A QUANTITATIVE TEST FOR SMALL AMOUNTS OF SUGAR IN THE URINE.

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A rapid, accurate method for the determination of small amounts of sugar in the urine is not available at present. To overcome this uncertainty, a micro method was adopted. By adapting the blood sugar method of Lewis and Benedict,1 even traces of urinary sugar may be determined quantitatively with great precision.

Since the colorimetric estimation of Lewis and Benedict depends upon the reaction of the sugar with alkali and picric acid, and a similar color reaction is obtained by the action of alkali and picric acid on the creatinine and other substances normally present in urine, these must be removed before the method can be applied. Normal urines without sugar yield a color reaction with the Lewis and Benedict method equivalent to 0.05 to 0.1 per cent glucose. In order to remove these interfering substances, the process recently suggested by Folin2 was used.

The complete method is as follows:

To about 10 cc. of urine are added 2 gm. of picric acid and 2 gm. of bone-black, the mixture is shaken for about 5 minutes and filtered.3 2 cc. of this filtrate are used for the determination, and placed in a 25 cc. volumetric flask. Then 15 cc. of saturated aqueous solution of picric acid are added and the flask is filled to the mark with distilled water and shaken. Filtration at this point is not necessary. 8 cc. aliquots are measured into large Jena test-tubes for duplicate determinations. 2 cc. of saturated picric acid solution and exactly 1 cc. of 10 per cent sodium carbonate are added, then one drop of mineral oil, and the contents of the flask are evaporated rapidly over a direct flame until pre-


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Sugar in the Urine

Precipitation occurs. About 3 cc. of water are added, the tube is again heated to boiling to dissolve the precipitate, the contents of the tube are cooled, transferred quantitatively to a 10 cc. volumetric flask, made up to mark, shaken, and then filtered through cotton into the colorimeter chamber. The color is compared with a picramic acid standard:

Picramic acid ........................................... 0.064 gm.  
Sodium carbonate (anhydrous) .............................. 0.100 “  
Water to make ........................................... 1,000 cc.

Calculation:

\[
\text{Per cent of sugar} = \frac{\text{Reading of standard}}{\text{Reading of unknown}} \times 0.1
\]

Tables I and II indicate that creatinine and other substances which give a color reaction with alkaline picrate are entirely removed by the picric acid and bone-black process.

TABLE I.

The Method Applied to Glucose Added to Urine.

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Substance added</th>
<th>Preliminary treatment</th>
<th>Result, glucose per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine</td>
<td>None</td>
<td>None</td>
<td>0.084</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 per cent glucose</td>
<td>None</td>
<td>0.183</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 &quot; &quot; &quot;</td>
<td>Bone-black</td>
<td>0.024</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 &quot; &quot; &quot;</td>
<td>&quot; + picric acid</td>
<td>0.100</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 &quot; &quot; &quot;</td>
<td>Bone-black</td>
<td>0.128</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 &quot; &quot; &quot;</td>
<td>&quot; + picric acid</td>
<td>Not readable.</td>
</tr>
</tbody>
</table>

TABLE II.

The Method Applied to a Pentose.

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Substance added</th>
<th>Preliminary treatment</th>
<th>Result, glucose per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine</td>
<td>None</td>
<td>None</td>
<td>0.054</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 per cent l-xylose</td>
<td>&quot;</td>
<td>0.153</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 &quot; &quot; &quot;</td>
<td>Bone-black</td>
<td>0.070</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 &quot; &quot; &quot;</td>
<td>Picric acid</td>
<td>0.153</td>
</tr>
<tr>
<td>&quot;</td>
<td>0.1 &quot; &quot; &quot;</td>
<td>Bone-black + picric acid</td>
<td>0.101</td>
</tr>
</tbody>
</table>
As the tables show, this procedure is applicable to urines containing pentoses as well as glucose. The method proved to be valuable in estimating the quantity of sugar excreted in a case of pentosuria, in which the concentration of this sugar was only 0.1 to 0.3 per cent.

After the completion of the above article the writer's attention was called to a method published by V. C. Myers, which is similar to, but not identical with her own.

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