PHYSICAL THERAPY EVALUATION OF THE ADOLESCENT DANCER

Erin Fifrick, PT, DPT, SCS, CSCS

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FINANCIAL DISCLOSURES

- No relevant financial interests or relationships to disclose

OBJECTIVES

- Discuss clinically relevant information about ballet, Irish dance, and competitive dance
- Understand physical demands on dancers' bodies
- Identify common injuries within each dance form
- Review key components of a physical therapy evaluation specific to dancers
- Provide resources to guide the effective evaluation of a dancer

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BALLET

Fundamental Information

- Performance dance
- Highly technical
- Terminology based in French language

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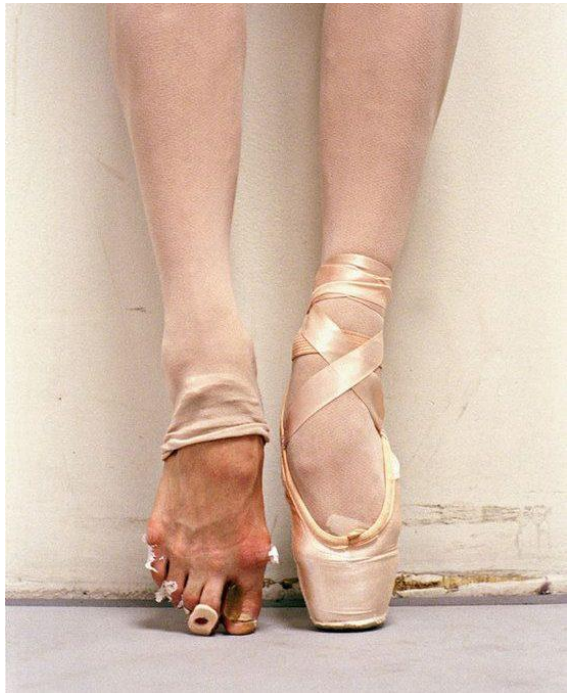
BALLET

Fundamental Information

- Equipment
  - Ballet shoe
    - Flat sole
    - Leather or canvas
  - Pointe shoe
    - Satin and leather
    - Toe box: layers of material held together with strong glue
    - Toe spacers



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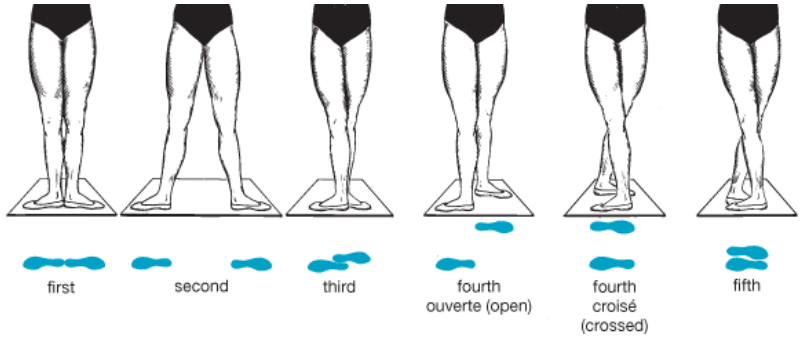
Images: https://www.huffpost.com/entry/what-ballet-dancers-wear-to-work_l_5db9e7a5e4b066da552b7126, https://www.google.com/url?sa=i&url=https%3A%2F%2Fmybeginnerpointe.com%2Ftop-tip-16-relieving-pain-after-pointe-work%2F&psig=AOvVaw3svGhV8sy7dtnu6qDOEkbo&ust=1666885102107000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCMCl3ZGd_voCFQAAAAAdAAAAABAF

BALLET

Functional Demands

- Range of motion requirements
  - Hip
    - External rotation (turnout)
      - Longitudinal axes of feet rotated 180° away from each other
      - Rotation should primarily come from hip joints
      - Minimum requirements to achieve ideal turnout:
        - 70° hip external rotation bilaterally
        - 5° tibial external rotation bilaterally
        - 15° foot external rotation bilaterally



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BALLET

Functional Demands

- Range of motion requirements
  - Hip
    - Extension: 10-20° without lumbar compensation
    - Hamstring flexibility: 110° measured as hip flexion with knee extended

Image: https://i.pinimg.com/736x/9b/67/c8/9b67c8920ed4de580d6d94bd709fd705.jpg

BALLET

Functional Demands

- Range of motion requirements
  - Ankle
    - Plantarflexion: 90° measured as ankle + midfoot motion
  - Foot
    - Great toe MTP extension: ≥ 90°
    - FHL length: ≥ 20° measured in long sit as passive great toe extension with maximum ankle DF

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BALLET

Strength Demands

- Trunk stabilizers for upright posture
- Hip external rotators for turnout
  - Gluteus maximus
  - 6 deep rotators: obturator internus and externus, superior and inferior gemelli, quadratus femoris, piriformis
- Psoas as primary hip flexor, spinal stabilizer, and small ER moment arm throughout ROM
- Tensor fascia latae as secondary hip flexor
- Gluteus medius for femoral head stability and pelvic stability
- Hip adductors for postural control and neutral pelvis

BALLET

Injury Epidemiology

- Population: pre-professional ballet dancers, 773 female and 383 male with a mean age of 15.9 years
- Majority of injuries occur in the lower extremity (69-91%)
  - Foot and toes most common site (reported range: 13.1-33%)
  - Hip (7.1-30%)
  - Ankle (8.4-50%)
  - Knee (7-22%)
- Most common injury type: sprains, strains, and overuse injuries such as tendinopathies
- Stress fractures and ankle impingement also commonly reported

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BALLET

Injury Risk Factors

- Elite dancers:
  - Poor lumbopelvic control
  - Inappropriate transversus abdominis contraction
  - Decreased lower extremity strength
  - Poor aerobic fitness
- Recreational dancers:
  - Hip hypermobility
  - Ankle hypermobility
  - Longer training hours
  - Rate of growth associated with increased risk lumbar and lower extremity injury in young ballet dancers
- Poor alignment identified as risk factor for both elite and recreational ballet dancers

