Asma da esercizio fisico

CORSO DI AGGIORNAMENTO
“I FENOTIPI DELL’ASMA’”
Arenzano 16 Febbraio 2008

Exercise-induced bronchospasm: a different phenotype?
ElA è presente in circa il 70-80% dei bambini non in terapia con steroidi inalatori

L’asma da sforzo allontana i bambini dallo sport!
Exercise training on disease control and quality of life in asthmatic children

Thirty-eight children with moderate to severe persistent asthma: control (N=17) training (N=21) groups

In trained children:

- ↑ physiological variables at peak and submaximal exercise
- ↓ Severity of exercise-induced bronchoconstriction (EIB) and postexercise breathlessness
- ↑ Pediatric Asthma Quality of Life Questionnaire (PAQLQ) scores
- ↓ Daily doses of inhaled steroids

Exercise-induced asthma (EIA), connotes transient airflow obstruction associated with physical exertion.
1962: Jones and colleagues reported that the effect of exercise on the asthmatic airway was dependent on the duration of activity.

Prolonged exercise of 5-to 10-min duration created bronchoconstriction

Jones RS, Br J Dis Chest 1962

Asma da esercizio fisico

Riduzione dei flussi espiratori dopo, ma non durante, esercizio fisico breve (6 min) preceduto da warm-up (W)

Beck et al., JAP 1999
The bronchospasm can occur also during the exercise, especially during prolonged exertion.

Godfrey S, Bar-Yishay E, Exercise induced asthma revised, Respiratory Medicine 1993
Asma da esercizio fisico
Aumento della resistenza inspiratoria (RLIH)

durante e dopo esercizio prolungato

Suman et al., JAP 1999

Mistaken Diagnosis of EIB

• Being unfit
• Breathlessness in the overweight/obese
• Vocal cord dysfunction
• Exercise hyperventilation syndrome

Are all often incorrectly diagnosed as EIB.

For these disorders the symptoms occur DURING rather than AFTER exercise.
Obesity Pseudo Asthma

Being fit reduces ventilation for a given exercise task so being fit will mean feeling less breathless

Pseudo-asthma: when cough, wheezing, and dyspnea are not asthma.
Weinberger, Pediatrics Oct 2007

Exercise-induced vocal cord dysfunction
Although most exacerbations are self-limited or subside readily with medication, sudden fatal asthma exacerbations occur in both competitive and recreational athletes, and can be precipitated by sporting activity.


61 deaths over a 7-y period

- 81% < 21 y
- 57% elite athletes

- Adolescenti a rischio: 10-14 anni fascia prevalente!
- Non solo sport agonistico.
• Adolescenti a rischio: 10-14 anni fascia prevalente!
• Non solo sport agonistico.
• **Molti con asma lieve.**
Exercise-induced bronchospasm in children: effects of asthma severity

The prevalence of EIB is greater in children with more severe asthma, and the intensity of response to exercise is not consistently related to the clinical severity of asthma.

Cabral, AJRCCM 1999

- Adolescenti a rischio: 10-14 anni fascia prevalente!
- Non solo sport agonistico.
- Molti con asma lieve.
- 77% non in terapia di fondo per asma!
A PILOT SURVEY OF $\beta_2$-AGONIST INHALER AVAILABILITY FOR CHILDREN WITH ASTHMA DURING ORGANIZED SPORTING EVENTS

% children with asthma

- 579 ch.<12 yrs playing baseball or soccer
- Parents reported asthma

14%
80/579

% of asthmatic children reporting to have ready available a rescue medication

- 579 ch.<12 yrs playing baseball or soccer
- Parents reported asthma

22%
18/80
Sir John Floyer, who was himself asthmatic, first described the adverse effects of physical exercise on his asthma, noting that different types of exercise had greater or lesser adverse effects.

Floyer J, Sir. A treatise of the asthma. R Wilkin & W Innis, London, 1698

For many years, it was generally assumed that this was because the severity of exercise was also different.

