Contamination of Dietary Supplements in Sports

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Contamination of Dietary Supplements in Sports

• The opinions:
  – of a Sports Physician and Exercise Physiologist,
  – of a (former) NADO member,
  – of an IF Medical and Antidoping Commission member
Why is it so important?

• Public Health Issue (General and Sports population):
  – Ephedrine (USA cases)
  – Liqiang 4 (Glyburide; FDA warning July 2005)
  – ..... 

• Sports Rules:
  – National Antidoping Agency (NADO)’s rules
  – World Antidoping Agency (WADA)
Why is it so important?

• WADA code:
  – Principle of strict liability:

  *The athlete being responsible for whatever is in his or her body irrespective to how it got there.*
High level athlete

In competition – Out of competition urine tests

Adverse analytical finding

Hearing

Sanction (warning to life ban) +/- national laws
Why to worry?


Analysis of Non-Hormonal Nutritional Supplements for Anabolic-Androgenic Steroids – Results of an International Study

Oct 2000 – Nov 2001:
- 634 non hormonal nutritional supplements
- 13 different countries
- 91.2%: stores, 8.2%: internet, 0.6%: telephone
- 46% of pro-hormone selling companies
- 54% of non prohormone selling companies
- Capsules, tablet, powder, fluids
- $[C] > 0.01 \mu g/g$
<table>
<thead>
<tr>
<th>Country</th>
<th>No. of companies</th>
<th>No. of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>105</td>
<td>408</td>
</tr>
<tr>
<td>Germany</td>
<td>31</td>
<td>59</td>
</tr>
<tr>
<td>UK</td>
<td>5</td>
<td>37</td>
</tr>
<tr>
<td>Netherlands</td>
<td>12</td>
<td>27</td>
</tr>
<tr>
<td>Italy</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>France</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Switzerland</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>Norway</td>
<td>7</td>
<td>12</td>
</tr>
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<td>10</td>
</tr>
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<td>7</td>
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<td>Denmark</td>
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<td>6</td>
</tr>
<tr>
<td>Sweden</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Austria</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Finland</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Portugal</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>215</strong></td>
<td><strong>634</strong></td>
</tr>
<tr>
<td>Ingredients</td>
<td>Ingredients</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------------</td>
<td></td>
</tr>
<tr>
<td>amino acids/(hydrolyzed) proteins</td>
<td>lysophosphatidylcholine</td>
<td></td>
</tr>
<tr>
<td>minerals</td>
<td>methylsulfonylmethane</td>
<td></td>
</tr>
<tr>
<td>herbal extracts</td>
<td>enzymes</td>
<td></td>
</tr>
<tr>
<td>vitamins</td>
<td>(N-acetyl) glucosamine (sulfate)</td>
<td></td>
</tr>
<tr>
<td>carnitine/acyetyl-L-carnitine</td>
<td>chrysin</td>
<td></td>
</tr>
<tr>
<td>creatine</td>
<td>melatonin</td>
<td></td>
</tr>
<tr>
<td>HMB</td>
<td>hemoglobin</td>
<td></td>
</tr>
<tr>
<td>pyruvate</td>
<td>inosine</td>
<td></td>
</tr>
<tr>
<td>ribose</td>
<td>NAC</td>
<td></td>
</tr>
<tr>
<td>fatty acids/oils</td>
<td>inositol</td>
<td></td>
</tr>
<tr>
<td>caffeine</td>
<td>lecithin</td>
<td></td>
</tr>
<tr>
<td>chondroitin (sulfate)</td>
<td>choline</td>
<td></td>
</tr>
</tbody>
</table>
Results

14.8% of T and Nandrolone prohormones not declared on the label
Results

Table 3 Nutritional supplements containing prohormones, in relation to the total number of supplements purchased in different countries

