CHAPTER—I

SECTION—A

BLOOD ASCORBIC ACID AND DEHYDROASCORBIC ACID LEVELS
IN HUMAN SUBJECTS UNDER DIFFERENT STRESS CONDITIONS
Ascorbic acid (AA) utilisation is greatly increased in stress. Seriously injured human physiologically behaves in a manner similar to what is observed in case of scorbutic (Levenson et al., 1957). Physical stress such as occurs during surgical operation or following severe burns or shock of any type results in a sharp fall of ascorbic acid in circulation and the amount excreted in the urine with or without loading test (Lund and Crandon, 1941; Lund et al., 1947).

In this Chapter results have been presented (Tables 1.2 through 1.5) on the blood AA and dehydroascorbic acid (DHA) levels in human subjects experiencing a variety of stressful conditions such as severe head injury, fracture, lacerated injury, crush injury and burns. The values from normal subjects are given in Table 1.1. Pregnancy after onset of labour is a natural stressful condition. Table 1.8 gives result on blood AA and DHA level in pregnancy during labour.

According to Vanderkamp (1966) schizophrenics metabolised ascorbic acid at a very high rate. Pauling (1968) introduced the concept of orthomolecular psychiatry and recommended much higher doses of ascorbic acid for treating cases of mental disorders. In this Chapter (Table 1.9) results have also been presented on blood AA and DHA levels of patients with mental disorder. All the mental patients were newly diagnosed untreated cases.
Collective evidences suggest that ascorbic acid utilization is increased in the development and progress of cancer (Cameron et al., 1979). Plasma ascorbic acid concentrations are reduced in cases of leukemia (Wilson, 1975; Cameron et al., 1979). Over and above, both carcinoma and leukemia are intense form of biochemical stress. Tables 1.6 and 1.7 give results on the blood AA and DHA levels of patients suffering from carcinoma and leukemia. To avoid effects of different anticancer drugs and radiations on metabolism, the patients examined were all newly diagnosed untreated cases.
### Table 1.1

Blood AA, DHA levels in normal human subjects

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Blood AA mg/dl</th>
<th>Blood DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29 M</td>
<td>0.79</td>
<td>0.05</td>
</tr>
<tr>
<td>2</td>
<td>19 M</td>
<td>0.66</td>
<td>0.04</td>
</tr>
<tr>
<td>3</td>
<td>29 M</td>
<td>0.39</td>
<td>0.04</td>
</tr>
<tr>
<td>4</td>
<td>18 M</td>
<td>0.20</td>
<td>0.01</td>
</tr>
<tr>
<td>5</td>
<td>49 M</td>
<td>0.48</td>
<td>0.04</td>
</tr>
<tr>
<td>6</td>
<td>15 M</td>
<td>0.78</td>
<td>0.07</td>
</tr>
<tr>
<td>7</td>
<td>38 M</td>
<td>0.80</td>
<td>0.10</td>
</tr>
<tr>
<td>8</td>
<td>61 M</td>
<td>0.50</td>
<td>0.02</td>
</tr>
<tr>
<td>9</td>
<td>27 M</td>
<td>0.30</td>
<td>0.02</td>
</tr>
<tr>
<td>10</td>
<td>20 M</td>
<td>0.64</td>
<td>0.03</td>
</tr>
<tr>
<td>11</td>
<td>51 M</td>
<td>0.78</td>
<td>0.10</td>
</tr>
<tr>
<td>12</td>
<td>18 M</td>
<td>0.37</td>
<td>0.02</td>
</tr>
<tr>
<td>13</td>
<td>24 M</td>
<td>0.48</td>
<td>0.02</td>
</tr>
<tr>
<td>14</td>
<td>31 M</td>
<td>0.30</td>
<td>0.02</td>
</tr>
<tr>
<td>15</td>
<td>34 M</td>
<td>0.57</td>
<td>0.05</td>
</tr>
<tr>
<td>16</td>
<td>54 M</td>
<td>0.70</td>
<td>0.10</td>
</tr>
<tr>
<td>17</td>
<td>30 M</td>
<td>0.70</td>
<td>0.10</td>
</tr>
<tr>
<td>18</td>
<td>18 M</td>
<td>0.55</td>
<td>0.07</td>
</tr>
<tr>
<td>19</td>
<td>41 M</td>
<td>0.57</td>
<td>0.06</td>
</tr>
<tr>
<td>20</td>
<td>36 M</td>
<td>0.54</td>
<td>0.15</td>
</tr>
</tbody>
</table>
**Table 1.1 (Contd.)**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Blood AA mg/dl</th>
<th>Blood DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>42 M</td>
<td>0.40</td>
<td>0.02</td>
</tr>
<tr>
<td>22</td>
<td>32 M</td>
<td>0.90</td>
<td>0.15</td>
</tr>
<tr>
<td>23</td>
<td>52 M</td>
<td>0.72</td>
<td>0.13</td>
</tr>
<tr>
<td>24</td>
<td>32 M</td>
<td>0.72</td>
<td>0.10</td>
</tr>
<tr>
<td>25</td>
<td>43 M</td>
<td>0.50</td>
<td>0.04</td>
</tr>
<tr>
<td>26</td>
<td>18 F</td>
<td>0.79</td>
<td>0.05</td>
</tr>
<tr>
<td>27</td>
<td>17 F</td>
<td>0.79</td>
<td>0.15</td>
</tr>
<tr>
<td>28</td>
<td>58 F</td>
<td>0.55</td>
<td>0.05</td>
</tr>
<tr>
<td>29</td>
<td>31 F</td>
<td>0.55</td>
<td>0.04</td>
</tr>
<tr>
<td>30</td>
<td>33 F</td>
<td>0.80</td>
<td>0.10</td>
</tr>
<tr>
<td>31</td>
<td>34 F</td>
<td>0.50</td>
<td>0.04</td>
</tr>
<tr>
<td>32</td>
<td>42 F</td>
<td>0.65</td>
<td>0.08</td>
</tr>
<tr>
<td>33</td>
<td>23 F</td>
<td>0.50</td>
<td>0.04</td>
</tr>
<tr>
<td>34</td>
<td>28 F</td>
<td>0.56</td>
<td>0.08</td>
</tr>
<tr>
<td>35</td>
<td>35 F</td>
<td>0.36</td>
<td>0.06</td>
</tr>
<tr>
<td>36</td>
<td>35 F</td>
<td>0.48</td>
<td>0.04</td>
</tr>
<tr>
<td>37</td>
<td>45 F</td>
<td>1.35</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Intakes of vitamin C tablets were nil

n = 37 (25M, 12F)

Blood AA — 0.60 ± 0.20 S. D.