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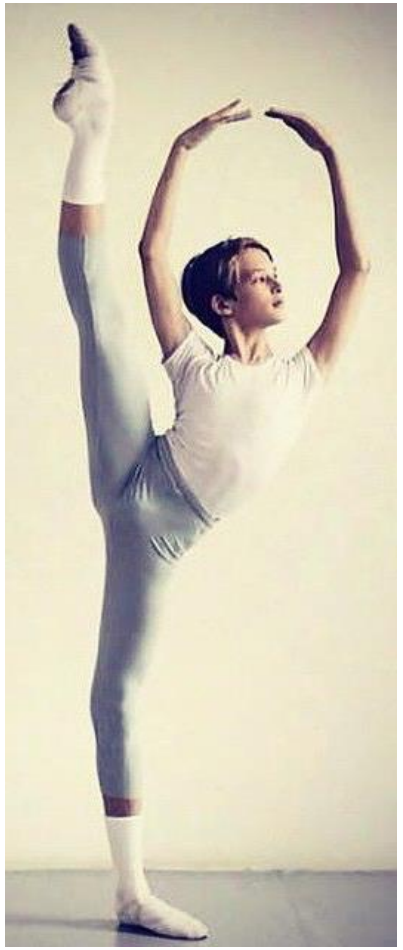
BALLET

Physical Therapy Evaluation

- Subjective
  - Styles of dance
  - Years dancing
  - En pointe?
  - Menstrual status
  - Training hours
  - Leg dominance (leaps, pirouettes)
  - Aggravating dance movements
  - Outcome measures
    - Dance Functional Outcome Survey



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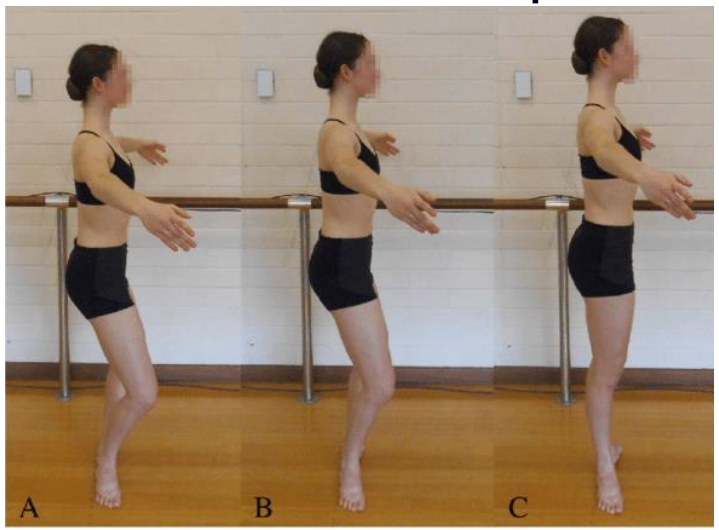
BALLET

Physical Therapy Evaluation

- Objective
  - Posture
    - Assess in turnout (1st position)
    - Note lumbar lordosis and anterior pelvic tilt, genu recurvatum, hallux valgus
  - Squat assessment: demi plié



Images: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.researchgate.net%2Ffigure%2FSagittal-view-of-a-dancer-purposely-demonstrating-forced-turnout-in-first-position_fig1_330862764&psig=AOvVaw23yfr_CJzEr5_xslCc3Or5&ust=1666886437994000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCOjYgYei_voCFQAAAAAdAAAAABAD, https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.energetiksblog.com.au%2Fblog%2F2017%2F6%2F7%2Fdance-advice-the-art-of-

BALLET

Physical Therapy Evaluation

- Objective
  - Flexibility
    - Measure whole leg passive and active turnout
    - Hypermobility: Beighton Scale
      - Total score ≥4/9 for post-pubertal and ≥6/9 for pre-pubertal adolescents indicates general joint hypermobility
  - Strength
    - Plantarflexors
    - Iliopsoas
  - (+/-) Pointe readiness assessment

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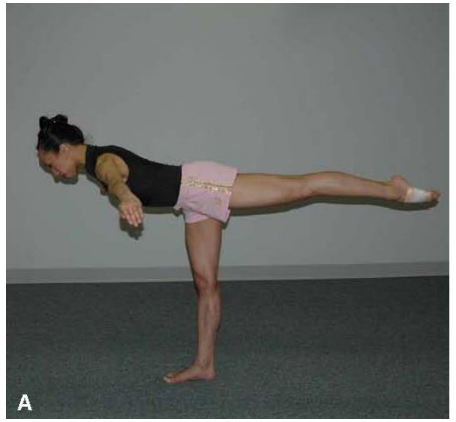
Physical Therapy Evaluation

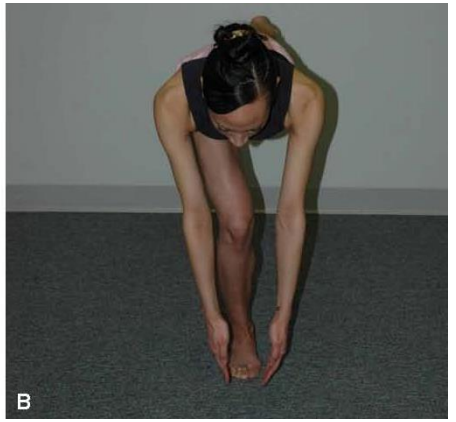
- Pointe readiness
  - Many dancers cite age 12 as age they began pointe work, although many still skeletally immature at this age
  - Consensus that dancers need minimum of 3-4 years of ballet training prior to pointe work
  - Functional tests may be better indicator of readiness than time or physical development
  - Cognitive/psychological considerations

BALLET

Physical Therapy Evaluation

- Pointe readiness assessment
  - Pass/fail tests





1. 20 SL heel raises to max height
2. Bench step-down: 4/5 times with good form
3. Topple test (single pirouette): controlled, decelerated landing
4. SL balance with arms crossed and eyes closed x30 sec
5. Passé-relevé balance test with good form
6. SL saute: 8/16 jumps with arms crossed
7. Airplane test (SL RDL with toe touch): 4/5 times with good form
8. Pencil test: no gap over ankle
9. DL lower test: no anterior pelvic tilt before 45° LE angle

