THE BENEFITS OF A SYSTEMATIC ASSESSMENT OF RESPIRATORY HEALTH IN ILLNESS SUSCEPTIBLE ATHLETES

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ONLINE DATA SUPPLEMENT

ADDITIONAL METHODOLOGICAL DETAIL

SARAH Measurements

Physiological assessments

FeNO: Airway inflammation was determined as the mean of duplicate measurements of FeNO determined at a flow rate of 50 mL˙s-1 + 10% and pressure of 16 cmH_2O. (NIOX VERO (NIOX, Aerocrine, Sweden) (1)). A FeNO >25 ppb was considered elevated (1).

NPIF: Assessment of nasal flow / obstruction (2) was obtained with a nasal peak flow meter (In check, Clement-Clarke International Ltd, Harlow, Essex, UK); as the highest value of three maximal nasal inspiratory manoeuvres.

Spirometry: Lung function was assessed by maximal expiratory flow-volume manoeuvres, in accordance with the ATS/ERS recommendations (3) using a digital spirometer (Spiro-USB and Microlab, Carefusion, Germany). In athletes with obstructed lung function (defined as FVC: FEV_1 < 70% predicted), spirometry was reassessed 15 minutes following bronchodilator (4 × 100 µg Salbutamol) administration. A positive reversibility challenge was defined as an increase in FEV_1 of ≥ 12% and 200 ml from baseline (4).

EVH Challenge: Athletes with normal baseline lung function underwent an EVH challenge as a surrogate indicator of EIB. In brief, athletes inspired medical grade air (21% O2, 5% CO2 and 74% N2 with <2% humidity) for 6 minutes at a target ventilation rate. Maximal flow volume loops were measured in duplicate at 3, 5, 7, 10 and 15-minutes post EVH. A test was considered positive (EVH+) if FEV_1 fell by ≥ 10% from baseline at two consecutive time points from the pre-test value (5). Where relevant, athletes were withheld asthma medication, prior to testing, in line with recommendations (5).

SPT: Athletes scoring ≥3 in the AQUA questionnaire underwent SPT using a panel of common aeroallergens and in accordance with a protocol recommended by the European Academy of Allergology and Clinical Immunology (6).

ONLINE REFERENCES

1. Dweik RA, Boggs PB, Erzurum SC, Irvin, Charles G, Leigh, Margaret W, Lundberg JO, Olin A-C, Plummer AL, Taylor, Robin D. An Official ATS Clinical Practice Guideline: Interpretation of Exhaled Nitric Oxide Levels (FENO) for clinical applications. *Am J Respir Crit Care Med* 2011;184:602–615.

2. Ottaviano G, Fokkens WJ. Measurements of nasal airflow and patency: A critical review with emphasis on the use of peak nasal inspiratory flow in daily practice. *Allergy* 2016;71:162–174.

3. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, Crapo R, Enright P, van der Grinten CPM, Gustafsson P, Jensen R, Johnson DC, MacIntrye N, McKay R, Navajas D, Pedersen OF, Pellegrino R, Viegi G, Wagner J. Standardisation of spirometry. *Eur Respir J* 2005;26:319–338.

4. Fitch KD, Sue-Chu M, Anderson SD, Boulet LP, Hancox RJ, McKenzie DC, Backer V, Rundell KW, Alonso JM, Kippelen P, Cummiskey JM, Garnier A, Ljungqvist A. Asthma and the elite athlete: Summary of the International Olympic Committee's Consensus Conference, Lausanne, Switzerland, January 22-24, 2008. *J Allergy Clin Immunol* 2008;122:254–260.

5. Anderson SD, Argyros GJ, Magnussen H, Holzer K. Provocation by eucapnic voluntary hyperpnoea to identify exercise induced bronchoconstriction. *Br J Sports Med* 2001;35:344–347.

6. Bousquet J, Heinzerling L, Bachert C, Papadopoulos N., Bousquet P., Burney P., Canonica G., Carlsen K., Cox L, Haahtela T, Lodrup Carlsen K., Price D, Samolinski B, Simons FE., Wickman M, Annesi- Maesano I, Baena- Cagnani, C.E Bergmann K., Bindslev- Jensen C, Casale T., Chiriac A, Cruz A., Dubakiene R, Durham S., Fokkens

W., Gerth- van- Wijk R, Kalayci O, Kowalski M., Mari A, Mullol J, *et al.* Practical. *Allergy* 2012;67:18–24.

Table E1. Number of positive responses athletes showed to the allergen panel Number of athletes showing a positive response to each allergen.

Number of positive responses	Number of athletes	
0	23	(43%)
1	7	(13%)
2	6	(11%)
3	8	(15%)
4	5	(9%)
5	2	(4%)
6	1	(2%)
7	1	(2%)
8	0	(0%)
9	0	(0%)
10	0	(0%)
Positive response to allergen		
House dust mite	19	(35%)
6 grasses	21	(39%)
Mugwort	1	(2%)
3 Trees	12	(22%)
Cat	11	(20%)
Dog	8	(15%)
Horse	5	(9%)
Aspergillus	3	(6%)
Cladosporium	2	(4%)
Alternaria	3	(6%)

N = 54

Table E2. Treatment and intervention recommendations following SARAH assessment.

Recommendation	Number of athletes	
Nasal rinse	24	(20%)
Nasal spray (Avamys, Dymista, and Rinatec)	32	(26%)
ENT referral	4	(3%)
Initiation of regular preventative medication for asthma/ EIB (e.g. Inhaled steroid, Montelukast, Inhaled steroid + LABA)	26	(21%)
New reliever inhaler therapy for Asthma/ EIB	24	(20%)
Change to existing inhaler therapy for Asthma/ EIB	11	(9%)
Discontinue previously prescribed inhalers for Asthma/ EIB	7	(6%)
Medical review of reflux	16	(13%)
Further review for EILO/ Dysfunctional breathing	31	(25%)

Definition of abbreviations: ENT; Ear nose and throat, EIB; Exercise induced bronchoconstriction, EILO; Exercise induced laryngeal obstruction.