**EFFECT OF EXERCISE TYPE**

- Frequency and Severity of EIA
- Free-range running (↓ 47% PEF)
- Running on a treadmill (↓ 33%)
- Cycling (↓ 25%)
- Swimming, kayaking, walking (↓ 15%)

Anderson, Br J Dis Chest 1975; Fitch, JAMA 1976
During training and competition, highly trained swimmers inhale large amounts of air that floats just above the water surface. Therefore they are repeatedly and strongly exposed to chlorine derivatives.
### Symptoms of EIA

<table>
<thead>
<tr>
<th>Typical</th>
<th>Atypical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough: during or after exercise</td>
<td>Stomach cramps</td>
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<tr>
<td>Wheezing</td>
<td>Headache</td>
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<tr>
<td>Shortness of breath during or after exercise</td>
<td>“Being out of shape”</td>
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Symptoms of EIA

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<td>Headache</td>
</tr>
<tr>
<td>Shortness of breath during or after exercise</td>
<td>“Being out of shape”</td>
</tr>
</tbody>
</table>

può manifestarsi come dolore toracico

CHEST PAIN IN CHILDREN: DIAGNOSIS THROUGH HISTORY AND PHYSICAL EXAMINATION
Evangelista JA, JPHC 2000; 14: 3

- 50 ch. referred for chest pain
- Physical examination and ECG

- 76% musculo-skeletal pain
- 12% EIB
- 8% gastric problem
- 4% psycogenic
Exercise-induced Asthma: Pathophysiology

- Respiratory water loss
- Mucosal cooling
- Vasoconstriction
- Rapid rewarming of airways
- Vascular engorgement, edema
- Airway narrowing

- Mucosal dehydration
- Increased osmolality
- Mediator release
- Smooth muscle contraction, edema

Increased urinary excretion of LTE4 after exercise

Reiss TF, Thorax 1997

Exhaled breath condensate cysteinyl leukotrienes are increased in children with exercise-induced bronchoconstriction

Maximal FEV₁ decrease after exercise in asthmatic children with EIB at baseline and after 3 days of treatment with montelukast

Carraro S, JACI 2005
Mechanisms Underlying the Definition of Asthma

Risk Factors (for development of asthma)

INFLAMMATION

Airway
Hyperresponsiveness

Airflow Obstruction

Risk Factors (for exacerbations)

Symptoms

Blood eosinophil counts for the prediction of the severity of exercise-induced bronchospasm in asthma

Eosinophils play a major role in the severity of exercise-induced bronchoconstriction in children with asthma

Pediatr Pulmonol 2006
Atopy may be related to exercise-induced bronchospasm in asthma
Koh YI, Clin Exp Allergy 2002

Atopy defined as skin test reactivity may contribute to the development of EIB in asthma, independently of AHR to metacholine.

Exhaled breath condensate cysteinyl leukotrienes are increased in children with exercise-induced bronchoconstriction
Carraro S, JACI 2005

Cys-LT levels in EBC of asthmatic children with EIB, asthmatic children without EIB, and healthy control children.
Emerging evidence indicates that *injury to the airway epithelium* is a key susceptibility factor for EIB.

One consequence of epithelial injury is replacement of ciliated epithelial cells by mucin secreting cells.

Athletes and exercise-induced bronchoconstriction

Same inflammation ??

EIA and EIB: different phenotypes?

“We use the term exercise-induced bronchospasm (EIB) to describe the airway obstruction that occurs in association with exercise without regard to the presence of chronic asthma”.

American Academy of Allergy, Asthma & Immunology Work Group Report: Exercise-induced asthma

John M. Welbourn, MD,1 Sergio Benlolo, MD,2 Robert Goldstein, MD,3 Timothy Craig, DO,3 Luis Delgado, MD,4 Miguel Capelo Filipi, MD,5 Deutsche Possuti, MD,6 Christopher Rundquist, MD,6 and William Surins, MD7 Iowa City, Iowa; Rome and Siena, Italy; Midville, PA; Porto, Portugal; and Colorado Springs, Colo
Exercise-induced Asthma:
Prevalence

Up to 90% of subjects with asthma will have EIB

Mc Fadden ER, NEJM 1994
Factors that Exacerbate Asthma

- Allergens
- Air Pollutants
- Respiratory infections
- **Exercise and hyperventilation**
- Weather changes
- Sulfur dioxide
- Food, additives, drugs