Image: https://www.google.com/url?sa=i&url=https%3A%2F%2Fcpdfordanceteachers.com%2F2015%2F04%2F09%2Fpointe-readiness%2F&psig=AOvVaw2NX1pWyTi_RRS9J1lj3_Cc&ust=1666886929703000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCKD3hfGj_voCFQAAAAAdAAAAABAD

IRISH DANCE

Fundamental Information

- Primarily competitive dance with several performances yearly
- High impact
- No upper body movement except in team dancing
- Dances are performed in soft and hard shoes
- Must dance in turnout position but otherwise unlike ballet
- Year-round with major competitions Thanksgiving weekend, 4th of July weekend, and in March

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IRISH DANCE

Fundamental Information

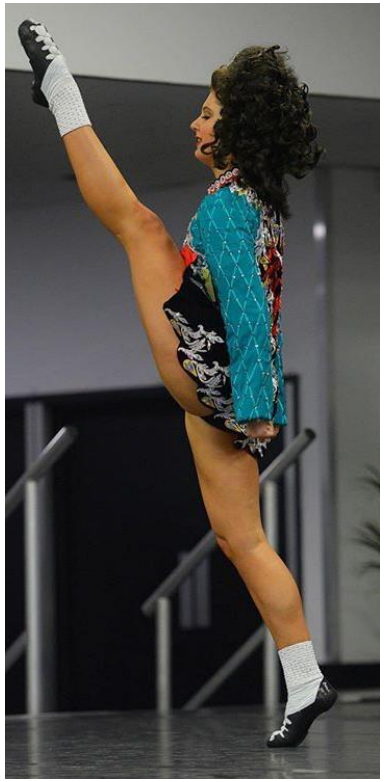
- Equipment
  - Soft shoe
    - Female soft shoe
      - Also known as “ghillies”
      - Leather
    - Male soft shoe
      - Also known as “reel shoe”
      - Leather with fiberglass heel
    - Hard shoe
      - Leather with fiberglass toe and heel
      - Allow dancers to go up on toes

Images: https://www.google.com/url?sa=i&url=https%3A%2F%2Fboynewalk.ie%2Firish-dance-pumps-soft-shoes%2F&psig=AOvVaw0JbuhxynNaHbgDFGqRA8ER&ust=1666917427103000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCPDtwruV__oCFQAAAAAdAAAAABAH, https://www.google.com/url?sa=i&url=https%3A%2F%2Fus.movedancewear.com%2Fdance-shoes%2Firish-dancing-shoes%2F&psig=AOvVaw0JbuhxynNaHbgDFGqRA8ER&ust=1666917427103000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCPDtwruV__oCFQAAAAAdAAAAABAR, https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.antoniopacelli.com%2Firish-dance-shop%2Fproduct-detail%2Fcapezio-reel-with-concorde-heel&psig=AOvVaw2Ro46DnWXSeOOHmlk7gbo2&ust=1666917692837000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCJiuv7qW__oCFQAAAAAdAAAAABAG

IRISH DANCE

Functional Demands

- Range of motion requirements
  - Hip
    - Hamstring flexibility: 110° measured as hip flexion with knee extended
    - External rotation (turnout): ideal is defined as longitudinal axes of feet rotated 180° away from each other, as in ballet



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IRISH DANCE

Functional Demands

- Range of motion requirements
  - Ankle
    - Plantarflexion: 90° measured as ankle + midfoot motion
    - Eversion: no specific number identified in the literature at this time

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IRISH DANCE

Functional Demands

- Strength requirements
  - Lower extremity power
    - Triple extension
  - Plantar flexor strength and endurance
  - Spinal extensor and anti-rotator strength

Image: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DEj9OlLgUU70&psig=AOvVaw12a_zWOo4HNYcj2s6ix_Hw&ust=1666918982156000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCPiMt6Cb__oCFQAAAAAdAAAAABAN

IRISH DANCE

Injury Epidemiology

- Population: 95% (243/255) Irish dancers under the age of 19
- 80% of the injuries due to overuse and 20.4% acute and traumatic injuries
- 95.9% of injuries involved the hip or lower extremity:
  - Foot (33.2%)
  - Ankle (22.7%)
  - Knee (19.7%)
  - Hip (14.4%)
- Typical diagnoses:
  - Tendon injury (13.3%)
  - Apophysitis (11.4%)
  - Patellofemoral pain and instability (10.8%)
  - Stress injury (10.1%)
  - Muscle injury (7.8%)

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IRISH DANCE

Injury Epidemiology

- Population: 69 female Irish dancers, age 8-23 sustained 217 injuries over 7 years
- Majority of injuries to lower extremity (94.9%), remaining to lumbosacral spine and pelvis (5.1%)
- Top injuries:
  - Stress fractures (29.9%)
    - Most common location: sesamoids (27.7% of all stress injuries)
  - PFPS (11.1%)
  - Sever's apophysitis (6.0%)
  - Ankle sprains (5.1%)
  - Posterior tibialis tendonitis (4.6%)
  - Plantar fasciitis (4.6%)

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IRISH DANCE

Physical Therapy Evaluation

- Subjective
  - Styles of dance
    - Solos (+/-) teams
    - Dances performing in competitions
  - Years dancing
  - Go up on toes?
  - Menstrual status
  - Training hours
  - Leg dominance (jumps)
  - Aggravating movements
  - Outcome measures
    - Recommend your lower extremity survey of choice

Image: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.ticketmaster.com%2Ftrinity-irish-dance-company-tickets%2Fartist%2F804468&psig=AOvVaw2mQAi35dqK26XJgZQxFlZ3&ust=1666923550793000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCKDVtaWs__oCFQAAAAAdAAAAABAD

Physical Therapy Evaluation

- Objective
  - Posture
    - Assess in turnout
    - Note lumbar lordosis and anterior pelvic tilt, genu recurvatum, hallux valgus
  - Squat assessment: single leg
  - Hop assessment: single leg (20x)
  - Flexibility
    - Measure whole leg passive and active turnout
    - Hypermobility: Beighton Scale

IRISH DANCE

Physical Therapy Evaluation

- Objective
  - Strength
    - Plantarflexors
    - Iliopsoas
    - Hip abductors
    - Spinal extensors

