardiovascular system - cannot support exercise and control or regulate body temperature effectively at the same time. Through symptoms alone, it's difficult to differentiate between heat exhaustion and dehydration.

To treat heat exhaustion:

- **Rest in a cool, shaded or air-conditioned area.**
- **Drink small amounts of fluid often.**
- **Loosen and remove unnecessary equipment and clothing.**

Treatment for heat exhaustion is almost identical to that for dehydration.

Heat Stroke



Some Warning Signs:

- High body temperature
- Nausea
- Drowsiness
- Confusion/ Disorientation
- Irrational behavior
- **COLLAPSE - COMA**

Treatment:

- Seek emergency medical treatment!
- Cool first - transport second!

Epstein *Am J Med Sports* 2000

Heat stroke is a serious medical condition requiring emergency medical treatment because it causes the athlete to collapse and may result in coma or death. You need to recognize and seek treatment at the early warning signs before heat illness escalates to this level.

- Heat stroke is different from heat exhaustion - in heat exhaustion, the cardiovascular system is strained, in heat stroke, the body's central nervous system fails.

Early warning signs of heat stroke include weakness, nausea, dizziness, confusion, disorientation, drowsiness and irrational behavior. However, these symptoms may only appear in 1 out of every 4 people with heat stroke before collapse. These symptoms can last from just a few minutes to hours. Sweating may or may not stop - dry skin is not necessarily a telltale sign of heat stroke.

Heat stroke is an emergency where immediate medical treatment is needed.

- Your team staff should **seek medical help immediately.**
- **Then the golden rule is to cool first, transport second.** Someone suffering from heat stroke needs fast cooling **with an ice bath, ice packs, a cool shower, wet towels or any other available means** (shade, a pool, etc.).

Case Study: 16-year-old football player



Some Warning Signs:

- Practiced in 94°F and 52% humidity
- Collapsed on the field
- Suffered from high body temperature

Treatment:

- Ice Pack
- I.V. and oxygen
- Tracheotomy (to breathe through a tube in the neck)

Arch Intern Med 1968

This is a true story about a 16-year-old, healthy male football player. He collapsed on the field during summer practice on a particularly hot and humid day.

He was taken to the hospital where he was packed in ice and given an I.V. and oxygen. Fluids and cooling lowered his body temperature. A tracheotomy was performed to maintain an airway and allow him to breathe through a tube in his neck. He had considerable internal bleeding.

This player unfortunately had a heart attack and died. The heat stroke may have damaged his blood vessels, resulting in a loss of blood inside his body.

We're not trying to scare you, we just want you to understand that this is serious.

Don't become a victim of any type of heat illness!

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What Can an Athlete Do to Prevent Heat Illness?



- Get acclimated to the heat!
 - Keep fit in the off-season
 - Exercise in the heat for 10-14 days
 - Start with short, low-intensity practices, wearing minimal clothing
 - Gradually increase duration, intensity, clothing and equipment
- Drink based on your actual fluid losses

Your best bet for avoiding heat illness is to get acclimated to the heat. **Keep aerobically fit year-round and manage your body fat, especially before returning to pre-season practices.**

- **Exercise in the heat - Your body may need up to 14 days of working out or exercising in the heat to adjust or become acclimated.** The more fit you are, the shorter this acclimation period. **These practices don't have to occur in succession, but don't have 2 or more rest days in a row.**
- **Start with short, easy practices, wearing minimal clothing, such as shorts and a T-shirt. Gradually increase the length of practices, the intensity of workouts and the amount of clothing and equipment worn.**
- Drink the right amount of a sports drink, like Gatorade, before, during and after activity to help your body recover. Drink during exercise to minimize losses in body weight but don't over drink.

