Stress in adolescent girls and boys

Perceived stress and psychobiological mechanisms among students with and without ADHD

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Questions

Are adolescent girls and boys stressed?

If so, is this reflected in their bodily functioning?

Are there differences between students with and without ADHD?
Starting point

- limited knowledge of adolescent girls and boys
- stress among students in compulsory school as a potential problem; risk for future health problems

- what is stress
  - how study stress?

- how do girls and boys talk about stress?
  - perceptions of stress
  - biomarkers of stress

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How research and measure stress?

Perceived stress: self-reports in questionnaires

Pressure Activation Stress-scale (PAS-scale)
Lindblad et al., 2008

Conceptually clear measure: measures stress (not complaints)

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Stress and support in school (FORTE research program)

The Complexity of Stress in Mid-Adolescent Girls and Boys
Findings from the Multiple Methods School Stress and Support Study

Viveca Östberg · Ylva B Almquist · Lisa Folkesson · Sara Brolin Låftman · Bitte Modin · Petra Lindfors

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Abstract In many Western countries adolescents, especially girls, report high levels of stress and stress-related health complaints. In this study we investigate the concept of stress in a group of 14–15 year-olds (grade 8 in two Stockholm schools) using a multiple methods approach. The aim is to analyse stress, and gender differences in stress, as indicated by a measure of perceived stress (questionnaires, n=212), the diurnal variation in the biomarker cortisol (saliva samples, n=108) and the students’ own accounts of stress (semi-structured interviews, n=49). The results were generated within the traditional framework of each method and integrated at the point of interpretation. The hypothesis that adolescent girls experience more stress than boys

schools
• 2 schools in Stockholm
• 19 classes
• schoolyears 8 & 9
• 14-16 year-olds

# of students
• about 545 invited

data
• ca 400 returned questionnaires
• 190 provided saliva samples
• interviews

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Perceived stress among students

Pressure and activation (PAS-scale; Lindblad et al., 2008)

Response alternatives: never, seldom, sometimes, often, always

**Pressure**
- I do **too many things** at the same time
- I feel under **pressure** from **school demands**
- I feel under **pressure** from **demands at home**
- I feel under **pressure** from my **inner demands**
- I feel **helpless**
- I don’t have **enough time**
- I **never** feel really **free**

**Activation**
- I **hurry** even if I don’t have to
- I **eat rapidly** even if I don’t have to
- I keep a **high speed** all the day
- I find it **difficult to relax**

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### PAS: girls and boys school years 8 and 9

<table>
<thead>
<tr>
<th>PAS-dimension</th>
<th>Girls</th>
<th>Boys</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>3.11</td>
<td>2.54</td>
<td>39.54***</td>
</tr>
<tr>
<td>Activation</td>
<td>3.33</td>
<td>2.70</td>
<td>23.06***</td>
</tr>
</tbody>
</table>

- statistically significant differences between **girls** (sometimes/often) and **boys** (seldom/sometimes)
- not associated with school year; small differences 8/9

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**PAS: girls and boys school years 8 and 9**

<table>
<thead>
<tr>
<th>Question</th>
<th>girls/boys</th>
<th>girls/boys</th>
<th>girls/boys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% seldom/never</td>
<td>% sometimes</td>
<td>% often/always</td>
</tr>
<tr>
<td><strong>PRESSURE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>too many things at the same time</td>
<td>8/28</td>
<td>26/36</td>
<td>65/36</td>
</tr>
<tr>
<td>pressure from school demands</td>
<td>8/35</td>
<td>25/26</td>
<td>67/39</td>
</tr>
<tr>
<td>pressure from demands at home</td>
<td>58/64</td>
<td>19/21</td>
<td>23/14</td>
</tr>
<tr>
<td>pressure own demands</td>
<td>12/32</td>
<td>20/29</td>
<td>68/39</td>
</tr>
<tr>
<td>helpless</td>
<td>55/84</td>
<td>31/6</td>
<td>14/8</td>
</tr>
<tr>
<td>not enough time</td>
<td>20/40</td>
<td>41/35</td>
<td>39/25</td>
</tr>
<tr>
<td>never fee</td>
<td>17/43</td>
<td>23/25</td>
<td>60/32</td>
</tr>
<tr>
<td><strong>ACTIVATION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hurry</td>
<td>31/55</td>
<td>35/28</td>
<td>33/17</td>
</tr>
<tr>
<td>eat fast</td>
<td>31/41</td>
<td>29/26</td>
<td>40/32</td>
</tr>
<tr>
<td>high speed all day</td>
<td>31/58</td>
<td>35/20</td>
<td>33/22</td>
</tr>
<tr>
<td>difficulties relaxing</td>
<td>24/57</td>
<td>35/23</td>
<td>40/20</td>
</tr>
</tbody>
</table>
PAS: with ADHD and without

Girls with ADHD higher levels of pressure than boys with ADHD

No differences for ADHD-subgroups: hyperactive/impulsive, unattentiveness, combinations

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### PAS: girls & boys with ADHD and without


<table>
<thead>
<tr>
<th>PAS</th>
<th>girls/boys with ADHD</th>
<th>with ADHD/without diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRESSURE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>too many things at the same time</td>
<td>*** girls more often</td>
<td>*** with ADHD more often</td>
</tr>
<tr>
<td>pressure from school demands</td>
<td></td>
<td>*** with ADHD more often</td>
</tr>
<tr>
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<td></td>
<td>*** with ADHD more often</td>
</tr>
<tr>
<td>pressure own demands</td>
<td>* girls more often</td>
<td></td>
</tr>
<tr>
<td>helpless</td>
<td>** girls more often</td>
<td>*** with ADHD more often</td>
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<td>not enough time</td>
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<tr>
<td>never fee</td>
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<td></td>
<td>*** with ADHD more often</td>
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</table>
How research and measure stress?