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COMPETITIVE DANCE

Fundamental Information

- Genres include: pom, jazz, lyrical, contemporary, hip hop, kick, ballet, acro, tap
- Competitive dancers almost always train and compete a variety of dance styles (3+), by default are not trained as comprehensively in technique especially in ballet and acro
- Dancer's background may influence his/her choreography
- Year-round with major competitions in January through May

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COMPETITIVE DANCE

Fundamental Information

- Equipment
  - Jazz shoes
  - Lyrical shoes – designed to provide padding to ball of foot with heel exposed
  - Hip hip: tennis shoes
  - Ankle weights, dumbbells

Images:
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https://www.google.com/url?sa=i&url=https%3A%2F%2Fus.movedancewear.com%2Fdance-shoes%2Fcontemporary-

COMPETITIVE DANCE

Injury Epidemiology

- Contemporary
  - Population: 130 collegiate dancers
  - Ankle/foot (30%), lower back (15%) and knee (14%) most commonly involved
  - Other studies discuss pre-professional dancers with similar incidence of injuries reported

Image: https://www.google.com/url?sa=i&url=http%3A%2F%2F8tracks.com%2Fexplore%2Fmodern_dance&psig=AOvVaw3Vw5bXLLyOqXs4AgbX96Iz&ust=1666920376071000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCPj21MGg__oCFQAAAAAdAAAAABAu

COMPETITIVE DANCE

Injury Epidemiology

- Hip hop
  - Population: 232 hip hop dancers (breakers, pop/lockers, new schoolers) over age 13
  - 52% of injuries involved LE, 32% UE
  - Breakers have higher rates of injury
  - Overuse is most common MOI, followed by landing (42%), twisting (36%), and slipping (31%)

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Image: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.momjunction.com%2Farticles%2Fbest-rap-hip-hop-songs-for-kids_00788928%2F&psig=AOvVaw3zGMKPh1fet-W5ucBoduhe&ust=1666920813736000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCPCziJKi__oCFQAAAAAdAAAAABAI

COMPETITIVE DANCE

Injury Epidemiology

- Clinically we see:
  - Ischial tuberosity/ASIS/AIIS apophysitis or avulsion fracture
  - Iselin's disease
  - Sever's disease
  - Labral pathology
  - Spondylolysis, spondylolisthesis
  - Glenohumeral instability

COMPETITIVE DANCE

Physical Therapy Evaluation

- Subjective
  - Styles of dance
  - Years dancing
  - En pointe?
  - Do you tumble/do acro?
  - Menstrual status
  - Training hours
  - Leg dominance (jumps, turns)
  - Aggravating movements
  - Outcome measures
    - Recommend your lower extremity survey of choice

Image: https://www.google.com/url?sa=i&url=https%3A%2F%2Fstudio65dancecompany.com%2Fclasses%2Fjazz-level-56%2F&psig=AOvVaw3-yU9J0_98cHNP8IgkTtRO&ust=1666921359004000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCMDh3Zak__oCFQAAAAAdAAAAABAJ

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- Objective
  - Posture
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  - Squat assessment: single leg
  - Hop assessment: single leg (20x)
  - Flexibility
    - Measure whole leg passive and active turnout
    - Spinal mobility
    - Hypermobility: Beighton Scale

COMPETITIVE DANCE

Physical Therapy Evaluation

- Objective
  - Strength
    - Plantarflexors
    - Iliopsoas
    - Core
    - Shoulder stabilizers

Image: https://www.google.com/url?sa=i&url=https%3A%2F%2Fthedancebuzz.com%2F2012%2F01%2F23%2Flove-playlist-for-lyrical-contemporary-class%2F&psig=AOvVaw3jdGGiU3HPqo9oOuvUhPHF&ust=1666921534496000&source=images&cd=vfe&ved=0CAwQjRxqFwoTCNjPjumk__oCFQAAAAAdAAAAABAS

CLINICAL PEARLS

- PT involvement in diagnosis and treatment of young dancers' injuries results in timely intervention and reduces missed time from dance
- Dancers sincerely appreciate those who demonstrate knowledge of and respect their sport
- Ballet and Irish dance teachers generally more flexible and understanding regarding return from injury recommendations; competitive dance instructors are more rigid and often have an all or nothing policy
- Dancers, their parents, and their instructors benefit greatly from confident delivery of specific participation guidelines
- Limited participation in dance can be very challenging from an emotional perspective

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RESOURCES

- Ballet dictionary can be found at: https://www.abt.org/explore/learn/ballet-dictionary/
- APTA Independent Study Course
  - Dance Medicine: Strategies for the Prevention and Care of Injuries to Dancers

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Performance-Enhancing Substance Use in the Young Athlete

Shayne D. Fehr, MD, FAAP, CAQSM
Associate Professor, Medical College of Wisconsin

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Disclosures

- I, Shayne Fehr, have no financial relationships with the manufacturer(s) of any commercial product(s) and/or provider(s) of commercial services discussed in this CME activity.

Objectives

- Review background of performance-enhancing substances
- Examine prevalence of PES use in the pediatric population
- Identify common substances and supplements, their claimed enhancements and side-effects

Performance-Enhancing Substances (PESs)

- "…the spectrum of dietary supplements, as well as legal and illegal drugs that often are used by athletes for the purpose of improving athletic performance." LaBotz, AAP 2016
  - Also should be mindful that broader definition would also include the purpose of improvement of appearance
  - Whether they work or not
  - We are not talking about PEZ®

