Use of stress hormone analyses in hair for diagnosis and stress management

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There are different stress hormone (cortisol) biomarkers.

Table 1  A comparison of properties of the various matrices for cortisol measurement.

<table>
<thead>
<tr>
<th>Property</th>
<th>Serum</th>
<th>Saliva</th>
<th>Urine</th>
<th>Hair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective level of invasiveness associated with sample collection</td>
<td>High</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
</tr>
<tr>
<td>Cortisol affected by stress of sampling procedure?</td>
<td>Possibly</td>
<td>Possibly</td>
<td>Possibly</td>
<td>No</td>
</tr>
<tr>
<td>Storage requirements</td>
<td>Spinning and refrigeration</td>
<td>Refrigeration or freezing</td>
<td>Refrigeration or freezing</td>
<td>Room temperature; stable for years</td>
</tr>
<tr>
<td></td>
<td>followed by freezing</td>
<td>Single point measure</td>
<td>12–24 h; integral of exposure</td>
<td>Months to years; integral of exposure</td>
</tr>
<tr>
<td>Time periods of cortisol production represented</td>
<td>Single point measure</td>
<td>No; only free cortisol measured</td>
<td>No; only free cortisol measured</td>
<td>No; only free cortisol measured</td>
</tr>
<tr>
<td>Affected by changes in cortisol binding globulin?</td>
<td>Yes; total cortisol measured</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Clinically relevant reference ranges established?</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Proposed cortisol incorporation into hair.
The advantages of hair cortisol measurements.

1. Non-invasive procedure.
2. No problems with storage of samples.
3. Uses well-developed and standardized cortisol assays (saliva).
4. No problem with stress during sampling.
5. Can be used to determine chronic stress levels.
6. Can be used to track stressful periods in the patients’ / clients’ life.
7. Can be used in both humans and animals.

Critical issues
1. Extraction procedure.
2. Determination of reference ranges.
3. Standardization of procedures.
Examples of stress hormone analyses performed by Chardon Pharma.
Women with endometriosis are chronically stressed.

Van Aken et al., 2018

pg cort / mg hair

Contr  Endo
31     31

*
Conventional housing of pigs is more stressful than biological housing.
Pregnant rabbits have low corticosterone levels.

![Graph showing pg cort/mg hair levels for different groups: Male, Female not pregnant, Female 1 day pregnant, Female 1 week pregnant. The graph indicates lower corticosterone levels in pregnant females compared to other groups.]
Homozygous Ndufs4def mice have increased hair corticosterone levels.