---

Prevalence of EIA

- Hallstrand found 9% of school children had EIA
  
  *Hallstrand TS, J Pediatr 2002*

- Rupp found 12% of school children had EIA
  
  *Rupp NT, Ann Allergy 1993*

Method: sport-specific challenge testing in nonathletes
KEEPING CHILDREN WITH EXERCISE-INDUCED
ASTHMA ACTIVE  Milgrom H Pediatrics 1999; 104 :38

% subjects with EIB

<table>
<thead>
<tr>
<th></th>
<th>General population</th>
<th>Rhinitis</th>
<th>Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10%</td>
<td>6-12%</td>
<td>40%</td>
<td>90%</td>
</tr>
</tbody>
</table>

British study: EIA (>15% fall in FEV1) in 29/100 sequentially referred potential recruits with a history suggestive of asthma in childhood but no asthma symptoms or therapy in the last 4 years.

Sinclair DG etal. Eur Respir et J 1995;8:1314-17
Prevalence of EIA

Physical activity is associated with a slower decline in pulmonary function and with lower mortality

TABLE 1. Incidence of EIA.

<table>
<thead>
<tr>
<th>Sport</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-country skiers</td>
<td>50</td>
</tr>
<tr>
<td>Ice hockey</td>
<td>35</td>
</tr>
<tr>
<td>Speed skaters</td>
<td>43</td>
</tr>
<tr>
<td>Figure skaters</td>
<td>36</td>
</tr>
<tr>
<td>Summer and winter Olympic athletes</td>
<td>17</td>
</tr>
<tr>
<td>School children</td>
<td>12</td>
</tr>
</tbody>
</table>

Pelkonen M, AJRCCM 2003
Exercise-induced Asthma: diagnosis

ASTHMA SCREENING OF HIGH SCHOOL ATHLETES: IDENTIFYING THE UNDIAGNOSED AND POORLY CONTROLLED WITH FREE-RUNNING CHALLENGE
Ann All Asthma Immunol 2002; 88: 380

- 801 student athletes
- questionnaire and free running exercise challenge

Total 801 student athletes

Asthma and EIA identified by questionnaire 46 (5.7%)

49 (6.5%) identified by free running test

remaining 755
Perception of exercise induced asthma by children and their parents

Modest specificity (82%) and low sensitivity (50%) of children’s descriptions

Panditi S, ADC 2003

Differences between child and parent reports of symptoms among children with asthma

Lara M Pediatrics 1998; 102: E68

- 97 ch. with asthma
- Child and parent interviews
- Exercise test

REPORTED WHEEZING DURING EXERCISE

<table>
<thead>
<tr>
<th></th>
<th>Ch</th>
<th>Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>20%</td>
<td>17%</td>
</tr>
<tr>
<td>Occasionally</td>
<td>47%</td>
<td>45%</td>
</tr>
<tr>
<td>Always</td>
<td>35%</td>
<td>35%</td>
</tr>
</tbody>
</table>

**WHEEZING**
History and/or p.e. compatible with EIA

Spirometry (FEV1 reversibility > 12%)

Treat as ASTHMA

Tan RA, Ann Allergy Asthma Immunol 2002
Pulmonary Function Tests

- Flow-volume loop demonstrates flattened inspiratory loop when symptomatic.

| Normal | VCD |

History and/or p.e. compatible with EIA

Spirometry (FEV1 reversibility > 12%)

- MC challenge; Exhaled nitric oxide
- Trial with β2-agonists

Treat as ASTHMA

+ Treat as EIA

Tan RA, Ann Allergy Asthma Immunol 2002
History and/or p.e. compatible with EIA

Spirometry (FEV1 reversibility > 12%)

- Treat as ASTHMA
- MC challenge
- Trial with β2-agonists
- Exercise
- Treat as EIA
- Treat as EIA
- Other diagnoses

Tan RA, Ann Allergy Asthma Immunol 2002

Per avviare il bambino asmatico allo sport

Valutare il bambino mediante test da sforzo
Il test da sforzo appare particolarmente adeguato in età pediatrica poiché rappresenta uno stimolo fisiologico che riproduce circostanze di “vita reale”, quotidiane.