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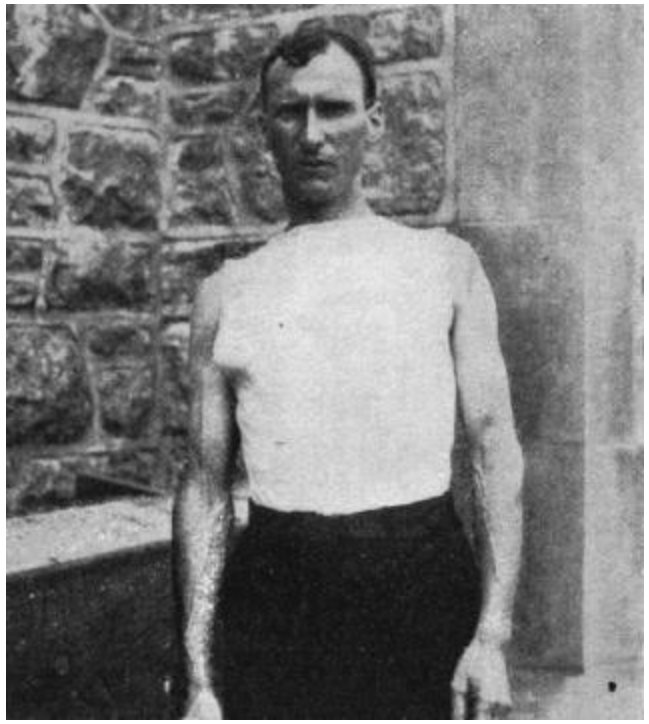
PES History

- PES use as old as sports
- Ancient Olympians used wines, herbal teas and mushrooms
- Dop = Dutch colonists' word for drink used by Zulu warriors to enhance prowess in battle
- 1904: Olympic Marathon
  - Winner Thomas Hicks used Strychnine & Brandy



https://en.wikipedia.org/wiki/Thomas_Hicks_(athlete)

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Background

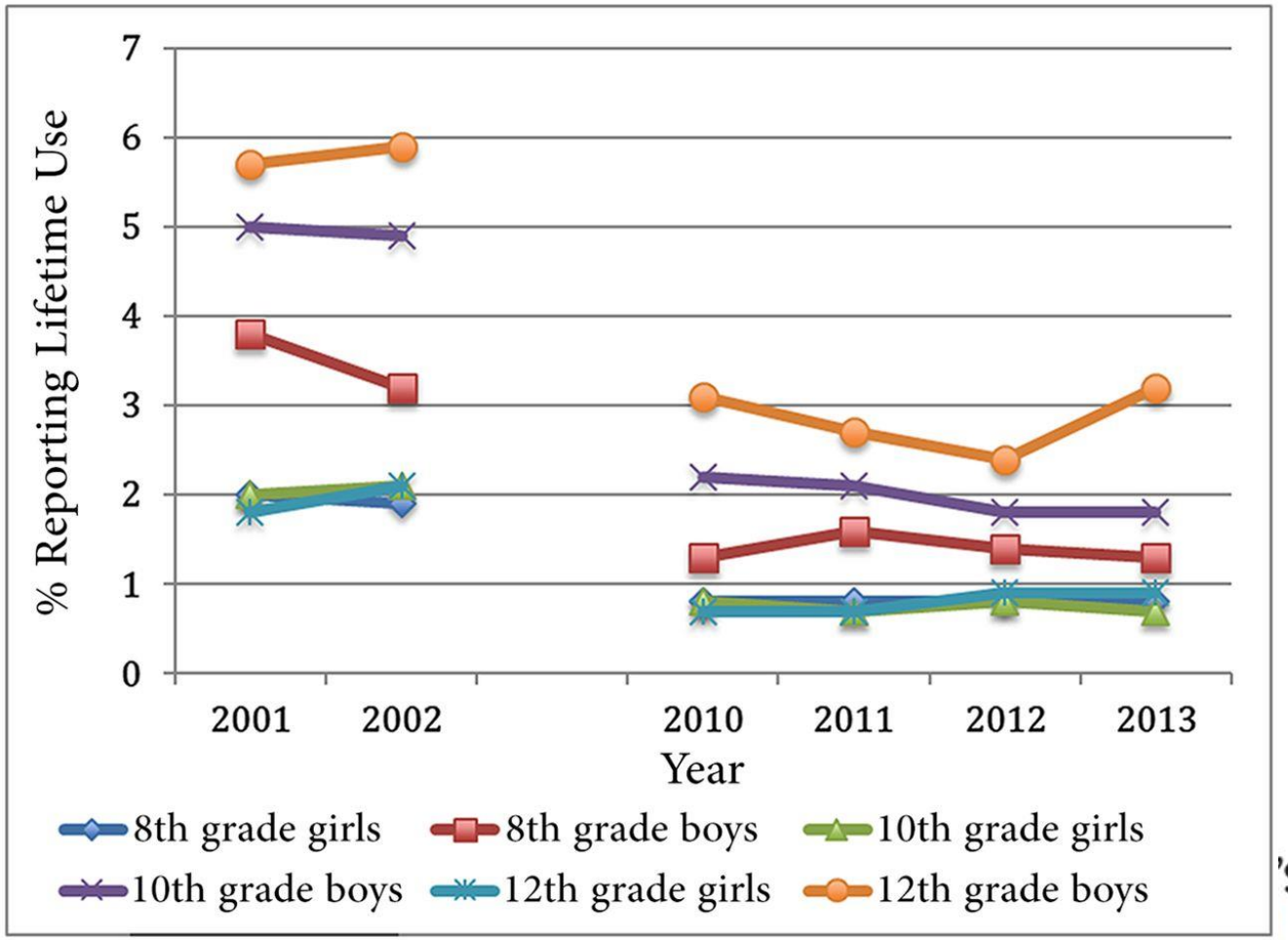
- Sports are a big business, lucrative endorsement contracts given to the successful
  - Fame and money are motivators
- PESs huge problem in pro, collegiate, and amateur sports
- Detection rate is lower than actual use
- Availability of PESs has increased over the past 2 decades
  - Internet
  - Proliferation
  - Marketing (especially energy drinks)

Anabolic Steroid Use in Adolescents

- Organized youth sport has grown dramatically, as have pressures to perform

TAYLOR HOOTON FOUNDATION

Percentage of eighth, 10th, and 12th graders reporting any lifetime use of anabolic androgenic steroids by year and sex (data from MTF, 2014).[5]



Pediatrics. 2016;138(1). doi:10.1542/peds.2016-1300

Supplement Use

- Reeder et al., 2002
  - 20% high school students use a nutritional supplement
  - Most common reason to use is to increase strength
  - Sport participation does not influence use
- Wiens et al., 2014
  - Canadian athletes ages 11-25
  - 98% used a supplement
  - 11-17 year olds taking vitamins and minerals mainly
- Cuff and LaBotz, 2020
  - Approximately 1/3 of all youth use creatine, protein powders, or dietary supplements, higher in athletes and college students