<table>
<thead>
<tr>
<th>Country</th>
<th>No. of products</th>
<th>No. of positives</th>
<th>Percentage of positives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>31</td>
<td>8</td>
<td>25.8%</td>
</tr>
<tr>
<td>Austria</td>
<td>22</td>
<td>5</td>
<td>22.7%</td>
</tr>
<tr>
<td>UK</td>
<td>37</td>
<td>7</td>
<td>18.9%</td>
</tr>
<tr>
<td>USA</td>
<td>240</td>
<td>45</td>
<td>18.8%</td>
</tr>
<tr>
<td>Italy</td>
<td>35</td>
<td>5</td>
<td>14.3%</td>
</tr>
<tr>
<td>Spain</td>
<td>29</td>
<td>4</td>
<td>13.8%</td>
</tr>
<tr>
<td>Germany</td>
<td>129</td>
<td>15</td>
<td>11.6%</td>
</tr>
<tr>
<td>Belgium</td>
<td>30</td>
<td>2</td>
<td>6.7%</td>
</tr>
<tr>
<td>France</td>
<td>30</td>
<td>2</td>
<td>6.7%</td>
</tr>
<tr>
<td>Norway</td>
<td>30</td>
<td>1</td>
<td>3.3%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>13</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Sweden</td>
<td>6</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Hungary</td>
<td>2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>total</td>
<td>634</td>
<td>94</td>
<td>14.8%</td>
</tr>
</tbody>
</table>
Results

Fig. 7 Number of positive supplements among products from prohormone and non-prohormone sellers.
Results

10 µg of prohormones produces adverse analytical finding

Fig. 1 Distribution of the total prohormone concentrations (µg/g) in positive samples (n = 94).
An athlete-centered view of the problem

Supplying nutritional supplements

- Industry
- Athlete
- Coach
- Physician
- Int. Fed.
- Public Authorities
- NADO
- WADA
An athlete-centered view of the problem

Relevant Information / nutritional supplements

- Athlete
- Industry
- Public Authorities
- NADO
- WADA
- Int. Fed.
- Coach
- Physician
An athlete-centered view of the problem

Regulation

Athlete

Public Authorities

Industry

NADO

WADA

Int. Fed.

Coach

Physician
Nutritional Supplements in Sports: the athlete perspective

• Commonly cited reasons for supplement use:
  – Compensation for an inadequate diet,
  – As an "insurance policy" against potential deficiencies
  – To meet abnormal demands of hard training or frequent competition
One Athlete's day

JUNE 11TH

10.10am 3g L-lysine with 30mg Vit B6
4 phosphate tablets
2 scoops protein powder
3 teaspoon acetylglutamine
3g Vit C
3 tablets detox
50 mg zinc

Drank isotonic drink whilst training

1.45pm 3g L-lysine with 30mg Vit B6
3g Vit C
3 tablets detox
50 mg zinc

11.00pm 3g L-lysine with 30mg Vit B6
3g Vit C
3 tablets detox
1 scoop protein powder
3 teaspoon acetylglutamine

Most athletes exceed the recommended doses of supplements.

This may be because:

“If one scoop is good, two scoops must be twice as good.”

Opponents are using more than the recommended dose.
Nutritional Supplements in Sports: the Athlete’s perspective

- Commonly cited reasons for supplement use:
  - Compensation for an inadequate diet,
  - As an "insurance policy" against potential deficiencies
  - To meet abnormal demands of hard training or frequent competition
  - To produce a specific benefit on performance
  - To keep up with team mates and opponents
The way to Victory
## Athènes 2004, Cycling, Kilometre Men

<table>
<thead>
<tr>
<th>Rank</th>
<th>Name</th>
<th>NOC</th>
<th>Time 750-1000</th>
<th>Speed km/h</th>
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<tbody>
<tr>
<td>1</td>
<td>HOY Chris</td>
<td>GBR</td>
<td>1:00.711</td>
<td>59.297 GOLD</td>
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<tr>
<td>2</td>
<td>TOURNANT Arnaud</td>
<td>FRA</td>
<td>1:00.896 0.185 (0.3%)</td>
<td>59.117</td>
</tr>
<tr>
<td>3</td>
<td>NIMKE Stefan</td>
<td>GER</td>
<td>1:01.186</td>
<td>58.836</td>
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</table>

## Athènes 2004, Coxless four, 2000 m Men’s Final

<table>
<thead>
<tr>
<th>Rank</th>
<th>NOC</th>
<th>Name</th>
<th>2000m</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>GBR</td>
<td>WILLIAMS Steve</td>
<td>6:06.98 (1)</td>
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<tr>
<td></td>
<td></td>
<td>CRACKNELL James</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>COODE Ed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PINSENT Matthew</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CAN</td>
<td>BAERG Cameron</td>
<td>6:07.06 (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HERSCHMILLER Thomas</td>
<td>0.08 (0.02%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WETZEL Jake</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>WILLIAMS Barney</td>
<td></td>
</tr>
</tbody>
</table>
Nutritional Supplements in Sports: 
the athlete perspective

