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Effect of Storage on Some Blood and Serum Constituents

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Abstract:
Objective: To examine the possibility that the storage of blood or serum can cause an effect on some blood parameters, the concentrations of total cholesterol (TC), urea, uric acid, Sodium (Na⁺), potassium (K⁺) and chloride (Cl⁻) were determined in the blood or serum samples, stored at 4°C, during 0, 2, 4, 6 hours as well as at 1, 2 and 6 days.

Keywords: Storage, blood, serum, constituents.

Method:
A total of 56 subjects (35 males and 21 females), mean of age was 21 years (range: 19-23 years) were selected for the study. They were non-smokers, apparently, healthy persons, their weights within normal range, and they had no family history of diseases and no drug had been taken in last week. Blood samples were collected after an average fasting for 12 hours, and the concentrations of TC, urea, uric acid, Na⁺, K⁺ and Cl⁻ were determined immediately (i.e the zero time) and then later after 2, 4, 6 hours and 1, 2 and 6 days. All samples were stored at 4°C,

Results:
The passage of the time affects the concentration of many blood constituents once it has been shed from the body. In the serum sample and during 6 days of storage at 4°C, the concentrations of TC and electrolytes (Na⁺, K⁺ and Cl⁻) approximately remained constant. However, the concentrations of urea and uric acid were non – significantly lowered. In plasma, analysis was made immediately after blood collection and after 2, 4, 6 and 24 hours. A significant increase in the concentration of potassium ion and non- significant decreases in the concentration of urea and uric acid were observed during the storage of whole blood in a plane tube at 4 °C for 24 hours.

Conclusion:
Based on these results, we can conclude that a contact between red blood cells and plasma stored at 4°C for an over night or even a short period, may produce changes in many blood parameters.

Introduction:
Blood is a fluid substance that circulates in arteries and veins of the body. It is composed of plasma, which constitutes 55% of the volume of the blood and millions of cells, which constitute about 45% of its volume. The total blood volume is about 5 liters in average. Plasma is a complex substance, its principal component is water. It also contains plasma protein, inorganic substances such as sodium, potassium, calcium, chloride, carbonate and bicarbonate, sugars, hormones, enzymes, fats, amino acids and such waste products as
urea and creatinine. On the other hand, serum is the fluid obtained after the removal of one of plasma protein components, i.e., fibrinogen.

Since blood is the major circulating fluid in the body, and it cannot be compensated by another substance, whether natural or synthetic. The subject of blood storage has got an increasing importance, and it has got a lot of attention. As well, the analysis of the blood constituents has an important role in the diagnosis of diseases, and since the immediate analysis of the blood sample collected may not be always possible, the idea of the blood storage and its effect on different constituents of the blood become very important for right diagnosis. This study was done to assess the effect of the storage at 4°C for a variable time on different blood constituents.

Method:
This study was conducted during the period of September 2001 until the end of February 2002. A total of 56 (35 males and 21 females), mean of age was 21±2 years (range: 19-23 years), were selected for the study. They were non-smokers, apparently healthy, their weights within normal range, and they had no family history of diseases and no drug had been taken in the last week. The participants were mainly selected from undergraduate students at the College of Medicine, University of Basrah. Ten ml of venous blood-samples after an average fasting of 12 hours were drawn through a sterile disposable syringe. Serum was immediately separated by low-speed-centrifugations, and the concentrations of TC, urea, uric acid, Na⁺, K⁺ and Cl⁻ were determined immediately (i.e., the zero time) and then later after 1,2 and 6 days of storage at 4°C, other samples of 10 ml were drawn by venipuncture for the determination of all the above parameters after the contact between red blood cells and plasma for 2,4,6 and 24 hours. All samples were stored at 4°C. The biochemical parameters were performed in the Department of Biochemistry, College of Medicine, University of Basrah. Serum cholesterol, urea and uric acid were determined by standard methods using kits from BioMerieux, France. Serum sodium and potassium concentrations are measured using Flame Emission Photometry Method. Serum chloride levels the determined by Coulometric Titration Method using Chloride meter Coming EEL. Quality control sera from BioMerieux were included in each assay batch for the all above data. The results values were presented as mean±SD. Student “t” test was used for comparison of data. For all analysis, a value of 0.05 was considered significant.

Results:
Characteristics of all subjects who participated in this prospective study are summarized in Table 1. The effect of the storage on the concentrations of total serum cholesterol, urea, uric acid, sodium, potassium and chloride in a serum sample is presented in Table 2. During 6 days of storage at 4°C, the concentrations of total cholesterol and electrolytes are approximately remained constant, however, the concentrations of urea and uric acid were non-significantly lowered when compared to their values on the zero time and on the first day (P>0.05).

Table 3 shows the effect of the storage at 4°C, on the concentrations of TC, urea, uric acid and electrolytes in the plasma in contact with RBC for a period of 2,4,6 and 24 hours.

A significant increase in the concentration of potassium (P<0.05) and non-significant decreases (P>0.05) in the concentrations of urea and uric acid were observed during the storage of whole blood in a plane tube at 4°C. This increase was approximately more with the increase in the storage of time (i.e., 24 hours). However, the concentrations of TC, Na⁺ and Cl⁻ remain approximately constant.