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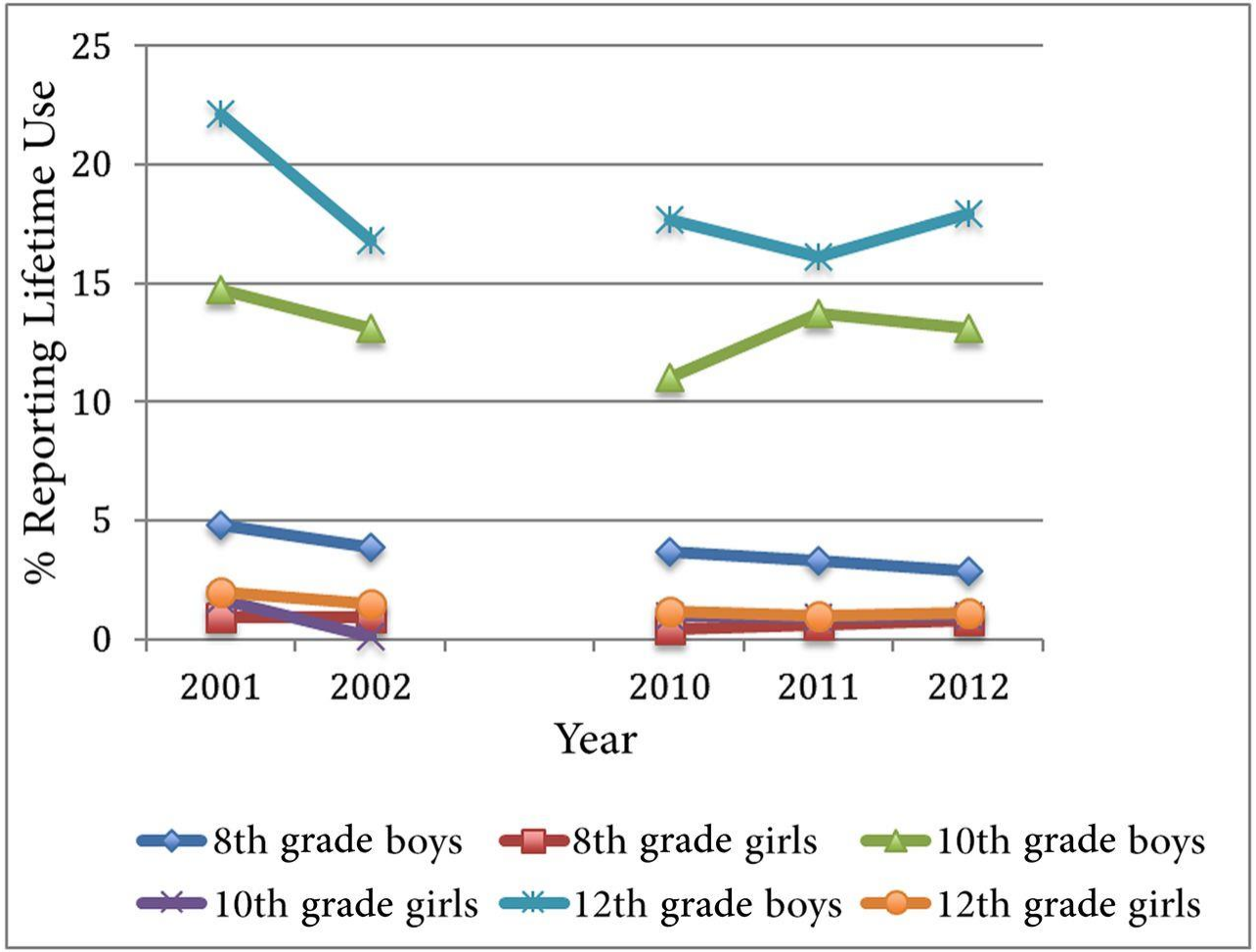
Creatine Use in Adolescents

- Creatine use had been stable…
- Recent data from Monitoring the Future (MTF) annual survey of 50,000 students in eighth, 10th, and 12th grade, shows an uptick in use, especially in 8th graders!
- https://monitoringthefuture.org/data/Prevalence2021/Creatine.htm

Percentage of eighth, 10th, and 12th graders reporting any lifetime use of creatine by year and sex (data from MTF, 2014).[5]



Pediatrics. 2016;138(1). doi:10.1542/peds.2016-1300

IOC & WADA

- 1999: IOC convened World Conference on Doping & Sport
  - Created World Anti-Doping Agency (WADA) to develop standards & world-wide control program
  - Countries also have own anti-doping agency (e.g., USADA)

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Banned Substances (WADA)

- “Any pharmacological substance which is not addressed by any of the subsequent sections of the List and with no current approval by any governmental regulatory health authority for human therapeutic use (e.g drugs under pre-clinical or clinical development or discontinued, designer drugs, substances approved only for veterinary use) is prohibited at all times.”

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2023 WADA Banned at All Times

Anabolic-Androgenic Steroids (AAS)