Test da sforzo eseguito in laboratorio

<table>
<thead>
<tr>
<th>Tapis Roulant</th>
<th>Bicicletta</th>
</tr>
</thead>
</table>
| • Ventilazione aumenta di più, bronco-ostruzione facile (V’O2 +10%)  
• Per qualche paziente più facile da eseguire.  
• Più difficile determinare intensità (watt) |  
• Non ha velocità e inclinazione, solo carico di lavoro (workload)  
• Preferibile per pazienti con difficoltà di camminare/correre  
• Facile determinare intensità (watt) |
**EXERCISE TESTING**

![Graph showing FEV₁ over time in minutes for normal subject and asthmatic patient. Drop in FEV₁ ≥ 10% = positive test.]

**ASMA DA SFORZO – PRECAUZIONI**

- non eseguire il test se:
  - il paziente presenta broncospasmo a riposo
  - PEFR o FEV₁ < 70 % del predetto
  - < 80 % dei valori usuali
  - (in tal caso test di reversibilità)

- presenza del medico per tutta la durata del test
- cardiomonitor
- somministrare β₂ stimolante spray e ossigeno se broncospasmo grave
Anche il test della corsa libera è risultato valido e ripetibile, con il limite delle condizioni ambientali (temp. 20-24°C, umidità relativa < 40%)
EIB could be excluded with a probability of 90% in asthmatic children with FeNO levels < 20 parts per billion (ppb) without current inhaled corticosteroid treatment, and < 12 ppb in children with current inhaled corticosteroid treatment.
Value of surrogate tests to predict exercise-induced bronchoconstriction in atopic childhood asthma
Lex, Pediatr Pulmonol 2007

All children with normal eNO levels (≤ 25 ppb) had normal lung function results after exercise; hence the negative predictive value (NPV) of eNO levels for prediction of EIB was 100%.

Exhaled nitric oxide and exercise-induced bronchospasm assessed by FEV1, FEF25-75% in childhood asthma
Nishio K, J Asthma 2007

Not only FEV1 but FEF25-75% can be used to evaluate the correlations between BHR (EIB) and airway inflammation (eNO) in asthmatic children. A low eNO is useful for a negative predictor for EIB.
Asma bronchiale negli atleti
Percorso diagnostico per le Olimpiadi di Atene

Test di broncostimolazione positivo

1) test metacolina: PD20 < 200 mcg
2) test sforzo- < 10 % FEV1 v. b.
3) test iperpnea vol. isocapnica < 10% FEV1 v.b.
4) Aerosol ipertonico < 15% FEV1 v.b.

Diagnosi di Iperreattività bronchiale

→ Asma bronchiale → Terapia - Prevenzione

EUCAPNIC VOLUNTARY HYPERVENTILATION

- 6min of hyperpnoea
  - dry air
  - 4.9% CO₂
- 10% fall in FEV₁
- Specific for diagnosis of EIA (Rundell et al. 2004)
- Recommended by the IOC
## IBAs USE SYDNEY vs ATHENS

<table>
<thead>
<tr>
<th></th>
<th>SYDNEY 2000 (notified)</th>
<th>ATHENS 2004 (approved)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IBAs</td>
<td>PERCENT</td>
</tr>
<tr>
<td>NZL</td>
<td>31</td>
<td>21.1%</td>
</tr>
<tr>
<td>AUS</td>
<td>128</td>
<td>20.7%</td>
</tr>
<tr>
<td>UK</td>
<td>62</td>
<td>19.9%</td>
</tr>
<tr>
<td>USA</td>
<td>112</td>
<td>18.9%</td>
</tr>
<tr>
<td>CAN</td>
<td>55</td>
<td>18.6%</td>
</tr>
<tr>
<td>FIN</td>
<td>10</td>
<td>14.3%</td>
</tr>
</tbody>
</table>

Anderson et al. submitted

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Per avviare il bambino asmatico allo sport

**Attuare la prevenzione non farmacologica**
SCHACHTER, E. N., E. LACH, and M. LEE. 
The protective effect of a cold weather mask on exercised-induced asthma. 

A special warm-up routine has been shown to reduce the severity of EIA.
EIA: terapia non farmacologica

ALLENAMENTO INTERMITTENTE

Esecuzione, durante il preriscaldamento, di sprint brevi (10-12), della durata di 20-30 secondi, intercalati da periodi di recupero di 1-2 min, per indurre refrattarietà all’EIA senza provocare broncostruzione clinicamente significativa

FRANÇOIS-PIERRE COUNIL, J Pediatr 2003

ASMA DA SFORZO (EIA) - ALLERGIA

esposizione allergeni

aumento

EIA

sforzo

↑ reattività bronchiale aspecifica

↑ infiammazione
**ASMA DA SFORZO ED INQUINAMENTO ATMOSFERICO**

Bronchoconstriction in asthmatics exposed to sulfur dioxide during repeated exercise.

