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Short Term Effects on Symptoms of Atopic Dermatitis in Children by Weather and Pollution

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SHORT TERM EFFECTS ON SYMPTOMS OF ATOPIC DERMATITIS IN CHILDREN BY WEATHER AND POLLUTION

Paolo Kinsella

Chemistry 101-007 | Fall Semester 2017 | Dr. Carlson
• What is atopic dermatitis? (AD)
  • An inflammatory skin disease that mainly affects young children (Kim et al, 1)
  • It affects the ability of your skin to hold moisture and causes skin to become irritated, itchy, and dry (‘Atopic Dermatitis (Eczema) – Topic Overview’)
• The cause is unclear but there are conditions that can make it worse
• The effects that air pollution and weather have on the condition have yet to be thoroughly investigated (Kim et al, 1)

[https://www.google.com/search?q=weather+and+pollution&rlz=1C1GGRV_enUS751US751&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjUjpe0_oTXAhXBKyYKHVVRAVcQ_AUICygC&biw=1366&bih=662#imgrc=Ir1k80FgmP-e0M]
WHY THIS IS IMPORTANT

• AD is increasing across the world. This abundance of the disease makes it a hot topic of interest for the health of the public

• As the changing climate of the planet has become more recognized as a major problem, the effects of certain factors of this change have become more of a concern when considering many diseases

• A panel study was done in Korea to find out what the short term effects of certain weather and pollution conditions are on the symptoms of AD in children

(Kim et al, 2)
METHODOLOGY

• 177 young patients from the Seoul area who had AD were enrolled in the study
• Between August of 2013 and December of 2014 they were followed and symptoms were recorded
• Weather variables such as average daily temperature, humidity, temperature range, and rainfall
• Pollutants such as nitrogen dioxide, ozone, and particulate matter (objects with diameter ≤ 10 µg, known as $PM_{10}$)

These were the weather and pollution factors estimated for their effects on AD symptoms

(Kim et al, 1)
FINDINGS

• Weather and pollution conditions were as follows:
  • Average daily mean temperature: 15.0 °C
  • Average daily humidity: 64.9%
  • Average diurnal temperature range: 8.9 °C
  • Average rainfall: 2.7 mm/day
  • Average concentration of $PM_{10}$: 45.2 $\mu$g/m$^3$
  • Average concentration of nitrogen dioxide ($NO_2$): 32.4 parts per billion (ppb)
  • Average concentration of ozone ($O_3$): 38.1 ppb

(Kim et al, 4)
Table 2. Summary of meteorological variables and air pollutant levels during the study period.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean ± SD(^a)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meteorological variable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>15.0 ± 9.7</td>
<td>-11.2</td>
<td>32.0</td>
</tr>
<tr>
<td>DTR(^b) (°C)</td>
<td>8.9 ± 3.0</td>
<td>1.6</td>
<td>22.2</td>
</tr>
<tr>
<td>Relative humidity (%)</td>
<td>64.9 ± 14.3</td>
<td>26.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Rainfall (mm/day)</td>
<td>2.7 ± 9.7</td>
<td>0.0</td>
<td>157.5</td>
</tr>
<tr>
<td><strong>Air pollutant</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM(_{10}) (µg/m(^3))</td>
<td>45.2 ± 26.4</td>
<td>3.6</td>
<td>193.7</td>
</tr>
<tr>
<td>NO(_2) (ppb)</td>
<td>32.4 ± 13.4</td>
<td>1.0</td>
<td>104.5</td>
</tr>
<tr>
<td>O(_3) (ppb)</td>
<td>38.1 ± 20.3</td>
<td>1.1</td>
<td>123.0</td>
</tr>
</tbody>
</table>

\(^a\)SD: standard deviation; 
\(^b\)DTR: diurnal temperature range.

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This table shows averages as well as standard deviation and extreme values recorded (Kim et al, 5)
FINDINGS

• When daily mean temperatures increased, a decrease in symptoms were associated.
• An increase in relative humidity was associated with a decrease in the risk of symptoms.
• An increase in the temperature range was found to bring about an increase in symptoms.
• AD symptoms increased with rainfall amounts.
• All pollutants were associated with an increase in symptoms.

(on next slide)

(Kim et al, 4-5)
Fig 2. Effects of meteorological variables and air pollution on Atopic Dermatitis (AD) symptoms by moving average. Data represent percent changes and 95% confidence intervals in AD symptoms per 5-unit increase in daily mean temperature (°C), relative humidity (%), diurnal temperature range (°C) and 10-unit increase in PM$_{10}$ (µg/m$^3$), NO$_2$ (ppb), and O$_3$ (ppb). RH: relative humidity; DTR: diurnal temperature range; MA: moving average.

% change of risk on the y-axis shows the influence of various weather and pollution factors on symptoms (Kim et al, 6)
CONCLUSION

There is a strong correlation between AD symptoms and these weather and pollution variables

• Increases in temperature and relative humidity had the affect of reducing AD symptoms while increases in rainfall and temperature range aggravated the symptoms

• All air pollutants aggravated the symptoms of AD

• The relationship between AD and daily temperature change had not been reported yet and in this study, it was found that symptoms of AD increased by 284.9% for every 5 °C increase when above 14 °C

(Kim et al, 7-8)
CONCLUSION

• The recommendation that humidity and temperature should be considered for the alleviation of symptoms is supported by these results. Other studies have presented opposing findings, however
• Region and time of year may have something to do with results
• In order to come to a more confident conclusion, more studies will need to be done

(Kim et al, 8)
• Thanks to climate change, more extreme weather events are expected as we move forward in time
• Human activity will continue to increase the number of pollutants in the air
• This will not be good for those who suffer from AD and makes this issue a very important one that should continue to be studied

(Kim et al, 9)
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