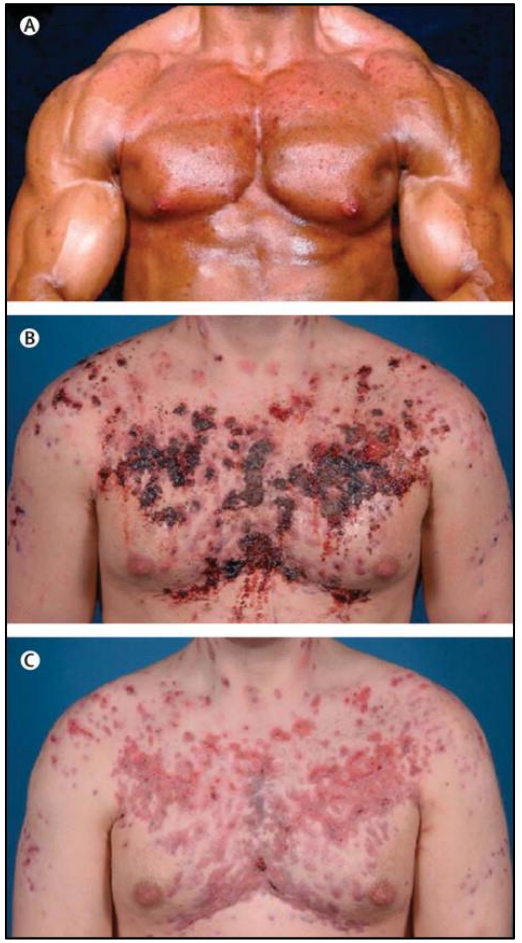
- Endogenous & exogenous
- Create testosterone or mimic testosterone's effects
  - Anabolic (increase protein synthesis)
  - Androgenic (develop male 2° sex characteristics)
- Dose-dependent increase in muscle mass, strength & power
  - Increase muscle protein synthesis (hypertrophy)
  - Directs pluripotent mesenchymal stem cells toward myogenic lines (instead of adipose)
- Augments RBC mass via increased EPO from kidney
- Anti-catabolic effect of attenuating cortisol
- BUT, androgens are converted to estrogen via aromatase enzyme in peripheral tissues
  - <1% of T is aromatized to Estradiol but has 100x potency
  - Leads to effects of estrogen (water retention, gynecomastia)
- Effects of dihydroT (acne, prostate enlargement, hair loss)

Other Anabolic agents

- Selective androgen receptor modulators (SARMs)
- Clenbuterol: Bronchodilator with stimulant and thermogenic effects on aerobic capacity, and fat metabolism
- Zeranol: Non-steroidal estrogenic growth stimulant that is used in veterinary medicine to promote cell growth and division, resulting in growth of muscle tissue

Physical Side effects of AAS

- Acne, increased body hair, baldness, HTN, atherosclerosis, cardiac hypertrophy/fibrosis, tendon rupture, decreased fertility, liver changes/cysts/tumors
  - Life threatening: MI, ruptured hepatic cyst, hepatic carcinoma
- Prolonged use blocks ability to naturally produce T, leaving significant **withdrawal effects**
- Youths: irreversible, premature closure of epiphyses
- Males: testicular atrophy, low and abnormal sperm, prostate hypertrophy
- Females: loss of breast tissue, masculinization



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Psychological Side Effects

- Aggression (‘roid rage), hostility, violence, paranoia
  - Associated with EtOH intoxication
  - Increased incidence of personality disorders
- Hypomania and mania 6-23%
  - Increased rate with >1,000 mg/week
- Major depression 6-22% on withdrawal
- Opiate like withdrawal and dependence
- Suicidality

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Banned Substances

- Peptide hormones, growth factors, related substances, and mimetics
  - Erthryopoietin receptor agonists
  - Growth hormone and its releasing factors, insulin-like growth factors, mechano growth factors
  - Hypoxia-inducible factor (HIF) stabilizers
  - Gonadotrophins (LH, hCG) in males
  - Corticotrophins
- Beta-2 agonists:
  - Oral agents below are prohibited, inhalers need a TUE
  - Arformoterol • Fenoterol • Formoterol • Higenamine • Indacaterol • Levosalbutamol • Olodaterol • Procaterol • Reproterol • Salbutamol • Salmeterol • Terbutaline • Tretoquinol (trimetoquinol) • Tulobuterol • Vilanterol

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Peptide Hormones

- HGH: Human Growth Hormone
  - Stimulates growth, cell reproduction and regeneration
  - Side effects: acromegaly, water retention, HA, arthralgias & myalgias, carpal tunnel, ?colon and prostate tumors
- IGF-I: Insulin-like Growth Factor I/Mechano Growth Factor
  - Stimulates protein synthesis
  - Side effects: hypoglycemia, decreased HGH, potential prostate / colon / lung ca association
- EPO: Erythropoietin
  - Stimulates production of red blood cells in bone marrow, increases VO2max
  - Side effects include HTN, red cell aplasia, thrombosis, heart failure
- hCG: Human Chorionic Gonadotropin:
  - Hormone produced in early pregnancy
  - hCG In males mimics Luteinizing hormone (stimulates Leydig cells in testes to produce T)
    - Commonly used at end of steroid cycle (subnormal androgen level due to steroid-induced suppression)

Banned Substances

- Hormone and metabolic modulators
  - Aromatase inhibitors (Arimidex, Femara)
  - Anti-estrogens such as clomiphene and selective estrogen receptor modulators (SERMS) such as tamoxifen
  - Agents preventing activin receptor IIB activation
  - Use of anti-E drugs helps combat effects of estrogen effects with high dose AAS
- Metabolic modulators
  - Activators of the AMP-activated protein kinase, e.g. AICAR; and Peroxisome Proliferator Activated Receptor
  - Insulin

Banned Substances

- Diuretics & masking Agents
  - Diuretics (dilutes urine, cuts weight)
    - Acetazolamide, furosemide, HCTZ, triamterene
  - Masking agents (complicate detection)
    - Probenecid
  - Plasma expanders (Mask EPO use by diluting Hct)
    - Glycerol, albumin, mannitol

Prohibited Methods

- Manipulation of blood and blood components
- Chemical and physical manipulation
- Gene and cell doping

2023 Banned in Competition

Banned Substances

- Stimulants
  - Amphetamines, cocaine, ephedrine, pseudoephedrine, etc. (caffeine, buproprion, phenylephrine are not prohibited)
    - Improve alertness and mental performance
    - Decreased body fat
    - Side effects: Irregular heart rate, elevated BP, dizziness, headache, heart attack, stroke, seizure, psychosis
- Narcotics
- Cannabinoids
- Glucocorticoids– prohibited PO, PR, IM, IV
  - Declaration of Use required for intra-articular, peri-tendinous, epidural, intradermal. Topical allowed.
- Alcohol: shooting, archery, bowling, etc.
- Beta-Blockers: Shooting, golf, gymnastics, etc.