Blood DHA — 0.06 ± 0.04 S. D.
Table 1.2

Blood AA and DHA levels in human subjects with severe head injury. The patients were unconscious.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>AA (mg/dl)</th>
<th>DHA (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60 M</td>
<td>trace</td>
<td>1.20</td>
</tr>
<tr>
<td>2</td>
<td>30 M</td>
<td>trace</td>
<td>1.40</td>
</tr>
<tr>
<td>3</td>
<td>16 M</td>
<td>trace</td>
<td>0.76</td>
</tr>
<tr>
<td>4</td>
<td>40 M</td>
<td>trace</td>
<td>1.64</td>
</tr>
<tr>
<td>5</td>
<td>28 M</td>
<td>trace</td>
<td>0.68</td>
</tr>
<tr>
<td>6</td>
<td>28 F</td>
<td>trace</td>
<td>0.68</td>
</tr>
<tr>
<td>7</td>
<td>35 M</td>
<td>trace</td>
<td>0.92</td>
</tr>
<tr>
<td>8</td>
<td>22 M</td>
<td>trace</td>
<td>0.60</td>
</tr>
<tr>
<td>9</td>
<td>50 F</td>
<td>trace</td>
<td>0.96</td>
</tr>
<tr>
<td>10</td>
<td>42 F</td>
<td>trace</td>
<td>1.04</td>
</tr>
<tr>
<td>11</td>
<td>18 M</td>
<td>trace</td>
<td>1.40</td>
</tr>
<tr>
<td>12</td>
<td>17 F</td>
<td>trace</td>
<td>1.10</td>
</tr>
<tr>
<td>13</td>
<td>23 M</td>
<td>trace</td>
<td>1.20</td>
</tr>
<tr>
<td>14</td>
<td>20 M</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>15</td>
<td>54 M</td>
<td>trace</td>
<td>0.92</td>
</tr>
<tr>
<td>16</td>
<td>44 M</td>
<td>trace</td>
<td>0.82</td>
</tr>
<tr>
<td>17</td>
<td>26 M</td>
<td>trace</td>
<td>1.08</td>
</tr>
<tr>
<td>18</td>
<td>45 M</td>
<td>trace</td>
<td>0.92</td>
</tr>
</tbody>
</table>
Table 1.2 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>27 F</td>
<td>trace</td>
<td>0.64</td>
</tr>
<tr>
<td>20</td>
<td>25 M</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>21</td>
<td>11 F</td>
<td>trace</td>
<td>0.70</td>
</tr>
<tr>
<td>22</td>
<td>35 M</td>
<td>trace</td>
<td>0.38</td>
</tr>
<tr>
<td>23</td>
<td>50 F</td>
<td>trace</td>
<td>0.64</td>
</tr>
<tr>
<td>24</td>
<td>22 M</td>
<td>trace</td>
<td>1.28</td>
</tr>
<tr>
<td>25</td>
<td>50 M</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>26</td>
<td>20 F</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>27</td>
<td>42 M</td>
<td>trace</td>
<td>0.90</td>
</tr>
<tr>
<td>28</td>
<td>17 M</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>29</td>
<td>58 M</td>
<td>trace</td>
<td>0.84</td>
</tr>
</tbody>
</table>

\[ n = 29 (21M, 8F) \]

AA = trace, DHA = 0.92 ± 0.27 S.D.

In all the above cases sample was drawn within 24 hrs of the injury vitamin C tablet and steroid intakes were nil.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Nature of fracture</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28 M</td>
<td>Compression fracture, lumbar vertebra</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>2</td>
<td>62 F</td>
<td>Fracture neck femur</td>
<td>0.25</td>
<td>0.17</td>
</tr>
<tr>
<td>3</td>
<td>60 F</td>
<td>Fracture shaft femur with lacerated injury</td>
<td>0.35</td>
<td>0.57</td>
</tr>
<tr>
<td>4</td>
<td>52 M</td>
<td>Fracture rib 5th, 6th, 7th (right side)</td>
<td>trace</td>
<td>1.00</td>
</tr>
<tr>
<td>5</td>
<td>24 F</td>
<td>Fracture pelvis</td>
<td>0.22</td>
<td>0.26</td>
</tr>
<tr>
<td>6</td>
<td>12 M</td>
<td>Compound fracture lower 1/3rd involving both legs</td>
<td>trace</td>
<td>0.80</td>
</tr>
<tr>
<td>7</td>
<td>28 M</td>
<td>Fracture left shaft femur</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>8</td>
<td>10 F</td>
<td>Fracture neck femur</td>
<td>0.20</td>
<td>0.64</td>
</tr>
<tr>
<td>9</td>
<td>50 M</td>
<td>Compound fracture in the femoral region</td>
<td>0.30</td>
<td>0.78</td>
</tr>
<tr>
<td>10</td>
<td>40 M</td>
<td>Fracture with dislocation of left elbow</td>
<td>trace</td>
<td>0.90</td>
</tr>
<tr>
<td>11</td>
<td>30 M</td>
<td>Compound fracture left shaft femur</td>
<td>0.20</td>
<td>0.18</td>
</tr>
<tr>
<td>12</td>
<td>13 M</td>
<td>Fracture mandible region</td>
<td>0.33</td>
<td>0.32</td>
</tr>
<tr>
<td>13</td>
<td>35 M</td>
<td>Fracture neck femur</td>
<td>0.50</td>
<td>0.26</td>
</tr>
<tr>
<td>14</td>
<td>38 F</td>
<td>Fracture left shaft femur</td>
<td>0.27</td>
<td>0.21</td>
</tr>
<tr>
<td>15</td>
<td>20 M</td>
<td>Fracture tibia (left leg)</td>
<td>trace</td>
<td>0.56</td>
</tr>
</tbody>
</table>
Table 1.3 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Nature of fracture</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>44 M</td>
<td>Fracture dorsolumbar spine</td>
<td>trace</td>
<td>0.32</td>
</tr>
<tr>
<td>17</td>
<td>85 M</td>
<td>Fracture neck femur</td>
<td>0.30</td>
<td>0.26</td>
</tr>
<tr>
<td>18</td>
<td>25 M</td>
<td>Compound fracture lower l/3rd involving both legs</td>
<td>0.36</td>
<td>0.20</td>
</tr>
<tr>
<td>19</td>
<td>20 F</td>
<td>Fracture tibia right leg</td>
<td>trace</td>
<td>0.52</td>
</tr>
<tr>
<td>20</td>
<td>12 M</td>
<td>Compound fracture lower l/3rd involving both legs</td>
<td>trace</td>
<td>0.90</td>
</tr>
<tr>
<td>21</td>
<td>20 M</td>
<td>Fracture metatarsal (right foot) with rupture of all extensor tendons</td>
<td>trace</td>
<td>0.92</td>
</tr>
</tbody>
</table>

n = 21 (16M, 5F)

AA = 0.16 ± 0.14 S.D., DHA = 0.52 ± 0.28 S.D.

