Stress, Pain & Sport

Pia Wippert

Stressors in everyday life can entail, along with emotional and behavioral reactions, a whole series of physiological reactions at different systematic levels (endocrinological, metabolic, immunological). This is also a cause for the development of stress-associated illnesses such as cardiovascular disease, cognitive impairment, fatigue syndrome, delayed healing of injuries, and pain syndromes. Current research has focused increasing attention on pain syndromes due to the significant economic harm caused by chronic pain patients. Sports, and especially endurance sports, are well-suited for the psychophysiological reduction of stress. Extreme sports, however, can actually induce stress and result in symptoms related to being overstressed. A good balance between exertion and recovery is therefore very important for elite athletes. The presentation gives an overview about this different topics and measurement methods of stress.

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Stress, Pain & Sport

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Potsdam, Februar 19, 2014

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At a glance

- What is stress
- Stress and exercise
- Stress and pain

More tolerant against fatigue

More tolerant against beer

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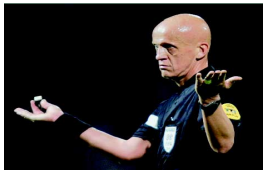
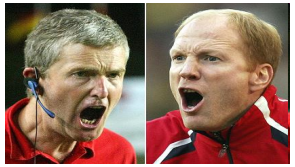
Why should we talk about stress?

Stress is your mind and body's response or reaction to a real or imagined threat, event or change

… but

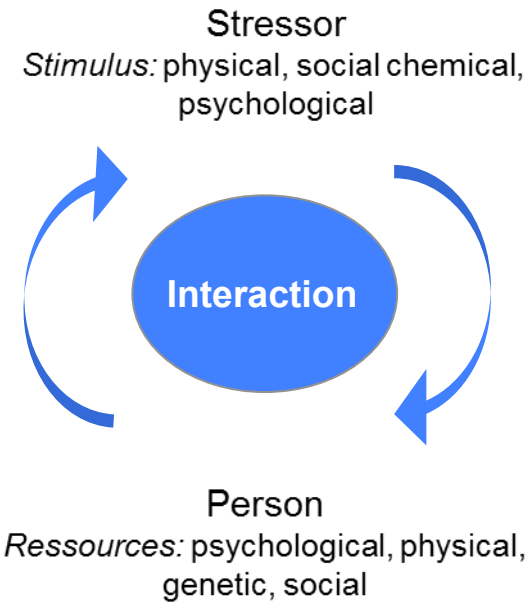
same stressor may cause different reactions in the same person depending on circumstances

… they differ in duration and intensity

Daily hassles, Life events, Acute or chronic stress

… the stress response is multifactorial

Cognitive (thoughts), Emotional, Behavioral, physiological



(vgl. Zimbardo & Gerrig, 2004, S. 562)

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Acute vs chronic stress

- Immediate stress response effective in acute emergencies
  - Autonomous Nervous System (sympathetic and parasympathetic)
- Repeated or chronic activation of the stress system can lead to a malfunctioning stress system:
  - Hyperactivity: high levels of cortisol (hypercortisolism)
  - Hypoactivity: low levels of cortisol (hypocortisolism)

With chronic consequences…

Albinson & Petrie, 2003; Fletcher & Hanton, 2003; Fredericson et al., 2005; Mellalieu et al., 2009; Niemann, 2008; Skoluda, 2012, McEwen et al., 2001; Rauh, 2010 , Wenning, 2000)

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Stress related disease

Long-term adaptation leads to accumulation of physiological costs in immune-, cardiovascular and metabolic system = *allostatic load*

Metabolic syndrome
(e.g., insulin resistance, increased glucose levels, visceral/ intra-abdominal adiposity)

Cardiovascular diseases
(increased blood pressure, Arteriosclerosis, Myocardial infarction)

Depression

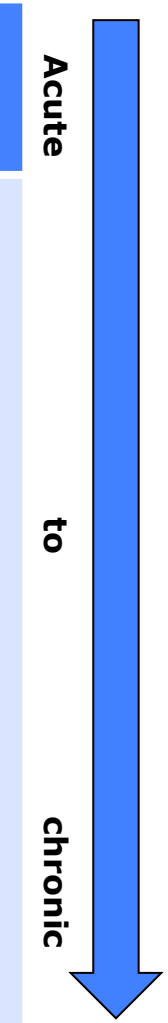
Cognitive constraints
(morphological changes in central cortex, e.g. hippocampus)

Decelerated wound healing & Changes in collagen and bone development

Respiratory diseases
(increase of allergic or autoimmune diseases)

Pain syndromes
(headache, Back pain)

Chronic fatigue syndromes



(McEwen et al., 2001; Rauh, 2010 , Wenning, 2000, Slade, 2012; Beckie et al. 2013, Juster et al., 2010)

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What's about stress and exercise?