Roger J. Appl. Physiol. 1985

Distribution of specific airway resistance ($s_{Raw}; \text{cm } H_2O \cdot s$) in asthmatic subjects exposed, during exercise, to air (0.0 ppm) or $SO_2$ (0.25, 0.5, and 1.0 ppm)

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**Fish Oil Supplementation Reduces Severity of Exercise-induced Bronchoconstriction in Elite Athletes**


Supplementing the diet with n-3 PUFA represents a potentially beneficial treatment for elite athletes with EIB.
Per avviare il bambino asmatico allo sport

Pianificare la protezione farmacologica

TERAPIA E PREVENZIONE DELL’ASMA DA SFORZO

1. **Premedicazione**

- β2-agonisti
- Cromoni
- Montelukast
TERAPIA E PREVENZIONE DELL’ASMA DA SFORZO

2. Terapia di fondo

• Steroidi inalatori
• Montelukast

TERAPIA E PREVENZIONE DELL’ASMA DA SFORZO

1. Premedicazione

• β2-agonisti
• Cromoni
• Montelukast
**Long-acting beta-agonists**

- Prevention of EIA in pediatric asthma patients: a comparison of two salmeterol powder delivery devices.
  Bronsky, Pediatrics 1999

- Evidence of the rapid protective effect of formoterol dry-powder inhalation against EIA in athletes with asthma.
  Ferrari, Respiration 2000

---

**ß2-Agonist Tolerance and EIB**

- Hancox RJ, AJRCCM 2002 (salbutamol)

- Nelson JA, NEJM 1998 (salmeterol)

Asma da esercizio fisico
L’effetto del salmeterolo e la sua durata si attenuano col trattamento cronico

Risposta alla metacolina
L’effetto protettivo del salmeterolo si riduce nel tempo

Nelson et al., NEJM 1998
Cheung et al AJRCCM 1998
Tolerance to the bronchoprotective effect of salmeterol in adolescents with exercise induced asthma

Simons, Pediatrics 1997;99:665

- SLM 50 mcg once daily vs PL+ daily inhaled steroids therapy
- Exercise at 1 and 12 hours after drug, on day 1 and 28

The duration of the bronchoprotective effect decreases during regular treatment with salmeterol despite concomitant use of inhaled steroids

TERAPIA E PREVENZIONE DELL’ASMA DA SFORZO

1. **Premedicazione**

- β2-agonisti
- Cromoni
- **Montelukast**
Onset and duration of protection against exercise-induced bronchoconstriction by a single oral dose of montelukast

Divij S. Poddar, MD; Laura van Adelsberg, MD; George Phillips, MD; Siepren A. Tilless, MD; William Busse, MD; Leslie Hendley, PharmD; Thomas Loeser, PhD; S. Baluchandra Doss, PhD; and Theodore F. Reis, MD

![Graph showing onset and duration of protection against exercise-induced bronchoconstriction by a single oral dose of montelukast](image)

***P ≤ 0.001


TERAPIA E PREVENZIONE DELL’ASMA DA SFORZO

2. Terapia di fondo

- Steroidi inalatori
- Montelukast
Bambini con broncostruzione indotta da esercizio fisico

- La broncostruzione indotta dall’esercizio fisico è espressione di asma non adeguatamente controllato.

- Bambini con broncostruzione indotta dall’esercizio fisico dovrebbero essere trattati come pazienti con asma persistente.