Tips to Beat Heat Illness



- Keep cool
- Start drinking early
- Gradually tackle the heat
- Limit use of full gear when heat and humidity rise
- Tell team staff about medication and dietary supplement use
- Speak up! Don't let your pride hurt you

Take the time to understand these prevention tips - it may save your life:

- **The cooler you stay, the harder you play. Take frequent cooling and fluid breaks.** Extreme heat can overwhelm even fit, hydrated athletes.
- **Stay hydrated with the right amount and kind of fluid.** Research shows that drinking sports drinks, like Gatorade, before, during and after practice help athletes stay better hydrated than water alone. Weigh-in before and after practices to learn how much fluid you lose as sweat and need to put back.
- **Workout at a low intensity and for a short amount of time your first few days in the heat, gradually increasing both over time.** Most players adjust to the heat rather quickly, although some players may take up to 14 days.
- In sports that require a lot of equipment, like football, **limit use of full-gear when heat and humidity are high.**
- Some medications or dietary supplements can affect how the body regulates heat. **Tell your health professionals** (physician, athletic trainer, sports nutritionist) **what medications and dietary supplements you're taking.**
- **Don't let pride hurt you - speak up when you don't feel well!** Not speaking up can be a deadly mistake.

Two-A-Day Practices: High Risk for Heat Illness



- Football players wear a lot of clothing and equipment
- Many players show up to pre-season practices unfit
- Practices begin during the hottest time of the year
- Days 1 and 2 can be a 1-2 punch

Two-a-day practice sessions for football are high-risk periods for dehydration and heat illness. This is due to several reasons:

- There are a lot of clothing and equipment needed in football, which make it difficult for the body to cool itself.
- Many football players return to pre-season practices less fit than usual, so they cannot get used to the heat as easily.
- Practices begin during the hottest time of the year. Hot temperatures and high humidity greatly increase risk for heat illness.
- Days 1 and 2 can be a 1-2 punch for heat illness. As the body begins to respond to the heat by building blood volume, athletes are at a higher risk for dehydration and heat illness.

Two-A-Day Practice Progression



Progression	Clothing/Gear
Phase 1*	Shorts and T-shirt, no pads Add helmet
Phase 2	Add shoulder pads and jersey Same
Phase 3	Full uniform Same

*based on acclimation

Drink fluids before, during and after practices,
and throughout the day

While there is not a lot of information on the best way to conduct two-a-day practices, there are a few rules-of-thumb that work well for many teams.

- **Athletes should only wear minimal clothing and equipment during the first practice, such as shorts and T-shirts. Additional equipment, such as helmets and pads should be added over time, working up to full pads and gear.**
- **These initial practices should be broken down to include 20 minutes of exercise in the heat, alternated with 20 minutes of rest in the shade. The duration of exercise in the heat should be gradually increased over the next few weeks.**
- **You might want to eat more salty foods for the first 3 to 5 days of practicing in the heat.** This is the time more sodium is lost through sweat. After the first week or 10 days, additional sodium may not necessary.
- **At every practice and game, watch for signs of dehydration and heat illness, and speak up if you need assistance.**
- **Drink fluids before, during and after practices and throughout the day!** Heat illness is preventable, no one should have to suffer from heat illness.

Drinking Guidelines



- National Athletic Trainers' Association (NATA) Position Statement: Fluid Replacement for Athletes*
- Specific recommendations for athletes in different sports and environmental conditions

*Casa et al. *J Athl Train* 35:212-224, 2000

The National Athletic Trainers' Association, or NATA, is a professional organization of athletic trainers whose members are the leading experts on the care of athletes. In 2000, the NATA issued fluid intake guidelines to highlight the need for developing fluid replacement practices with athletes. This position paper is a standard hydration protocol for all athletes.

Staying hydrated should be a priority for all athletes, regardless of sport and environmental climate. The NATA guidelines serve as a general strategy for fluid replacement, but it is still critical to consider your environment and specific sport when planning a hydration plan.

Let's review the NATA fluid recommendations for before, during and after exercise.