All the cases were new and untreated. Blood samples were drawn within 24 hrs. Vitamin C tablets and steroid intakes were nil.
### Table 1.4

**Blood AA, DHA levels in human subjects with lacerated injury/crush injury and miscellaneous types of injury.**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Nature of the injury</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18 M</td>
<td>Trauma over spine resulting in paraplegia</td>
<td>trace</td>
<td>1.12</td>
</tr>
<tr>
<td>2</td>
<td>20 M</td>
<td>Severe crush injury (machine) of the right hand</td>
<td>trace</td>
<td>1.60</td>
</tr>
<tr>
<td>3</td>
<td>50 F</td>
<td>Crush injury involving right foot, amputation urgently required</td>
<td>trace</td>
<td>0.94</td>
</tr>
<tr>
<td>4</td>
<td>18 M</td>
<td>Bomb injury from a bomb explosion, the patient unconscious</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>5</td>
<td>22 M</td>
<td>Trauma over spine, nature of injury severe</td>
<td>trace</td>
<td>0.80</td>
</tr>
<tr>
<td>6</td>
<td>45 F</td>
<td>Lacerated injury, left hand and left leg badly damaged</td>
<td>trace</td>
<td>0.46</td>
</tr>
<tr>
<td>7</td>
<td>30 M</td>
<td>Severe chest injury (a heavy weight fell over chest)</td>
<td>trace</td>
<td>1.40</td>
</tr>
<tr>
<td>8</td>
<td>20 M</td>
<td>Trauma over spine, the patient unconscious</td>
<td>trace</td>
<td>0.98</td>
</tr>
<tr>
<td>9</td>
<td>22 M</td>
<td>Severe bomb injury, the patient unconscious</td>
<td>trace</td>
<td>1.04</td>
</tr>
<tr>
<td>10</td>
<td>24 F</td>
<td>Trauma over spine, nature of injury severe</td>
<td>trace</td>
<td>0.94</td>
</tr>
<tr>
<td>11</td>
<td>25 M</td>
<td>Chest injury (severe), the patient unconscious</td>
<td>trace</td>
<td>0.84</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Age &amp; Sex</td>
<td>Nature of the injury</td>
<td>AA mg/dl</td>
<td>DHA mg/dl</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>----------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>12</td>
<td>25 M</td>
<td>Multiple injury on both upper and lower limbs</td>
<td>trace</td>
<td>0.62</td>
</tr>
<tr>
<td>13</td>
<td>25 M</td>
<td>Intra-abdomenal stab injury (severe)</td>
<td>trace</td>
<td>0.46</td>
</tr>
<tr>
<td>14</td>
<td>22 F</td>
<td>Severe lacerated injury involving left thigh and left hand</td>
<td>trace</td>
<td>0.32</td>
</tr>
<tr>
<td>15</td>
<td>25 M</td>
<td>Multiple injury on both upper and lower limbs</td>
<td>trace</td>
<td>0.40</td>
</tr>
<tr>
<td>16</td>
<td>19 M</td>
<td>Crush injury of right foot, and both hands, the patient unconscious</td>
<td>trace</td>
<td>1.30</td>
</tr>
<tr>
<td>17</td>
<td>30 M</td>
<td>Intra-abdomenal stab injury (severe)</td>
<td>trace</td>
<td>1.06</td>
</tr>
<tr>
<td>18</td>
<td>24 M</td>
<td>Bullet injury (chest), general condition very low</td>
<td>trace</td>
<td>0.62</td>
</tr>
<tr>
<td>19</td>
<td>50 F</td>
<td>Severe lacerated injury of the left foot with fracture patella</td>
<td>trace</td>
<td>0.42</td>
</tr>
<tr>
<td>20</td>
<td>25 M</td>
<td>Intra-abdomenal stab injury, trace the patient unconscious</td>
<td>trace</td>
<td>0.62</td>
</tr>
<tr>
<td>21</td>
<td>21 M</td>
<td>Intra-abdomenal stab injury, trace the patient unconscious</td>
<td>trace</td>
<td>0.76</td>
</tr>
<tr>
<td>22</td>
<td>20 M</td>
<td>Auto-amputation of right great toe</td>
<td>trace</td>
<td>0.78</td>
</tr>
<tr>
<td>23</td>
<td>24 M</td>
<td>Severe bomb injury</td>
<td>trace</td>
<td>1.08</td>
</tr>
<tr>
<td>24</td>
<td>25 M</td>
<td>Intra-abdomenal stab injury, trace the patient unconscious</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Age &amp; Sex</td>
<td>Nature of the injury</td>
<td>AA mg/dl</td>
<td>DHA mg/dl</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>----------------------------------------------------------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>25</td>
<td>14 M</td>
<td>Trauma over spine due to fall from a considerable height</td>
<td>trace</td>
<td>0.42</td>
</tr>
<tr>
<td>26</td>
<td>25 M</td>
<td>Intra-abdominal stab injury (severe)</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>27</td>
<td>14 F</td>
<td>Trauma over spine, general condition low</td>
<td>trace</td>
<td>0.42</td>
</tr>
<tr>
<td>28</td>
<td>22 F</td>
<td>Electric shock with lacerated injury</td>
<td>trace</td>
<td>1.28</td>
</tr>
<tr>
<td>29</td>
<td>25 M</td>
<td>Intra-abdominal stab injury, the patient unconscious</td>
<td>trace</td>
<td>0.70</td>
</tr>
<tr>
<td>30</td>
<td>40 F</td>
<td>Crush injury involving right foot</td>
<td>trace</td>
<td>0.32</td>
</tr>
<tr>
<td>31</td>
<td>36 M</td>
<td>Intra-abdominal stab injury, general condition low</td>
<td>trace</td>
<td>0.54</td>
</tr>
<tr>
<td>32</td>
<td>17 M</td>
<td>Severe crush injury (machine) involving right hand</td>
<td>trace</td>
<td>0.82</td>
</tr>
<tr>
<td>33</td>
<td>40 M</td>
<td>Trauma over spine resulting in quadriplagia</td>
<td>trace</td>
<td>0.86</td>
</tr>
<tr>
<td>34</td>
<td>24 M</td>
<td>Intra-abdominal stab injury</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>35</td>
<td>26 F</td>
<td>Lacerated injury involving right foot, the patient unconscious</td>
<td>trace</td>
<td>0.76</td>
</tr>
<tr>
<td>36</td>
<td>60 M</td>
<td>Severe stab injury, general condition very low</td>
<td>trace</td>
<td>0.64</td>
</tr>
</tbody>
</table>
Table 1.4 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Nature of the injury</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>26 M</td>
<td>Intra-abdominal stab injury, the patient unconscious</td>
<td>trace</td>
<td>0.78</td>
</tr>
<tr>
<td>38</td>
<td>40 M</td>
<td>Trauma over spine resulting in quadriplagia</td>
<td>trace</td>
<td>0.86</td>
</tr>
<tr>
<td>39</td>
<td>49 F</td>
<td>Severe lacerated injury with head injury</td>
<td>trace</td>
<td>0.82</td>
</tr>
<tr>
<td>40</td>
<td>51 M</td>
<td>Injury on face inflicted by knife, general condition low</td>
<td>trace</td>
<td>1.26</td>
</tr>
</tbody>
</table>

n = 40 (30M, 10F)

AA = trace, DHA = 0.80 ± 0.30 S.D.