Perceived stress: reports in questionnaires

- girls report more activation and pressure than do boys
- students with ADHD report more activation and pressure than students without a diagnosis
- girls with ADHD report more pressure than do boys with ADHD

Conceptually clear measure: measures stress (not complaints)

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Biomarker of stress

**salivary cortisol**

= ?

“**stresshormone, stressmarker**”

- **“HPA-axis” activity**
  - hypothalamo-pituitary-adrenal axis
  - regulates cortisol
  - central function
  - pronounced diurnal rhythm

- **measured in saliva**
  - Salivette® tubes
  - non-invasive, easily accessible
  
  + **diary**, (electronic surveillance)

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Biomarkers: salivary cortisol

Salivary cortisol

- diurnal rhythm among girls and boys
- few studies investigating non-clinical groups of youth
- students themselves sample saliva + note details regarding confounders in diary

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1Department of Psychology, Stockholm University, Stockholm, Sweden, 2Centre for Health Equity Studies (CHESS), Stockholm University/Karolinska Institutet, Stockholm, Sweden

Abstract: The hypothalamic-pituitary-adrenal (HPA) axis, including its regulation of cortisol, is central to bodily functioning and salivary cortisol is a commonly used biomarker that reflects the functioning of the HPA axis. However, knowledge of diurnal cortisol rhythms in healthy adolescents is limited and few studies have examined patterns in midadolescent girls and boys across single and aggregate cortisol measures. To fill this gap, the present study investigated single and aggregate cortisol measures reflecting diurnal rhythms in 14 to 16-year-old girls and boys. Self-administered salivary samples from 79 girls and 42 boys were collected during two school days at four timepoints: (a) immediately at awakening, (b) 30 min after waking up, (c) 60 min after waking up, and (d) at 8:00 p.m. Additionally, diary data including time of awakening, sampling times, and other potential confounders were analyzed. As for single measures, both girls and boys exhibited a typical diurnal cortisol profile with high levels in the morning that decreased throughout the day. However, girls had higher morning cortisol than did boys with significant differences at time of awakening, and at 30 and 60 min postawakening. For the aggregate measures, girls had a larger total level of cortisol in terms of cortisol awakening response (CAR), area under the curve (AUCo), and rise over run (slope increase), while no differences emerged for reactivity measures. Taken together, these findings suggest differences in single and aggregate cortisol measures between midadolescent girls and boys. Such differences in diurnal cortisol between pubertal girls and boys may play a role for the differential health trajectories typically found among adult women and men.

Keywords: adolescence; covariates; gender; salivary cortisol measures

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Cortisol during two schooldays among girls and boys

**Girls** had **higher levels** of morning cortisol than did **the boys** statistically significant differences

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Cortisol during a schoolday among students with ADHD and without a diagnosis


students with ADHD have lower levels of morning cortisol than the others statistically significant differences

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Mind/body link: is the perception mirrored in cortisol?

Girls have higher levels of morning cortisol than do boys. Separate analysis of girls and boys takes confounders such as school year/age, menstruation (girls) and so on into account.

Results:

Pressure and activation are not significantly associated with cortisol neither for girls, nor for boys.

But pressure and activation are associated with subjective health complaints (pain, ache).

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Mind/body link: is the perception mirrored in cortisol?

Students with ADHD have lower levels of morning cortisol than do students without a diagnosis.

It takes age, ADHD-symptoms + other confounders into account.

Results:

Pressure and activation are not related to cortisol neither for students with ADHD or those without a diagnosis.

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alpha-amylase & cortisol during a schoolday

combine the 2
cortisol och amylas

investigate the interplay between different biomarkers reflecting different bodily systems

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alpha-amylase & cortisol during a schoolday

combine cortisol + amylase to investigate the interplay between different biomarkers (of stress) as related to perceived stress

Results

weak linkages between activation and pressure stress och and alpha-amylase and a combined ratio measure of alpha-amylase and cortisol but only for girls (few boys, small $n$)

most prominent for activation

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Conclusions...

- **Girls** in compulsory school, school years 8 + 9 report **higher levels of perceived stress** (pressure + activation) than do **boys**
  - in line with previous research of other dimensions of stress, using other self-report measures

- **Students with ADHD** report higher levels of perceived stress than do those without a diagnosis
  - in line with expectations

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- **girls** in school years 8 and 9 have **higher levels of morning cortisol** than do **boys**

- **students with ADHD** have **lower levels of morning cortisol** than do those without a diagnosis
  - few international and national studies of girls and boys
  - **girls** exhibit a pattern similar to that of adult **women**...
  - **boys** exhibit a pattern similar to that of adult **men**...

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- preliminary link between **perceived stress and alpha-amylase, ratio alpha-amylase/cortisol among girls** (few boys)

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- Preliminary link between **perceived stress and alpha-amylase**, ratio alpha-amylase/cortisol among **girls** (few boys)

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Other reports, longitudinal data

Health behaviors among school children in Sweden (HBSC) 2013/2014

- the majority of the students report that they have a good health and high well-being
- girls more health complaints than boys, high percentage of girls with two complaints
- The amount of students who like school very much is high, has never been higher

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- Royal Academy of Sciences

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- Victoria Blom (PhD) & Roberto Riva (PhD) who helped out along the way
- Emeritus Professor Ulf Lundberg & Lab engineer Ann-Christine Sjöbeck
- Professor Frank Lindblad and colleagues

- All staff at the schools, in particular the teachers

- Students and their parents

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