Follow These Guidelines



Prepare Yourself

- Before exercise (2-3 hours) drink 17-20 oz of fluid and another 7-10 oz of fluid 10-20 minutes before events

Drink Often

- During exercise drink 28-40 oz of fluid per hour of play (at least 7-10 oz every 10-15 minutes)

Put it Back

- After exercise drink at least 20 oz per pound of weight loss within 2 hours of finishing training or competition

*Casa et al. *J Athl Train* 35:212-224, 2000

Here's a quick guide to show you how much fluid your body needs before, during and after exercise.

Before Exercise



- Start by drinking up before the game
- During exercise drink to minimize losses in body weight but don't over drink

*Casa et al. *J Athl Train* 35:212-224, 2000

You've got to start the game on a full tank - already hydrated. Doing so will correct any dehydration from previous training or competition and delay or avoid the effects of dehydration during the next session. This is especially important for athletes with two-a-day practices or frequent competitions because of increased risk for becoming chronically dehydrated.

To make sure you're fully hydrated before exercise, drink:

- **17 to 20 oz of fluid (which is the same as a standard size sports bottle) two to three hours prior to exercise.**
- **An additional 7 to 10 fl oz (half a sports bottle) just 10 to 20 minutes before exercise.**

An easy way to check hydration status is to look for clear, almost colorless urine (like the color of light lemonade). Be sure to experiment with the timing of pre-exercise fluid intake because everyone's bladder is different. You'll want to allow enough time to go to the bathroom before exercise.

During Exercise



- During exercise drink enough fluid to minimize loss of body weight
 - Drink on a schedule, before you're thirsty
 - Use timeouts or breaks to drink fluids
 - Drink cool, flavored and/or lightly sweetened fluids

*Casa et al. *J Athl Train* 35:212-224, 2000

During exercise, the goal is to minimize loss of body weight.

Putting this into practice isn't as easy as it may seem. **A good strategy is to start drinking fluids early and often. Follow the same drinking patterns on game day as during practices.**

Research suggests there are effective ways to make sure you keep drinking beyond satisfying thirst since thirst is not a reliable indicator of your hydration status.

- **Drink cool, flavored and/or lightly sweetened fluids.**
- **Have fluid containers readily accessible.**
- **Use a beverage container that works for you.**

FLUID NEEDS VARY AMONG ATHLETES. THE NATA BASES THESE GUIDELINES ON AVERAGE BODY WEIGHT. MAKE ADJUSTMENTS TO YOUR HYDRATION STRATEGY OR PROTOCOL. ATHLETES SHOULD BE AWARE OF THEIR SWEAT RATES AND DRINK TO MATCH, NOT EXCEED THOSE RATES.

After Exercise



- Be aware of how much fluid you lose through sweat
- Drink at least 20 oz per pound of weight loss within 2 hours of finishing training or competition

*Casa et al. *J Athl Train* 35:212-224, 2000

The goal of fluid replacement after exercise is to restore hydration levels to a normal state. **Make it a habit to always weigh-in before and at the end of every practice to calculate fluid losses accurately.** Using a weight chart makes sweat losses and required fluid calculations easy.

- **The NATA position statement recommends you completely replace lost fluids by drinking 20 to 24 oz per one pound decrease in body weight during exercise. It's best to drink this within two hours after exercise,** though rehydration can continue four to six hours after.
- Since fluid losses continue after exercise due to continued sweating and urine losses, you need to drink more than just 16 oz per pound body weight. 25 to 50 percent more is recommended, which is why you should drink 20-24 oz per pound.
- **If you don't fully replace fluids lost, you may experience chronic dehydration that could sideline you from competition.**

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The Fluid Formula: What Athletes Should be Drinking



- The ideal beverage may not be plain water
- Look for:
 - Carbohydrates
 - Electrolytes
 - Flavor
 - Cool temperature (50-59° F)

Since every athlete would rather spend more time in competition rather than sitting on the sidelines, it's important to consider the kind of fluid used for fluid replacement. The winning formula for athletes includes drinking fluids that have:

- Carbohydrates
- Electrolytes
- Flavor
- Cool temperature

History of Gatorade



A large, empty rectangular box with a thin black border, intended for writing the history of Gatorade. The box has a notch on its top-right and bottom-right corners, matching the layout of the header.