Blood samples in all the cases were drawn within 24 hrs of the injury. Vitamin C tablets and steroid intakes were nil.
Table 1.5

Blood AA, DHA levels in human subjects with burns

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Approx. percentage of burns</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12 M</td>
<td>40</td>
<td>trace</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>26 M</td>
<td>40</td>
<td>trace</td>
<td>0.42</td>
</tr>
<tr>
<td>3</td>
<td>21 F</td>
<td>30</td>
<td>trace</td>
<td>0.50</td>
</tr>
<tr>
<td>4</td>
<td>23 M</td>
<td>35</td>
<td>trace</td>
<td>0.90</td>
</tr>
<tr>
<td>5</td>
<td>30 M</td>
<td>30</td>
<td>trace</td>
<td>0.64</td>
</tr>
<tr>
<td>6</td>
<td>14 F</td>
<td>50</td>
<td>trace</td>
<td>0.90</td>
</tr>
<tr>
<td>7</td>
<td>45 M</td>
<td>20</td>
<td>trace</td>
<td>0.80</td>
</tr>
<tr>
<td>8</td>
<td>20 M</td>
<td>20</td>
<td>trace</td>
<td>1.40</td>
</tr>
<tr>
<td>9</td>
<td>16 M</td>
<td>30</td>
<td>trace</td>
<td>1.08</td>
</tr>
<tr>
<td>10</td>
<td>15 M</td>
<td>20</td>
<td>trace</td>
<td>0.76</td>
</tr>
<tr>
<td>11</td>
<td>50 M</td>
<td>20</td>
<td>trace</td>
<td>0.86</td>
</tr>
<tr>
<td>12</td>
<td>28 M</td>
<td>15</td>
<td>trace</td>
<td>0.50</td>
</tr>
<tr>
<td>13</td>
<td>34 F</td>
<td>20</td>
<td>trace</td>
<td>1.22</td>
</tr>
</tbody>
</table>

n = 13 (10M, 3F)

AA = trace, DHA = 0.84 ± 0.29 S. D.

Vitamin C tablet and steroid intake in all the cases were nil. Blood samples were drawn within 24 hrs of the burn.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Location of cancer</th>
<th>Blood AA (mg/dl)</th>
<th>Blood DHA (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60 F</td>
<td>Oesophagus</td>
<td>trace</td>
<td>0.20</td>
</tr>
<tr>
<td>2</td>
<td>26 M</td>
<td>Oesophagus</td>
<td>trace</td>
<td>1.00</td>
</tr>
<tr>
<td>3</td>
<td>54 M</td>
<td>Larynx</td>
<td>trace</td>
<td>1.24</td>
</tr>
<tr>
<td>4</td>
<td>62 F</td>
<td>Breast</td>
<td>trace</td>
<td>0.76</td>
</tr>
<tr>
<td>5</td>
<td>45 M</td>
<td>Oesophagus</td>
<td>trace</td>
<td>0.88</td>
</tr>
<tr>
<td>6</td>
<td>58 M</td>
<td>Tonsil.</td>
<td>0.25</td>
<td>0.11</td>
</tr>
<tr>
<td>7</td>
<td>51 F</td>
<td>Breast</td>
<td>0.50</td>
<td>0.08</td>
</tr>
<tr>
<td>8</td>
<td>36 F</td>
<td>Stomach</td>
<td>0.30</td>
<td>0.24</td>
</tr>
<tr>
<td>9</td>
<td>60 M</td>
<td>Larynx</td>
<td>0.40</td>
<td>0.12</td>
</tr>
<tr>
<td>10</td>
<td>35 M</td>
<td>Cheek</td>
<td>0.25</td>
<td>0.37</td>
</tr>
<tr>
<td>11</td>
<td>57 M</td>
<td>Colon</td>
<td>trace</td>
<td>1.26</td>
</tr>
<tr>
<td>12</td>
<td>42 F</td>
<td>Breast</td>
<td>0.80</td>
<td>0.32</td>
</tr>
<tr>
<td>13</td>
<td>65 M</td>
<td>Tonsil.</td>
<td>0.80</td>
<td>0.28</td>
</tr>
<tr>
<td>14</td>
<td>45 M</td>
<td>Lung</td>
<td>0.21</td>
<td>0.59</td>
</tr>
<tr>
<td>15</td>
<td>35 F</td>
<td>Breast</td>
<td>0.55</td>
<td>0.31</td>
</tr>
<tr>
<td>16</td>
<td>55 M</td>
<td>Larynx</td>
<td>trace</td>
<td>0.84</td>
</tr>
<tr>
<td>17</td>
<td>57 M</td>
<td>Stomach</td>
<td>0.34</td>
<td>0.18</td>
</tr>
<tr>
<td>18</td>
<td>41 M</td>
<td>Lip</td>
<td>0.91</td>
<td>0.17</td>
</tr>
<tr>
<td>19</td>
<td>24 M</td>
<td>Pancreas</td>
<td>0.30</td>
<td>0.82</td>
</tr>
</tbody>
</table>
Table 1.6 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Location of cancer</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>36 F</td>
<td>Kidney</td>
<td>0.31</td>
<td>0.31</td>
</tr>
<tr>
<td>21</td>
<td>50 F</td>
<td>Oesophagus</td>
<td>trace</td>
<td>0.20</td>
</tr>
<tr>
<td>22</td>
<td>45 M</td>
<td>Prostate</td>
<td>0.23</td>
<td>0.40</td>
</tr>
<tr>
<td>23</td>
<td>42 F</td>
<td>Colon</td>
<td>0.40</td>
<td>0.22</td>
</tr>
<tr>
<td>24</td>
<td>47 M</td>
<td>Colon</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>25</td>
<td>45 M</td>
<td>Stomach</td>
<td>0.57</td>
<td>0.13</td>
</tr>
<tr>
<td>26</td>
<td>54 M</td>
<td>Larynx</td>
<td>trace</td>
<td>1.24</td>
</tr>
<tr>
<td>27</td>
<td>20 M</td>
<td>Lung</td>
<td>0.34</td>
<td>0.20</td>
</tr>
</tbody>
</table>

\[ n = 27 \text{ (18M, 9F) } \]

\[ \text{AA} = 0.28 \pm 0.27 \text{ S.D.}, \ \text{DHA} = 0.47 \pm 0.38 \text{ S.D.} \]

