Background

- 0.9% sodium chloride IV fluid (normal saline) is critical in a clinical setting and may save lives [1].
- It is a cornerstone of intravenous solutions commonly used in the clinical setting (hospitals, clinics, recovery center and other) [2].
- Normal saline is an isotonic concentration of sodium chloride, which is best suited for parenteral replacement of chloride losses that exceed or equal the sodium loss [3,4].
- In the GCC region including Qatar, temperature value may rise over 50℃, according to climate data from Civil Aviation Authority of Qatar [5].

Objectives

Data on thermal stability of normal saline, in out-of-hospital settings, are lacking. The aim of this study was to evaluate the effect of temperature on normal saline stability at constant temperature of 22, 50, or 70 ℃, and at cyclic temperature of 70 ℃ for 8 hours and 22 ℃ for 16 hours for a period up to 28 days.

Methods

- Normal saline provided in flexible plastic containers (Qatar Pharma, BA:1929013008, n=96) were stored at constant temperature of 22, 50, or 70 ℃, and at cyclic temperature of 70 ℃ for 8 hours and 22 ℃ for 16 hours for a period up to 28 days.
- The containers were sampled at 0, 12, 24, 48 and 72 hours and at 1, 2, 3, and 4 weeks in the short- and long-term study, respectively.
- A 1 mL of normal saline was withdrawn from each container and stored at 4 ℃ until analysis. A 20 μL was diluted in 12 mL distilled water to be injected into ion exchange chromatography instrument (Metrohm, 850 Professional IEC) for the measurement of sodium and chloride levels.

Limitation

- Exclusion of relative humidity value and temperature over 70 ℃ in this thermal stability study.
- Storage in the cabinet of ambulance vehicles during hot summer season in an arid country like Qatar is to be assessed in real-life conditions.

Recommendations

- Normal saline containers are stable up to 4 weeks under simulated constant and cyclic high temperatures.
- The flexible plastic container can withstand heat up to 70 ℃.
- The physical properties of normal saline (color and clarity) is not changed under this study thermal conditions.
- We aim to collaborate with Hamad Medical Corporation Ambulance Service in Qatar to study the thermal stability of normal saline in out-of-hospital settings.

Results

- Discoloration or turbidity of normal saline fluid was not observed at any temperature or exposure period.
- The container slightly bulged at 50℃ and largely bulged at 70℃ & cyclic.
- The pH was 5.90±0.08 at 22℃, 5.73±0.04 at 50℃, 5.86±0.02 at 70℃ and 5.79±0.03 at cyclic.

<table>
<thead>
<tr>
<th>Time (Weeks)</th>
<th>Na⁺ (% Remaining ± SD)</th>
<th>Time (Hours)</th>
<th>Cl⁻ (% Remaining ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100±0.86</td>
<td>1</td>
<td>100±1.80</td>
</tr>
<tr>
<td>1</td>
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<td>12</td>
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<tr>
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<td>100±0.55</td>
</tr>
<tr>
<td>3</td>
<td>100±0.86</td>
<td>72</td>
<td>100±0.70</td>
</tr>
</tbody>
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Acknowledgment