Discussion:
By examining the data in Table 2 we can observe that in serum sample, the electrolytes and cholesterol were not affected by time, since their levels remained approximately constant. The other two components showed non-significant decreases in their levels. This is mostly due to inappropriate storage conditions. Regarding urea, it might be unstable under storage conditions, due to its high content of nitrogen, so a small amount of it may be converted back into ammonia. The uric acid also showed a decrease in its...
Table 2. Effect of the storage, at 4°C, on the concentrations of TC, urea, uric acid, Na⁺, K⁺ and Cl⁻ in a serum sample (N=56)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>0 time</th>
<th>1 day</th>
<th>2 days</th>
<th>6 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>187.9 ± 28.6</td>
<td>189.6 ± 31.4</td>
<td>186.7 ± 26.4</td>
<td>185.2 ± 27.3</td>
</tr>
<tr>
<td>Urea (mg/dl)</td>
<td>29.3 ± 4.6</td>
<td>27.6 ± 5.2</td>
<td>25 ± 5.4</td>
<td>24.2 ± 4.6</td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>5.6 ± 0.8</td>
<td>5.4 ± 0.9</td>
<td>5.1 ± 1.0</td>
<td>4.8 ± 0.7</td>
</tr>
<tr>
<td>Sodium (mEq/L)</td>
<td>137 ± 5.6</td>
<td>140 ± 4.2</td>
<td>139 ± 3.2</td>
<td>140 ± 3.0</td>
</tr>
<tr>
<td>Potassium (mEq/L)</td>
<td>3.9 ± 0.33</td>
<td>3.8 ± 0.28</td>
<td>4.1 ± 0.27</td>
<td>4.0 ± 0.24</td>
</tr>
<tr>
<td>Chloride (mEq/L)</td>
<td>99 ± 4.1</td>
<td>100 ± 4.7</td>
<td>99 ± 4.4</td>
<td>97 ± 3.5</td>
</tr>
</tbody>
</table>

Table 3. Effect of the storage, at 4°C, on the concentrations of TC, urea, uric acid, Na⁺, K⁺ and Cl⁻ in plasma in contact with Red Cells (N=56).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>0 time</th>
<th>2 hours</th>
<th>4 hours</th>
<th>6 hours</th>
<th>24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>171 ± 29</td>
<td>173 ± 31</td>
<td>175 ± 28</td>
<td>172 ± 33</td>
<td>169 ± 32</td>
</tr>
<tr>
<td>Urea (mg/dl)</td>
<td>25 ± 4.3</td>
<td>24 ± 3.9</td>
<td>22 ± 3.6</td>
<td>21.7 ± 4.2</td>
<td>20 ± 4.3</td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>5.2 ± 0.6</td>
<td>4.8 ± 0.9</td>
<td>4.7 ± 1.1</td>
<td>4.5 ± 0.8</td>
<td>4.2 ± 1.1</td>
</tr>
<tr>
<td>Sodium (mEq/L)</td>
<td>140 ± 3.1</td>
<td>139 ± 2.9</td>
<td>138 ± 2.8</td>
<td>139 ± 3.2</td>
<td>138 ± 3.3</td>
</tr>
<tr>
<td>Potassium (mEq/L)</td>
<td>3.7 ± 0.24</td>
<td>3.85 ± 0.3</td>
<td>4.1 ± 0.27</td>
<td>4.4 ± 0.25</td>
<td>4.8 ± 0.25</td>
</tr>
<tr>
<td>Chloride (mEq/L)</td>
<td>100 ± 4.1</td>
<td>98 ± 3.9</td>
<td>96 ± 4.2</td>
<td>97 ± 3.8</td>
<td>96 ± 3.7</td>
</tr>
</tbody>
</table>

*p < 0.05

References:

تأثير الخضرة على بعض مكونات الدم ووصل الدم

لمياء مصطفى النحاس، جمال أحمد عبدالباري، عبدالقادر عبد الوهاب

الخلاصة:
لدراسة خصائص احتمالية خضرة نموذج الدم أو معدل الدم من أن يسبب تغير عوامل مكونات الدم، تم تنفيذ
مختبرات الكولسترول الكلي، جوهر البول، حمض البوليك، الصوديوم، البوتاسيوم، والكالسيوم في نموذج بلازما
الدم، ومضمون الدم خلال فترة خضرة لمدة 2، 4، 6 ساعة و0، 2 و6 يوم، تم اختيار 56 شخصًا (35 من الذكور و
21 من الإناث) معدل عمرهم 9 سنة (تتراوح في مساحة 19-23 سنة)، كان جميعهم من غير المدخنين والذين هم ضعيفا
 الصحية، لم يتم استخدامهم ضمن اجتماع الطبيبة، والذين لذا، لم يتم من خلال مشاكل صحية من غير المعتاد من الدراسة. وقد تم قياس محتوى كولسترول الكلي، حمض البول، صوديوم، البوتاسيوم، الصوديوم
، البوتاسيوم والكالسيوم في الأثناء. 0، 4، 6 ساعة و0، 1 و2 و6 يوم، من مضمن الوقت أو الخضرة للدم
، كل من على تركيز بعض مكونات الدم، في نموذج الدم خلال فترة الخضرة السابقة 6 يوم، لم يؤثر الخضرة على
تركيز الكولسترول الكلي، الصوديوم، البوتاسيوم والكالسيوم، وتيت تراكيزهم تقريبا بالذات بينما أثر الخضرة على تركيز
جوهر البول، حمض البوليك، ومضمون البوليكين، ومضمون الكالسيومية.

أما في نموذج من بلازما الدم فإن تأثير الخضرة لمدة 2، 4، 6 و24 ساعة قد سبب ارتفاعًا ملاحظًا في
البوتاسيوم، لكنه خفيفًا في مكونات جوهر البول، حمض البوليك، عندما خضع نموذج الدم بدرجة 4، 6، 14 htmlFor
24 ساعة، واستعدادا لهذه النتائج، نوصي بصورة فضفاضة قسم دوالي الدم عن كريات الدم الحمراء لأن نقاء قريات الدم
الحمضاء لمدة 24 ساعة أو أقل نون قصيده تؤدي إلى حدوث تغيرات بعض مكونات الدم.