All were newly diagnosed untreated cases of carcinoma. Vitamin C tablet and steroid intake was nil in all the cases.
### Table 1.7

Blood AA, DHA levels in human subjects with leukemia

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Type of leukemia</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.30</td>
<td>1.14</td>
</tr>
<tr>
<td>2</td>
<td>17 M</td>
<td>Acute lymphatic leukemia</td>
<td>trace</td>
<td>0.68</td>
</tr>
<tr>
<td>3</td>
<td>39 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.18</td>
<td>0.64</td>
</tr>
<tr>
<td>4</td>
<td>40 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.50</td>
<td>0.28</td>
</tr>
<tr>
<td>5</td>
<td>35 F</td>
<td>Acute myeloid leukemia</td>
<td>0.20</td>
<td>0.52</td>
</tr>
<tr>
<td>6</td>
<td>8 F</td>
<td>Acute myeloid leukemia</td>
<td>trace</td>
<td>0.62</td>
</tr>
<tr>
<td>7</td>
<td>27 M</td>
<td>Acute myeloid leukemia</td>
<td>0.33</td>
<td>0.07</td>
</tr>
<tr>
<td>8</td>
<td>58 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.18</td>
<td>0.10</td>
</tr>
<tr>
<td>9</td>
<td>17 M</td>
<td>Acute myeloid leukemia</td>
<td>trace</td>
<td>0.12</td>
</tr>
<tr>
<td>10</td>
<td>10 M</td>
<td>Acute lymphatic leukemia</td>
<td>0.25</td>
<td>0.64</td>
</tr>
<tr>
<td>11</td>
<td>54 F</td>
<td>Chronic myeloid leukemia</td>
<td>trace</td>
<td>0.08</td>
</tr>
<tr>
<td>12</td>
<td>48 F</td>
<td>Acute lymphatic leukemia</td>
<td>0.24</td>
<td>0.14</td>
</tr>
<tr>
<td>13</td>
<td>18 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.16</td>
<td>0.04</td>
</tr>
<tr>
<td>14</td>
<td>9 M</td>
<td>Acute lymphatic leukemia</td>
<td>0.46</td>
<td>0.32</td>
</tr>
<tr>
<td>15</td>
<td>12 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.26</td>
<td>0.80</td>
</tr>
<tr>
<td>16</td>
<td>45 M</td>
<td>Chronic myeloid leukemia</td>
<td>trace</td>
<td>0.39</td>
</tr>
<tr>
<td>17</td>
<td>65 F</td>
<td>Chronic myeloid leukemia</td>
<td>0.21</td>
<td>1.20</td>
</tr>
<tr>
<td>18</td>
<td>47 F</td>
<td>Chronic myeloid leukemia</td>
<td>0.28</td>
<td>0.04</td>
</tr>
<tr>
<td>19</td>
<td>54 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.41</td>
<td>0.66</td>
</tr>
<tr>
<td>No.</td>
<td>Age &amp; Sex</td>
<td>Type of leukemia</td>
<td>AA mg/dl</td>
<td>DHA mg/dl</td>
</tr>
<tr>
<td>-----</td>
<td>-----------</td>
<td>--------------------------------------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>20</td>
<td>14 M</td>
<td>Acute myeloid leukemia</td>
<td>trace</td>
<td>0.68</td>
</tr>
<tr>
<td>21</td>
<td>16 F</td>
<td>Chronic myeloid leukemia</td>
<td>0.12</td>
<td>0.67</td>
</tr>
<tr>
<td>22</td>
<td>15 M</td>
<td>Chronic myeloid leukemia</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>23</td>
<td>42 F</td>
<td>Chronic myeloid leukemia</td>
<td>0.41</td>
<td>0.36</td>
</tr>
<tr>
<td>24</td>
<td>9 M</td>
<td>Acute lymphatic leukemia</td>
<td>0.16</td>
<td>0.40</td>
</tr>
<tr>
<td>25</td>
<td>45 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.12</td>
<td>0.29</td>
</tr>
<tr>
<td>26</td>
<td>42 F</td>
<td>Chronic myeloid leukemia</td>
<td>0.15</td>
<td>0.40</td>
</tr>
<tr>
<td>27</td>
<td>30 M</td>
<td>Acute lymphatic leukemia</td>
<td>trace</td>
<td>0.28</td>
</tr>
<tr>
<td>28</td>
<td>47 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.35</td>
<td>0.24</td>
</tr>
<tr>
<td>29</td>
<td>8 M</td>
<td>Acute lymphatic leukemia</td>
<td>0.40</td>
<td>0.50</td>
</tr>
<tr>
<td>30</td>
<td>36 M</td>
<td>Chronic myeloid leukemia</td>
<td>trace</td>
<td>0.26</td>
</tr>
<tr>
<td>31</td>
<td>40 M</td>
<td>Acute myeloid leukemia</td>
<td>0.31</td>
<td>0.03</td>
</tr>
<tr>
<td>32</td>
<td>47 F</td>
<td>Chronic myeloid leukemia</td>
<td>trace</td>
<td>0.80</td>
</tr>
<tr>
<td>33</td>
<td>9 M</td>
<td>Acute lymphatic leukemia</td>
<td>0.36</td>
<td>0.40</td>
</tr>
<tr>
<td>34</td>
<td>42 F</td>
<td>Chronic myeloid leukemia</td>
<td>0.15</td>
<td>0.36</td>
</tr>
<tr>
<td>35</td>
<td>44 F</td>
<td>Chronic myeloid leukemia</td>
<td>0.30</td>
<td>0.80</td>
</tr>
<tr>
<td>36</td>
<td>12 M</td>
<td>Chronic myeloid leukemia</td>
<td>trace</td>
<td>0.80</td>
</tr>
<tr>
<td>37</td>
<td>48 F</td>
<td>Chronic myeloid leukemia</td>
<td>0.15</td>
<td>0.39</td>
</tr>
<tr>
<td>38</td>
<td>9 M</td>
<td>Acute lymphatic leukemia</td>
<td>trace</td>
<td>0.52</td>
</tr>
</tbody>
</table>
Table 1.7 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Type of leukemia</th>
<th>AA (mg/dl)</th>
<th>DHA (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>65 M</td>
<td>Chronic myeloid leukemia</td>
<td>trace</td>
<td>0.12</td>
</tr>
<tr>
<td>40</td>
<td>15 F</td>
<td>Acute myeloid leukemia</td>
<td>0.17</td>
<td>0.48</td>
</tr>
<tr>
<td>41</td>
<td>18 M</td>
<td>Chronic myeloid leukemia</td>
<td>0.21</td>
<td>0.34</td>
</tr>
</tbody>
</table>

n = 41 (27M, 14F)

AA = 0.18 ± 0.15 S.D., DHA = 0.44 ± 0.29 S.D.