The Fluid Formula: Water vs. Sports Drinks



Water isn't enough

Water is a great thirst quencher, but a lousy rehydrator

- Water doesn't have the performance benefits of a sports drink
- Water doesn't have flavor
- Water shuts down thirst before you've replaced the fluid your body has lost through sweat
- Water doesn't have electrolytes and carbohydrate

"There are occasions when Gatorade is more effective than water, but no occasion when water is more effective than Gatorade"

- Dean Kleinschmidt, Head Athletic Trainer, Washington Redskins

Noakes et al. *Eur J Appl Physiol* 1988
Iuliano et al. *Int J Sports Nutr* 1998
Below et al. *Med Sci Sports Exerc* 1995

When you're exercising and sweaty, water is OK, but it just isn't enough. There are several reasons sports drinks are better than water for exercising athletes:

- **Water doesn't have the performance** benefits of a sports drink.
- **Water lacks flavor** to keep you drinking. Research shows that you'll hydrate better by drinking sports drinks.
- **Water "turns off" thirst too soon**, before your body is fully rehydrated.
- **Water doesn't have electrolytes**, like sodium, or energy that you need to perform at your best.

Dean Kleinschmidt, the Head Athletic Trainer for the Washington Redskins, believes that "There are occasions when Gatorade is more effective than water, but no occasion when water is more effective than Gatorade."

The Fluid Formula: Carbs Are Key



- Supply energy to working muscles
- Improve taste
- Stimulate absorption of fluid
- Enhance performance
- The right mix of carbs helps to speed energy to muscles



Research shows a 6% carb solution in a sports drink does all these things

Ryan et al. *J Appl Physiol* 1998
Shi et al. *Med Sci Sports Exerc* 1998
Below et al. *Med Sci Sports Exerc* 1995

What is it about a sports drink like Gatorade that fuels performance? Carbs are the key ingredient because they supply energy for working muscles. They also improve taste, stimulate fluid absorption and enhance athletic performance.

- **Gatorade contains a scientifically formulated mix of carbohydrate** (sucrose, glucose and fructose) **to assure fast delivery of fluids and use of carbohydrate by the body.** Unlike Gatorade, drinks that contain only fructose or have high levels of fructose should be avoided because too much fructose can slow absorption.
- It is important to make sure that the drink has an amount of carbohydrate that does not slow down fluid delivery. **The Gatorade 6-percent carbohydrate solution (14g/8oz) is a science-based formulation to speed hydration and deliver energy during exercise.**

The Fluid Formula: Electrolytes



Electrolytes (minerals like sodium and potassium) in sports drinks:

- Encourage drinking
- Replace electrolytes lost in sweat
- Help maintain fluid balance
- Sodium is the main electrolyte lost in sweat
- Potassium is lost in small amounts

Wilk and Bar-Or *J Appl Physiol* 1996
 Meyer et al. *Med Sci Sports Exerc* 1992
 Gonzalez-Alonzo et al. *J Sports Med* 1992
 Vrijens et al. *J Appl Physiol* 1999

Electrolytes (minerals such as sodium) are essential in helping athletes avoid dehydration.

Having electrolytes in a sports drink provides a number of benefits to athletes:

- **Encourages drinking** – Drinking fluids with sodium helps to trigger thirst.
- **Replaces electrolytes lost in sweat.**
- **Helps maintain fluid balance.**

Sodium is the main electrolyte lost through sweat. **It doesn't take a lot of sodium to make a sports drink work.** For example, Gatorade contains enough sodium (110mg/8oz) for you to rehydrate, yet it is classified as a low-sodium beverage by the FDA. To put it in perspective, Gatorade has less sodium than an equivalent serving of milk or a slice of bread.