Inhaled corticosteroids compared to placebo for prevention of exercise induced bronchoconstriction
Koh, Cochrane Database of Systematic Reviews 2007

Inhaled corticosteroids used for 4 weeks or more before exercise testing significantly attenuated exercise-induced bronchoconstriction
In asthmatic patients ICSs not only attenuate exercise-induced bronchospasm but also improve arterial blood oxygenation during exercise.
New Treatments for Exercise-induced Asthma: MONTELUKAST

Reprinted from The New England Journal of Medicine

Montelukast for the treatment of mild asthma and EIB
Leff, NEJM 1998
Montelukast for the treatment of mild asthma and EIB
Leff, NEJM 1998

Montelukast inhibits EIB in 6-to 14-year-old children with asthma
Kemp, J Pediatr 1998

Montelukast versus salmeterol in patients with asthma and EIB
Villaran, JACI 1999

Comparison of montelukast versus budesonide in the treatment of EIA
Vidal, AAAI 2001

Montelukast compared with salmeterol to prevent EIB

Comparative effects of LABA and INI-LT on EIB
Coreno, JACI 2000

Montelukast vs salmeterol in patients with asthma and exercise-induced bronchoconstriction
Villaran, J Allergy Clin Immunol 1999;104:547

- 197 patients, 15-45 yrs
- Mild asthma
- MNT or SLM for 8 wks
- Exercise challenge at definite times 20-24 h after dosing

The effect of montelukast was greater than salmeterol over a period of 8 weeks

<table>
<thead>
<tr>
<th>Week</th>
<th>Montelukast 10 mg od</th>
<th>Salmeterol 50 mcg bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal</td>
<td>ns</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Day 3</td>
<td></td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Week 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Week 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A comparison of the effects of oral montelukast and inhaled salmeterol on response to rescue bronchodilation after challenge

William Storms\textsuperscript{a}, Paul Chervinsky\textsuperscript{b}, Asma F. Ghannam\textsuperscript{c}, Steven Bird\textsuperscript{d}, Carolyn M. Hustad\textsuperscript{e}, Jonathan M. Edelman\textsuperscript{c,f}, for the Challenge Rescue Study Group\textsuperscript{f}

Respiratory Medicine (2004) 98, 1051–1062

Prolonged Effect of Montelukast in Asthmatic Children With EIB, Pediatr Pulmonol, 2005

- Studio in doppio cieco (n=64)
  Montelukast contro placebo per 8 settimane, seguito da crossover di parte del gruppo trattato (28/40) per ulteriori 8 settimane
Prolonged Effect of Montelukast in Asthmatic Children With EIB
Kim Pediatr Pulmonol, 2005

- Miglioramento significativo per tutti i parametri considerati
  - Massima caduta di FEV1
  - Score sintomatologico
  - Tempo di recupero

- Nel gruppo crossover, dopo 8 settimane di washout, tutti i parametri rimanevano persistentemente e significativamente migliorati rispetto ai valori basali

Effect of different antiasthmatic treatments on exercise-induced bronchoconstriction in children with asthma
Stelmach, JACI in Press
Montelukast administered in the morning or evening to prevent exercise-induced bronchoconstriction in children

Montelukast, taken for 2 weeks, is equally effective in exercise-induced bronchoconstriction when dosing either in the morning or in the evening

Pajaron-Fernandez, Pediatr Pulmonol 2006

A recent study reported that montelukast provided greater protection against bronchoconstriction after exercise during high PM1 than low PM1 exposure (approximately 90% vs. approximately 35%)

Montelukast does not affect exercise performance at subfreezing temperature in highly trained non-asthmatic endurance athletes


Compared to placebo, montelukast did not increase physiologic performance variables, or increase the mean running time to exhaustion.

these findings do not suggest the need for disallowing the use of this drug by asthmatic athletes.

Concentrazioni urinarie al di sopra delle quali un laboratorio accreditato dal CIO deve dichiarare i risultati

- **Salbutamolo** > 1000 ng/ml
- **Efedrina** > 10 ng/ml
- **Metilefedrina** > 10 ng/ml
- **Catina** > 5 ng/ml
- **Pseudoefedrina** > 25 ng/ml
- **Fenilpropanolamina** > 25 ng/ml

*Dal 2004 pseudoeefedrina e fenilpropalanina non sono proibite ma incluse nel programma di monitoraggio WADA*
Corticosteroidi
Norme WADA - CI O

Assolutamente vietati
per via sistemica
-------------------------

Ammessi solamente per via inalatoria per la terapia dell’asma bronchiale e delle allergopatie

CONTROINDICAZIONI

• Uso di respiratori subacquei
• Attività fisica in alta quota
• Sport motoristici
• Asma grave persistente
What About More Information?

macottini@alice.it