All were newly diagnosed untreated cases. Vitamin C tablet and steroid intakes were nil in all the cases.
Table 1.8

Blood AA and DHA levels in pregnancy during labour

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age</th>
<th>Gravidae</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>5th</td>
<td>0.28</td>
<td>0.12</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>1st</td>
<td>0.40</td>
<td>0.14</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
<td>2nd</td>
<td>0.20</td>
<td>0.44</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>1st</td>
<td>0.36</td>
<td>0.12</td>
</tr>
<tr>
<td>5</td>
<td>36</td>
<td>3rd</td>
<td>0.40</td>
<td>Nil</td>
</tr>
<tr>
<td>6</td>
<td>25</td>
<td>4th</td>
<td>0.40</td>
<td>0.08</td>
</tr>
<tr>
<td>7</td>
<td>24</td>
<td>2nd</td>
<td>0.22</td>
<td>0.10</td>
</tr>
<tr>
<td>8</td>
<td>24</td>
<td>1st</td>
<td>trace</td>
<td>0.68</td>
</tr>
<tr>
<td>9</td>
<td>32</td>
<td>1st</td>
<td>trace</td>
<td>0.70</td>
</tr>
<tr>
<td>10</td>
<td>32</td>
<td>6th</td>
<td>trace</td>
<td>0.56</td>
</tr>
<tr>
<td>11</td>
<td>32</td>
<td>2nd</td>
<td>trace</td>
<td>0.96</td>
</tr>
<tr>
<td>12</td>
<td>19</td>
<td>1st</td>
<td>trace</td>
<td>0.60</td>
</tr>
<tr>
<td>13</td>
<td>26</td>
<td>1st</td>
<td>trace</td>
<td>0.56</td>
</tr>
<tr>
<td>14</td>
<td>28</td>
<td>1st</td>
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<td>15</td>
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<td>1st</td>
<td>trace</td>
<td>0.66</td>
</tr>
<tr>
<td>16</td>
<td>23</td>
<td>3rd</td>
<td>0.20</td>
<td>0.36</td>
</tr>
<tr>
<td>17</td>
<td>19</td>
<td>2nd</td>
<td>trace</td>
<td>0.58</td>
</tr>
<tr>
<td>18</td>
<td>20</td>
<td>3rd</td>
<td>0.44</td>
<td>0.12</td>
</tr>
<tr>
<td>19</td>
<td>21</td>
<td>1st</td>
<td>0.28</td>
<td>0.44</td>
</tr>
</tbody>
</table>
Table 1.6 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age</th>
<th>Gravidea</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>26</td>
<td>2nd</td>
<td>0.33</td>
<td>0.23</td>
</tr>
<tr>
<td>21</td>
<td>30</td>
<td>1st</td>
<td>0.28</td>
<td>0.30</td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>4th</td>
<td>trace</td>
<td>0.56</td>
</tr>
<tr>
<td>23</td>
<td>18</td>
<td>2nd</td>
<td>0.57</td>
<td>0.15</td>
</tr>
<tr>
<td>24</td>
<td>17</td>
<td>1st</td>
<td>trace</td>
<td>0.44</td>
</tr>
<tr>
<td>25</td>
<td>23</td>
<td>2nd</td>
<td>0.40</td>
<td>0.32</td>
</tr>
<tr>
<td>26</td>
<td>25</td>
<td>1st</td>
<td>trace</td>
<td>0.90</td>
</tr>
<tr>
<td>27</td>
<td>25</td>
<td>4th</td>
<td>0.66</td>
<td>0.22</td>
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<tr>
<td>28</td>
<td>21</td>
<td>1st</td>
<td>trace</td>
<td>0.64</td>
</tr>
<tr>
<td>29</td>
<td>32</td>
<td>1st</td>
<td>0.25</td>
<td>0.43</td>
</tr>
<tr>
<td>30</td>
<td>23</td>
<td>2nd</td>
<td>0.33</td>
<td>0.25</td>
</tr>
<tr>
<td>31</td>
<td>24</td>
<td>2nd</td>
<td>0.33</td>
<td>0.25</td>
</tr>
<tr>
<td>32</td>
<td>18</td>
<td>1st</td>
<td>trace</td>
<td>0.72</td>
</tr>
<tr>
<td>33</td>
<td>40</td>
<td>4th</td>
<td>trace</td>
<td>0.50</td>
</tr>
<tr>
<td>34</td>
<td>24</td>
<td>3rd</td>
<td>trace</td>
<td>0.36</td>
</tr>
<tr>
<td>35</td>
<td>24</td>
<td>2nd</td>
<td>trace</td>
<td>0.30</td>
</tr>
<tr>
<td>36</td>
<td>19</td>
<td>1st</td>
<td>trace</td>
<td>0.50</td>
</tr>
<tr>
<td>37</td>
<td>19</td>
<td>2nd</td>
<td>0.36</td>
<td>0.12</td>
</tr>
<tr>
<td>38</td>
<td>30</td>
<td>2nd</td>
<td>0.23</td>
<td>0.67</td>
</tr>
<tr>
<td>39</td>
<td>25</td>
<td>1st</td>
<td>trace</td>
<td>0.40</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
<td>3rd</td>
<td>trace</td>
<td>0.40</td>
</tr>
</tbody>
</table>

n = 40, AA = 0.08 ± 0.07, DHA = 0.41 ± 0.23 S.D.
Vitamin C tablet and steroid intakes in all the cases were nil.
### Table 1.9