• Commonly cited reasons for supplement use:
  – Compensation for an inadequate diet,
  – As an "insurance policy" against potential deficiencies
  – To meet abnormal demands of hard training or frequent competition
  – To produce a specific benefit on performance
  – To keep up with team mates and opponents
  – Recommended by coaches, parent or other influential individual
  – To provide a practical alternative to everyday foods and drinks
The power of advertising

• Supplement sellers often have large budgets and can use effective advertising.

• Athletes generally do not discriminate between scientific evidence and advertising hype.

• This advertising works: if it did not, sellers would not spend money on it.
Nutritional Supplements in Sports: the Physician’s perspective

- Preserve athlete’s health
- Transfer: from basic sciences to athletes knowledge
- Consider Benefit/Risk ratio (an EBMedicine approach):
  - **Risks:**
    - Adverse health effect
    - Adverse analytical finding
    - Financial
  - **Benefits:**
    - Short-term supplementation / Particular situations:
      - Food/caloric restriction
      - Iron supplementation
      - Travelling (alternative to everyday food)
    - Ergogenic effects
The Ergogenic Compounds

- Créatine
- Caféine
- Bicarbonate
- Sport Drinks (CHO +/- Proteins)
- Meal replacements
- Protein products (specific situations)
Nutritional Supplements in Sports: the NADO’s perspective

• Preserve athlete’s health
• Implement the WADA code
• Deal with positive cases!! (Olympics, WC,...)
• Provide general information to athletes regarding nutritional supplements
• Set national program (NECEDO, ASDA…) of nutritional supplement testings
Phase II: Netherlands Security System Nutritional Supplements Elite Sports (NZVT)

Aim: “to develop a long term solution for the problems surrounding nutritional supplements and doping”

Partners
National Olympic Committee (NOC*NSF)
Branch association of health product manufacturers (NPN)
National Anti-Doping Organisation (NeCeDo)
NZVT elements

1. Enriched HACCP system
2. Batchwise laboratory analyses
3. Security analyses
4. Communication
Shared responsibilities

- Athletes remain responsible for the supplements that they take (strict liability)
- Producers must take action (self-regulation)
- Sport authorities ensure quality (independence)
Current advice on supplements

1. Only use what’s really necessary

2. Choose NZVT product/batch combinations
Procedure

- Handed in by producers
- Analysed by knowledgeable lab
- Producers pay the analysis
- Independent review of results
- Communication through website
Nutritional Supplements in Sports: the NADO’s perspective

• But NZVT is an exception: poor countries
• Implementation of basic antidoping rules = 0
• Substitution role of:
  – WADA
  – IOC
  – International Federations
Nutritional Supplements in Sports: the IF’s perspective

• Preserve athletes health (MADC)
• Frequently asked to “Give a list”
• Avoid having adverse findings and positive cases because of supplement contamination:
  – Time
  – Money
  – Human resources
• Substitution to some NADO
Nutritional Supplements in Sports: the IF’s perspective

• Communication - Education to athletes:
  – Recreational (national federations)
  – Top athletes:
    • antidoping program (IC & OOC)
    • Whereabout system
    • Competition and meetings
    • Athlete’s staff (coach, physicians, physio…)
    • Publication and website
Conclusions
An industry-centered view of the problem

- Athlete
- Public Authorities
- Industry
- Coach
- Int. Fed.
- WADA
- NADO
- Physician
Second International Symposium on Supplements in Sports

• **Main outcomes:**
  – Inadvertent doping offence is of importance!
  – The dietary supplement industry is best positioned to assume a leadership role in developing solutions
  – Self regulatory scheme – nutrition products:
    • without risk for health
    • no risk of producing a positive doping test
  – Key elements:
    • Logo
    • Risk analysis and accreditation
    • Independent auditing, GMP
    • Laboratory methods
  – Continuation of national or regional solution until adoption of the scheme