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Therapeutic Use Exemptions

- TUE: approval for athlete to use medication normally prohibited in the sport
  - Must be requested prior to competition
  - Retroactive approval only for emergency treatment of acute condition
  - Must have documented need and would experience serious adverse consequences if not allowed
  - Must be no reasonable alternatives
  - Does not allow use to enhance performance

Drug Testing

- Increasingly complex in collegiate, Olympic, and elite/professional sports

- High School
  - Rate of positive tests has never exceeded 1 percent
  - Random drug testing has not been shown to be an effective deterrent
  - State-dependent approach. Wisconsin does not recommend any specific drug testing

Supplements

Supplements are okay, right?

- Products can go on the market with no testing of efficacy and without FDAs knowledge
- Companies do not have to prove that their products are safe
- Supplements do not have to be manufactured according to any standards

User Beware

- National Athletic Trainer's Association Statement 2013
  - The dietary supplement industry is **poorly regulated** and takes in billions of dollars per year.
  - Proper **nutrition** and changes in the athlete's habitual diet should be considered **first** when improved performance is the goal.
  - Athletes need to understand the level of **regulation** (or **lack** thereof) governing the dietary supplement industry at the international, federal, state, and individual sport-participation levels.
  - Athletes should **not assume** a product is **safe** simply because it is marketed over the counter.
  - All products athletes are considering using should be evaluated for **purity** (ie, truth in labeling), **safety**, and **efficacy.**

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Potential Risks

- Effects of the substances themselves (especially concerning in youth considering the lack of safety studies)
- Contamination
- Poor packaging information leading to improper use
- Unknown toxicities
- Complete waste of money

Make Sure It Is Certified!

- NSF (National Sanitation Foundation) Certified for Sport®
  - Website: https://www.nsfsport.com/ and app
  - Recommended by the USADA
- Informed Sport
  - Website: https://sport.wetestyoutrust.com/ and app

Common Effective Supplements

Supplement	Postulated effect	Evidence of effectiveness	Adverse effects	Legal status
Caffeine	Decrease fatigue, increase aerobic capacity, enhance fat metabolism	Effective	Jitteriness, nervousness, headaches, difficulty concentrating or sleeping increased heart rate or blood pressure	Prohibited by NCAA [urine] >15 mcg/mL
Creatine	Increase muscle mass, ATP re-synthesis for short burst	Effective	Minimal Weight gain, GI upset, Muscle cramping?	Legal
CHO-electrolytes	Increase endurance	Effective	None	Legal
Protein-CHO recovery drinks	Speed recovery, increase lean mass	Effective	None	Legal

Caffeine Content

Name	Caffeine (mg) / 8 oz cup
Coke, Diet, Mt Dew	30
Jolt Cola	73
Red Bull	80
Rockstar	80
Coffee (drip)	145
Starbucks Grande Coffee	186
Redline RTD	250
Cocaine Energy Drink	280

To have urine >15 mcg/mL, need to take in >9mg/kg body weight within 3 hrs of testing. Thus, in an 80 kg (180 lb) athlete would require more than >720 mg:

- 9 Red Bulls, or
- 3 Cocaine Energy, or
- 2 Starbucks Grande (16oz)

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AAP Report on Energy Drinks

- Understand that energy drinks pose potential health risks primarily because of stimulant content; therefore, they are not appropriate for children and adolescents and should never be consumed.

WIAA Discouraged List

“Schools and coaches may not provide or allow discouraged items in connection to school’s program.”

- Creatine
- Pre-Workout Boosters (these products frequently contain discouraged or banned ingredients)
- Caffeine-enhanced products such as but not limited to energy drinks
- and energy shots
- AAKG, NO2, nitric oxide
- Co Enzyme Q
- HMB
- Pyruvate
- CLA (conjugated linoleic acid)
- Chromium Picolinate
- Amino Acids
- Amino acid derivatives such as L-Carnitine
- Protein Powders

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WIAA Permissible List

- Sport Drinks
- Fitness Water
- Electrolyte Drinks
- Sport Gels
- Meal Replacement Drinks
- Meal Replacement Bars
- Vitamins/Minerals

Summary Points from 2016 AAP Report

- PES use is common in adolescence, and these substances are used in attempts to enhance both physical performance and appearance.

- Throughout adolescence, use of all PESs tends to increase with age and is higher in athletes than in nonathletes.

LaBotz et al. Pediatrics 2016

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Summary Points

- Boys are at higher risk than girls for most PES use. Other risk factors for PES use include body dissatisfaction, higher BMI, training in a commercial gym, exposure to appearance-oriented fitness media, use of alcohol or drugs, and other risk-taking behaviors.

Summary Points

- PESs most commonly used by adolescents are protein supplements, creatine, and caffeine.

- Many PESs are sold over the counter as dietary supplements. Athletes and parents often are unaware of the lack of FDA oversight of supplements and the risk of contamination with prohibited substances or absent active ingredients in these products.

Summary Points

- Onset of endogenous hormone secretion during puberty, in combination with appropriate training techniques, is associated with large gains in strength and overall athletic performance. This is particularly true after the onset of peak height velocity. For most adolescent athletes, PES use will not produce significant improvements above those attained with adherence to appropriate nutrition and training fundamentals during this time.

Summary Points

- It can be difficult to keep pace with the frequent reports of newly recognized PESs. Although the majority of initial reports of PES benefit are subsequently discredited after further study, it can be helpful for pediatric health care providers to steer patients and families to reputable Web-based resources for further evaluation of PES claims.

Summary Points

- There is concern that initial use of over-the-counter PESs may be associated with increased risk of future anabolic steroid use and other risk-taking behaviors. Younger PES users appear to be at greater risk of polypharmacy.

Approach with Young Athletes

- Maintain an open dialogue
- Understand the motives behind the use of PES
- Discuss what is known and not known about these substances, adverse effects and dangers
- Drug testing alone is not proven to be a deterrent
- Promote balanced meals, good nutrition, and training
- Discuss safe alternatives

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Take Home

- Performance-enhancers are being commonly used in young athletes
- Some substances have known severe side effects and are dangerous
  - Watch out for psychological issues with steroid/hormone drugs
- Some substances are poorly regulated with little data, so may be unsafe
- Keep an open mind and open approach with patients

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