Blood AA and DHA levels in human subjects with mental development

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Nature of mental development</th>
<th>AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30 M</td>
<td>Schizophrenia</td>
<td>trace</td>
<td>0.20</td>
</tr>
<tr>
<td>2</td>
<td>18 F</td>
<td>Anxiety neurosis</td>
<td>trace</td>
<td>0.32</td>
</tr>
<tr>
<td>3</td>
<td>36 F</td>
<td>Endogenous depression</td>
<td>trace</td>
<td>0.40</td>
</tr>
<tr>
<td>4</td>
<td>46 M</td>
<td>Schizophrenia</td>
<td>trace</td>
<td>0.40</td>
</tr>
<tr>
<td>5</td>
<td>28 M</td>
<td>Schizophrenia</td>
<td>trace</td>
<td>0.34</td>
</tr>
<tr>
<td>6</td>
<td>25 F</td>
<td>Endogenous depression</td>
<td>trace</td>
<td>0.38</td>
</tr>
<tr>
<td>7</td>
<td>39 F</td>
<td>Anxiety with depression</td>
<td>trace</td>
<td>0.41</td>
</tr>
<tr>
<td>8</td>
<td>29 M</td>
<td>Obsessive compulsive psycho-neurosis</td>
<td>trace</td>
<td>0.42</td>
</tr>
<tr>
<td>9</td>
<td>54 F</td>
<td>Schizophrenia</td>
<td>trace</td>
<td>0.32</td>
</tr>
<tr>
<td>10</td>
<td>45 M</td>
<td>Chronic depression</td>
<td>trace</td>
<td>0.38</td>
</tr>
<tr>
<td>11</td>
<td>24 M</td>
<td>Schizophrenia</td>
<td>trace</td>
<td>0.42</td>
</tr>
<tr>
<td>12</td>
<td>45 M</td>
<td>Maniae psychosis</td>
<td>trace</td>
<td>0.46</td>
</tr>
<tr>
<td>13</td>
<td>48 M</td>
<td>Schizophrenia</td>
<td>trace</td>
<td>0.34</td>
</tr>
</tbody>
</table>

\[ n = 13 \text{ (8M, 5F) } \]

AA = trace, DHA = 0.40 ± 0.13 S.D.

All were newly diagnosed untreated cases of mental disorder. Vitamin C tablet and steroid intakes were nil in all the cases.
Blood M, DH& levels of normal human subjects and subjects with different stressful conditions

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Number of cases &amp; sex</th>
<th>Age (years)</th>
<th>Subjects</th>
<th>Blood AA mean ± S.D.</th>
<th>Blood DHA mean ± S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37 (M25, F12)</td>
<td>15-61</td>
<td>Normal</td>
<td>0.60±0.20</td>
<td>0.06±0.04</td>
</tr>
<tr>
<td>2</td>
<td>29 (M21, F8)</td>
<td>16-60</td>
<td>Severe head injury</td>
<td>trace</td>
<td>0.92±0.27</td>
</tr>
<tr>
<td>3</td>
<td>21 (M16, F5)</td>
<td>12-62</td>
<td>Fracture</td>
<td>0.16±0.14</td>
<td>0.52±0.28</td>
</tr>
<tr>
<td>4</td>
<td>40 (M30, F10)</td>
<td>14-60</td>
<td>Lacerated injury/crush injury/miscellaneous types of injury</td>
<td>trace</td>
<td>0.80±0.30</td>
</tr>
<tr>
<td>5</td>
<td>13 (M10, F3)</td>
<td>12-50</td>
<td>Burn cases</td>
<td>trace</td>
<td>0.84±0.29</td>
</tr>
<tr>
<td>6</td>
<td>27 (M18, F9)</td>
<td>20-65</td>
<td>Carcinoma</td>
<td>0.28±0.27</td>
<td>0.47±0.38</td>
</tr>
<tr>
<td>7</td>
<td>41 (M27, F14)</td>
<td>8-65</td>
<td>Leukemia</td>
<td>0.18±0.15</td>
<td>0.44±0.29</td>
</tr>
<tr>
<td>8</td>
<td>40</td>
<td>15-40</td>
<td>Pregnancy during labour</td>
<td>0.08±0.07</td>
<td>0.41±0.23</td>
</tr>
<tr>
<td>9</td>
<td>13 (M8, F5)</td>
<td>18-54</td>
<td>Mental derrangement</td>
<td>trace</td>
<td>0.40±0.13</td>
</tr>
</tbody>
</table>
Results

The results presented in Tables 1.1 through Table 1.9 and summarised in Table 1.10, indicate that blood AA is very low in different stressful conditions and there is a corresponding rise in blood DHA level. In cases of carcinoma and leukemia (new untreated cases) however, the blood AA level is somewhat higher compared to other forms of stress such as trauma, burns, fracture and mental disorders.

The results have also been presented in graphical forms in Figs. 1.2 and 1.3.

Identification of DHA in blood of traumatic patients as the 2,4-dinitrophenylhydrazone derivative

DHA in traumatic blood was isolated as the 2,4-dinitrophenylhydrazone (DNPH) derivative and identified by thin layer chromatography (TLC) and spectrophotometry as described in the methods section. In TLC, DNPH derivative of DHA isolated from traumatic blood had an Rf of 0.78 which was identical to the Rf of DNPH derivative prepared from authentic DHA. In 12.5 M H₂SO₄ solution, the absorption spectrum of the DNPH derivative isolated from traumatic blood was similar to that of the DNPH derivative prepared from authentic DHA (Figure 1.1). The absorption maximum was at 520 nm as reported previously (Dutta Gupta et al., 1972). No other DNPH derivative having an absorption maximum between 440 nm and 560 nm was detected.
Fig. 1.1: Absorption spectra of 12.5 M H$_2$SO$_4$ solution of:
- O, DNPH derivative of authentic DHA (24 μg) and
- ●, DNPH derivative of DHA (19.8 μg) isolated from stress blood.
Fig. 1.2: Blood AA level in normal and different stress conditions.

1. Normal
2. Severe head injury
3. Lacerated injury/crush injury
4. Fracture
5. Burns
6. Carcinoma
7. Leukemia
8. Pregnancy during labour
9. Mental derangements.
Fig. 1.3: Blood DHA level in normal and different stress conditions.

1. Normal
2. Severe head injury
3. Lacerated injury/crush injury
4. Burns
5. Fracture
6. Carcinoma
7. Leukemia
8. Pregnancy during labour
9. Mental derangements.
CHAPTER—I

SECTION—B

PLASMA ASCORBIC ACID AND DEHYDROASCORBIC ACID LEVELS
IN HUMAN SUBJECTS UNDER DIFFERENT STRESS CONDITIONS
There are reports that physical stress of any type induces a sharp fall in plasma ascorbic acid (Lund and Grandon, 1941; Lund et al., 1947). In the previous chapter it has been shown that ascorbic acid (AA) in different stress conditions disappears from the whole blood while dehydroascorbic acid (DHA) content is greatly increased. It was, therefore, of interest, to study the plasma AA and DHA levels in human subjects under different stress conditions. The results are presented in this section.