Double-Edged Sword

Physical exercise as a buffer

- Physical exercise it regulates the body's physiological functions
  - Parasympathetic rebound effect
  - Practice effect
- Physical exercise reduces stress reactivity

Stress Buffer

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Stress and Exercise:

Positive effects of Exercise

Physical exercise may be a stressor to the body, in moderate amounts it regulates the body's physiological functions…..

Chronic stress	Moderate exercise
Increases heart rate	Decreases heart rate
Increases blood pressure	Decreases blood pressure
Increases muscle tension	Decreases muscle tension
Decreases resistance to illness and injury	Increases resistance to illness and injury
Increases body fat	Decreases body fat
Decreases heart rate variability and effciency of heart muscle	Increases efficiency of heart muscle
Bone demineralization	Decreased bone demineralization
Decreased general well-being	Greater general well-being

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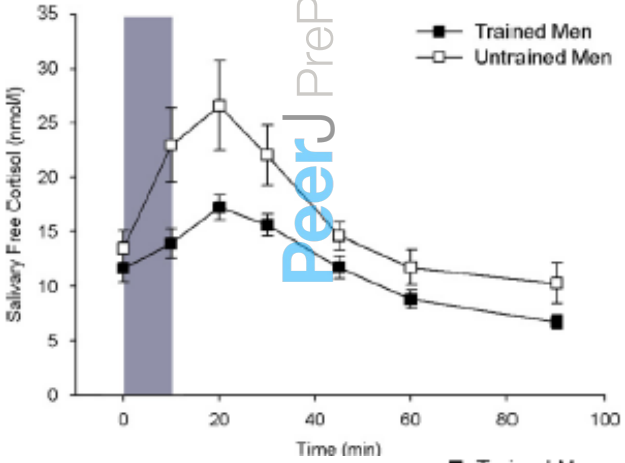
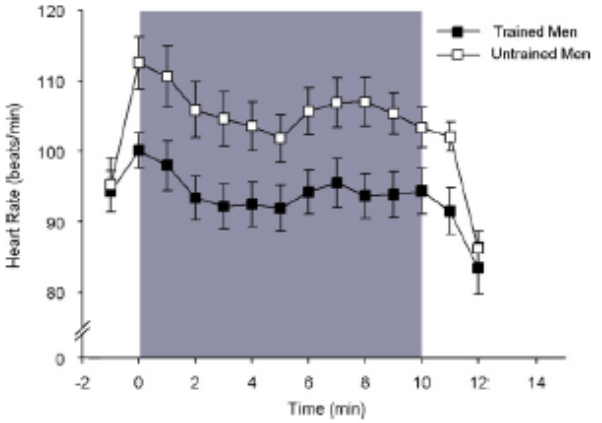
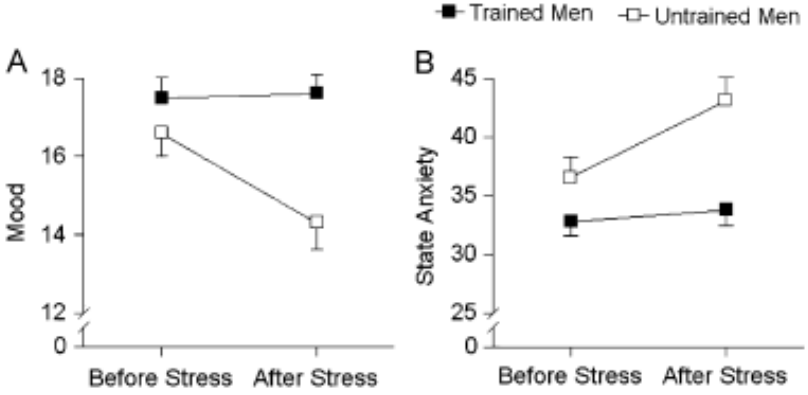
Stress reactivity and Exercise: Positive effects of Exercise

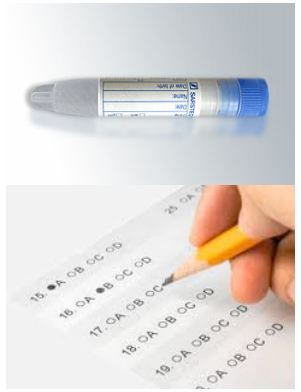
Decreased stress reactivity

A person who exercises regularly will have a higher threshold for physical and physiological stress and experience lower cortisol levels in reaction to a stressor than an inactive person.