- Sports drinks should be formulated to replace the small amount of potassium (30mg/8oz) that is also lost through sweat.

The Fluid Formula: Flavor and Temperature



- Flavor
 - Research shows drinks that are lightly sweetened and lightly flavored taste better so athletes drink more and avoid dehydration
- Cool temperature (50-59°F)

Passe et al. *Med Sci Sports Exerc* 1999

- **Research shows that athletes prefer a beverage that is lightly sweetened and lightly flavored when they exercise or get hot and thirsty.**
- The carbohydrate, sodium and flavoring in sports drinks all encourage drinking and help athletes to avoid dehydration.
- **How cold the beverage is also influences how much you'll drink.** While individual preferences exist, a range in cool temperature of 50-59°F is recommended.

What a Sports Drink Should NOT Have



- More than 8% carb concentration
- Caffeine
- Carbonation
- Amino acids
- Vitamins
- Oxygenation
- Herbs

Davis et al. *Int J Sports Med* 1999
 Gonzalez-Alonzo et al. *Int J Sports Med* 1992
 Maughan and Murray. *Sports Drinks*, 2001
 Murray et al. *Int J Sport Nutr* 1999
 Vahedi et al. *J Neurology, Neurosurgery, and Psychiatry* 2000

Myerscough *Aust Fam Physician* 1998
 Passe et al. *Int J Sport Nutr* 1997
 Ploutz-Snyder et al. *Eur J Appl Physiol* 1999
 Ryan et al. *J Appl Physiol* 1998

- Beverages with carbohydrate level of more than 8% slow fluid absorption. **Gatorade has a 6% carbohydrate solution (14g/8oz) which is a science-based formulation to speed hydration and deliver energy during exercise.**

Caffeinated beverages (such as colas, coffee, tea, and some energy drinks) are not recommended before, during or after sport activity. **Caffeine is not a nutrient and may irritate the gut. It can also act as a mild diuretic increasing fluid loss, which will impair rehydration efforts.** Almost all sports drinks are caffeine-free.

- **Carbonation can discourage you from drinking enough fluids due to throat burn. Also carbonation can cause a bloated feeling of fullness or stomach upset.**
- **Research shows there are no immediate performance benefits during exercise from including amino acids (the building blocks of protein) in a sports drink.**
- **No scientific data exist that show an immediate benefit to the body from adding vitamins to a sports drink.**
- Some drinks promise extra oxygen in their products. **Oxygen used by muscles is absorbed through the lungs, not by way of the digestive system.** That's why an athlete will not benefit from drinks supplemented with additional oxygen.
- **There have been no conclusive research studies showing performance benefits during exercise from herbs such as guarana. Some studies suggest these herbs may have bad side effects.** Experts question the safety and benefits of other herbal additives such as guarana.

Fluids That Don't Cut It During Exercise



- Plain water
- Fruit juice
- Energy drinks

There are fluids that don't cut it during exercise and recovery.

- **Plain water is often not enough.** Water is good, if that's all that is available, but research shows that during exercise, sports drinks are better for maintaining hydration than drinking water alone.
- **Fruit juice has a high carbohydrate and low sodium content.** Beverages with too much carbohydrate, particularly those with a high amount of fructose or fruit sugar, are absorbed more slowly. Even when fruit juices are diluted, they don't contain enough sodium to stimulate voluntary drinking or help maintain fluid balance.
- **Any drink with calories can call itself an energy drink. Most energy drinks are usually very high in carbohydrate and shouldn't be consumed prior to or during exercise.** Some may also contain herbs or other stimulants that do not enhance hydration and may be linked to serious side effects.
- Sports drinks were developed specifically for the purpose of rehydrating athletes before, during and after exercise.