ABSTRACT

The purpose of this thesis was to investigate the ergogenic potential of inhaled $ß_2$-agonists (IBAs) in athletes with and without exercise-induced bronchoconstriction (EIB) from multiple angles: by assessing the effect of 400 µg of salbutamol, a commonly used IBA, in female athletes; and by analyzing athletic performance after the inhalation of the maximal daily dose of salbutamol, *i.e.* 1600 µg, by taking dose per kg of body mass into consideration. Furthermore, four methods of calculating the fall index (FI) in the eucapnic voluntary hyperpnea (EVH) challenge were evaluated.

Female (Chapter 2) and male cyclists (Chapter 3) were screened for EIB using the EVH challenge. On two subsequent visits, athletes performed one 10-km time trial per visit. In a randomized order, athletes inhaled either salbutamol or placebo before completing the time trials. Athletic performance was assessed using mean power output. In Chapter 4, the FIs of the EVH challenges from Chapters 2 and 3 were calculated using four previously published methods and compared to the pulmonary response to the placebo time trial. Additionally, the intensity of the EVH target ventilation, calculated as 30 x forced expiratory volume in 1 second (FEV_1), was evaluated by comparing it to the highest generated ventilations in a graded maximal exercise test (GXT).

Despite significant increases in FEV_1 after IBA use, athletic performance was not improved in female or male athletes, regardless of EVH status. In women, power output was decreased, despite a significant increase in oxygen consumption, suggestive of an increased stimulation of women's adrenergic β_2-system. Similarly, in male athletes, significant increases in heart rate, ventilation, and perceived leg discomfort could indicate an upregulation of the adrenergic nervous system, independent of the relative IBA dose. Lastly, there were significant differences between the four FI calculation methods, influencing the EVH interpretations. Normalizing FIs by the ventilations achieved during voluntary hyperpnea was not supported in athletes with high percent predicted values for FEV_1 due to an increased risk of false-positives. The intensity of the EVH target ventilation ranged between 67% - 135% when normalized to the GXT ventilations.

BIOGRAPHICAL NOTES

Academic Studies:	Diplom, University of Potsdam, 2009 M.Sc. University of British Columbia, 2011

GRADUATE STUDIES

Field of Study:	Physiology of exercise-induced bronchoconstriction in humans

Courses:		**Instructors**
KIN 500B	The Saltin International Graduate Course in Clinical & Exercise Physiology	Dr. Robert Boushel
EPSE 592	Experimental Designs and Analysis in Educational Research	Dr. Eric Chan

AWARDS

Faculty of Education Graduate Award
David Bates Scholarship
AllerGen Research Skills Acquisition Award
Four Year Fellowships (4YF) Tuition Award
International Tuition Award

PUBLICATIONS

Koch S, Ahn JR and Koehle MS (2015) High-dose inhaled salbutamol does not improve 10-km time trial performance. *Medicine and Science in Sport and Medicine*. 47(11):2373-2379.

Koch S, MacInnis MJ, Sporer BC, Rupert JL and Koehle MS (2015) Pharmacogenetic effects of inhaled salbutamol on 10-km time trial performance in competitive male and female cyclists. *Clinical Journal of Sport Medicine.* 26 (2):145-151.

Koch S, Karacabeyli D, Galts C, MacInnis MJ, Sporer BC, Koehle MS. Effects of inhaled bronchodilators on lung function and cycling performance in female athletes with and without exercise-induced bronchoconstriction. *Journal of Science and Medicine in Sport.*18(5):607-612.

Koch S, MacInnis MJ, Sporer BC, Rupert JL and Koehle MS (2015). Inhaled salbutamol does not affect athletic performance in asthmatic and non-asthmatic cyclists. *British Journal of Sports Medicine*. 49(1):51-55.

MacInnis MJ, **Koch S,** MacLeod KE, Carter EA, Jain R, Koehle MS, Rupert JL (2014): Acute mountain sickness is not repeatable across two 12-hour normobaric hypoxia exposures. *Wilderness and Environmental Medicine.* 25(2):143-151.

Koch S, Cassel M, Linné K, Mayer F and Scharhag J. (2014): ECG and echocardiographic findings in paediatric elite athletes between 10 and 15 years of age. *European Journal of Preventive Cardiology.* 21(6): 774-81.

SELECTED PRESENTATIONS

Koch, S, Tran, R, Lee AD, Carlsten, C, Koehle MS. (2016): Thirty minutes of sub-maximal cycling improves cognitive function despite diesel exhaust exposure. Abstract accepted to be presented at the Annual Meeting of the American College of Sport Medicine (ACSM) in June, 2016, Boston, Massachusetts, USA.

Tran R, **Koch S**., Lee AD, Carlsten C, Guenette JA, Koehle MS (2016): Cycling during diesel exhaust exposure may decrease the bronchodilatory response to exercise in asthmatics. Abstract accepted to be presented at the American Thoracic Society (ATS) International Conference, May 2016, San Francisco, California, USA.

Koch S, Ahn YR, Koehle MS (2015): High-dose inhaled salbutamol does not increase 10-km time-trial performance in trained cyclists. European College of Sport Science (ECSS), 20th Annual Congress. Oral presentation, 2015 (international), Malmö, Sweden.

Smith, M, Giles LV, **Koch S**, Carlsten C, Koehle MS (2015): The effects of low- and high- intensity cycling in diesel exhaust on plasma norepinephrine. Canadian Academy of Sport and Exercise Medicine (CASEM) Annual Symposium. Oral presentation (national) Ottawa ON, Canada.

Koch S, Karacabeyli D, Galts C, MacInnis MJ, Koehle MS (2014) Inhaled bronchodilators and cycling: pulmonary function improvements in female athletes do not translate to performance regardless of asthmatic status. American Thoracic Society (ATS) International Conference. Poster presentation (international). San Diego, California, USA.

Ahn JR, **Koch S**, Koehle MS (2014). 1600 µg of inhaled salbutamol does not affect athletic performance in male athletes. Okanagan Cardiovascular & Respiratory Symposium. Oral presentation (national). Silverstar, British Columbia, Canada.

a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Graduate and Postdoctoral Studies

PROGRAMME

The Final Oral Examination
For the Degree of

DOCTOR OF PHILOSOPHY
(Kinesiology)

SARAH KOCH

Diplom, University of Potsdam, 2009
M.Sc., University of British Columbia, 2011

Monday, November 27, 20017, 12:30 pm
Room 200, Graduate Student Centre
Latecomers will not be admitted

"Exercise-induced bronchoconstriction – the effects of inhaled ß$_2$-agonists on athletic performance in humans"

EXAMINING COMMITTEE

Chair:
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Supervisory Committee:
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Dr. Jordan Guenette (Rehabilitation Sciences)
Dr. Christopher Carlsten (Experimental Medicine)

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