Rimmele et al., 2007

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What's about stress and exercise?

Double-Edged Sword

Physical exercise as a stressor

- When a person exercises intensely, the body perceives this as a form of stress and releases cortisol

(Jakob, 2001; Kudielka & Wüst, 2009; Dickerson & Kemeny, 2004; Teschenmacher & Geiger, 1999)

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Stress and Exercise:

Negative effects of exercise

Hair Cortisol studies

Endurance sports *(Skoluda et al., 2011)*

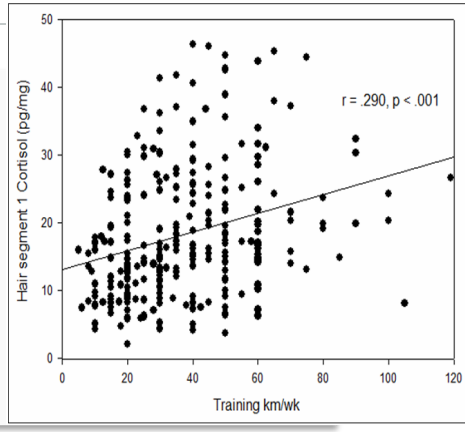
N = 374 (amateur athletes & non-athlete controls)

Elite athletes (Wippert et al., 2014)

N=47 (cortisol: elite athletes 26.6 ±18.6; non-athletes 13.8±8.8 pg·mg)

Non athletes & sport (Rector et al., 2013)

N=13 (frequency per week r=.61 (PE 2.9 ± 1.4 sessions/wk)



Chronic stress response

- The amount of cortisol produced by the body is in proportion to the intensity of the exercise or stressor
  - E.g. canoe reach up to 60 pg·mg
  - Ski jumpers reach up to 20 times higher epinephrine levels

- repeated or intense exercise can elicit a chronic stress response and can correspond to long-term negative effects of stress

Albinson & Petrie, 2003; Fletcher & Hanton, 2003; Fredericson et al., 2005; Mellalieu et al., 2009; Niemann, 2008; Skoluda, 2012, Wippert et al., in press)

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Exercise & stress related risks

More hyperactivity state

Delayed regeneration
(suppressed parasympathetic system)

Slower recovery from injuries
(changes in immune system, blood coagulation, wound healing)

Injury risk
(18-22% chronic stress, life stress 5x higher, life event in past 12 months 50-73%; e.g. decreased attention /increased muscle tension)

More hypoactivity state

Staleness, overtraining, fatigue states

Atypical depression

Pain syndromes

Symptom triad

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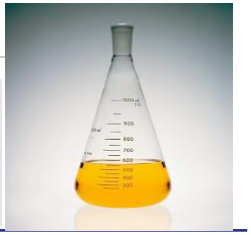
How to measure…



TYPE	Biomarker	ALI
NEUROENDOCRINE	Cortisol, Dehydroepiandrosterone, Epinephrine/Norepinephrine, Dopamine, Aldosterone	5
IMMUNE	Interleukin-6, Tumor necrosis factor-alpha, C-reactive protein, Insulin-like growth factor-1, Fibrinogen	5
METABOLIC	High density lipoprotein cholesterol, Low density lipoprotein cholesterol, Triglycerides, Glycosylated hemoglobin, Glucose Insulin, Albumin, Creatinine, Homocysteine	8
CARDIOVASCULAR AND RESPIRATORY	Systolic blood pressure, Diastolic blood pressure, Peak expiratory flow, Heart rate/pulse	4
ANTHROPOMETRIC	Waist-to-hip ratio, Body mass index	2
TOTAL SCORE	ALLOSTATIC LOAD	24

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Stress & Pain

authors	N	# AL	age	results
Slade et al., 2012	14.000	10	18-75	↑ Pain prevalence (headache, pain> 24h, diffuse pain)
Goertzel et al. (2006)	103	11	27-69	Chronic fatigue patients: ↑physical pain, ↑ symptom severity, ↓ physical functionality

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Thank you for your attention!

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