The plasma AA and DHA levels of normal subjects are given in Table 1.11. Table 1.12 shows the plasma AA and DHA values of human subjects under different stressful conditions.
Table 1.11

Plasma AA, DHA levels in normal human subjects

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Plasma AA mg/dl</th>
<th>Plasma DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19 M</td>
<td>0.68</td>
<td>Nil</td>
</tr>
<tr>
<td>2</td>
<td>29 M</td>
<td>0.65</td>
<td>0.04</td>
</tr>
<tr>
<td>3</td>
<td>18 M</td>
<td>0.45</td>
<td>Nil</td>
</tr>
<tr>
<td>4</td>
<td>44 M</td>
<td>0.40</td>
<td>0.06</td>
</tr>
<tr>
<td>5</td>
<td>42 M</td>
<td>0.40</td>
<td>0.06</td>
</tr>
<tr>
<td>6</td>
<td>26 M</td>
<td>0.70</td>
<td>0.04</td>
</tr>
<tr>
<td>7</td>
<td>36 M</td>
<td>0.80</td>
<td>Nil</td>
</tr>
<tr>
<td>8</td>
<td>24 M</td>
<td>0.45</td>
<td>0.08</td>
</tr>
<tr>
<td>9</td>
<td>48 M</td>
<td>0.53</td>
<td>Nil</td>
</tr>
<tr>
<td>10</td>
<td>31 M</td>
<td>0.67</td>
<td>Nil</td>
</tr>
<tr>
<td>11</td>
<td>54 M</td>
<td>0.70</td>
<td>0.08</td>
</tr>
<tr>
<td>12</td>
<td>28 M</td>
<td>0.35</td>
<td>0.02</td>
</tr>
<tr>
<td>13</td>
<td>37 M</td>
<td>0.45</td>
<td>0.04</td>
</tr>
<tr>
<td>14</td>
<td>60 M</td>
<td>0.30</td>
<td>0.07</td>
</tr>
<tr>
<td>15</td>
<td>54 M</td>
<td>0.53</td>
<td>Nil</td>
</tr>
<tr>
<td>16</td>
<td>41 M</td>
<td>0.62</td>
<td>0.05</td>
</tr>
<tr>
<td>17</td>
<td>32 M</td>
<td>0.55</td>
<td>0.05</td>
</tr>
<tr>
<td>18</td>
<td>52 M</td>
<td>0.48</td>
<td>0.04</td>
</tr>
<tr>
<td>19</td>
<td>27 M</td>
<td>0.50</td>
<td>0.10</td>
</tr>
</tbody>
</table>
Table 1.11 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Plasma AA mg/dl</th>
<th>Plasma DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>25 M</td>
<td>0.45</td>
<td>0.05</td>
</tr>
<tr>
<td>21</td>
<td>18 M</td>
<td>0.38</td>
<td>0.02</td>
</tr>
<tr>
<td>22</td>
<td>49 M</td>
<td>0.83</td>
<td>0.21</td>
</tr>
<tr>
<td>23</td>
<td>20 M</td>
<td>0.67</td>
<td>0.02</td>
</tr>
<tr>
<td>24</td>
<td>31 F</td>
<td>0.58</td>
<td>0.03</td>
</tr>
<tr>
<td>25</td>
<td>18 F</td>
<td>0.43</td>
<td>Nil</td>
</tr>
<tr>
<td>26</td>
<td>58 F</td>
<td>0.68</td>
<td>0.04</td>
</tr>
<tr>
<td>27</td>
<td>20 F</td>
<td>0.70</td>
<td>0.06</td>
</tr>
<tr>
<td>28</td>
<td>30 M</td>
<td>0.50</td>
<td>0.07</td>
</tr>
<tr>
<td>29</td>
<td>24 F</td>
<td>0.46</td>
<td>0.06</td>
</tr>
<tr>
<td>30</td>
<td>41 F</td>
<td>0.60</td>
<td>Nil</td>
</tr>
<tr>
<td>31</td>
<td>51 F</td>
<td>0.43</td>
<td>0.02</td>
</tr>
<tr>
<td>32</td>
<td>22 F</td>
<td>0.58</td>
<td>0.05</td>
</tr>
<tr>
<td>33</td>
<td>23 F</td>
<td>0.42</td>
<td>Nil</td>
</tr>
<tr>
<td>34</td>
<td>37 F</td>
<td>0.55</td>
<td>0.02</td>
</tr>
<tr>
<td>35</td>
<td>35 F</td>
<td>0.58</td>
<td>0.04</td>
</tr>
<tr>
<td>36</td>
<td>30 M</td>
<td>0.45</td>
<td>0.02</td>
</tr>
<tr>
<td>37</td>
<td>45 F</td>
<td>1.20</td>
<td>0.02</td>
</tr>
</tbody>
</table>

n = 37 (25M, 12F)

Plasma AA 0.56 ± 0.17 S. D.
Plasma DHA 0.04 ± 0.04 S. D.

Vitamin C tablet intake was nil.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Nature of the stress</th>
<th>L-AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>40 M</td>
<td>Multiple injury (knife), the patient unconscious</td>
<td>trace</td>
<td>0.18</td>
</tr>
<tr>
<td>2</td>
<td>31 F</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.30</td>
</tr>
<tr>
<td>3</td>
<td>50 M</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.24</td>
</tr>
<tr>
<td>4</td>
<td>40 F</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.18</td>
</tr>
<tr>
<td>5</td>
<td>35 M</td>
<td>Severe lacerated injury involving left leg</td>
<td>trace</td>
<td>0.24</td>
</tr>
<tr>
<td>6</td>
<td>30 F</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.24</td>
</tr>
<tr>
<td>7</td>
<td>25 M</td>
<td>Crush injury (machine) involving right hand</td>
<td>trace</td>
<td>0.20</td>
</tr>
<tr>
<td>8</td>
<td>24 M</td>
<td>Bullet injury, general condition very low</td>
<td>trace</td>
<td>0.11</td>
</tr>
<tr>
<td>9</td>
<td>17 M</td>
<td>Lacerated injury both legs (automobile accident)</td>
<td>0.17</td>
<td>0.04</td>
</tr>
<tr>
<td>10</td>
<td>26 M</td>
<td>Intra-abdominal stab injury</td>
<td>trace</td>
<td>0.12</td>
</tr>
<tr>
<td>11</td>
<td>28 M</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.16</td>
</tr>
<tr>
<td>12</td>
<td>24 M</td>
<td>Bomb injury, right and left thigh badly damaged</td>
<td>trace</td>
<td>0.20</td>
</tr>
<tr>
<td>13</td>
<td>18 F</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.32</td>
</tr>
</tbody>
</table>
Table 1.12 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Nature of the stress</th>
<th>L-AA (mg/dl)</th>
<th>DHA (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>35 M</td>
<td>Trauma over spine</td>
<td>trace</td>
<td>0.16</td>
</tr>
<tr>
<td>15</td>
<td>25 M</td>
<td>Crush injury (machine) involving right foot, amputation urgently required</td>
<td>trace</td>
<td>0.32</td>
</tr>
<tr>
<td>16</td>
<td>39 M</td>
<td>Injury on face inflicted by knife</td>
<td>trace</td>
<td>0.12</td>
</tr>
<tr>
<td>17</td>
<td>37 M</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.16</td>
</tr>
<tr>
<td>18</td>
<td>42 F</td>
<td>Trauma over spine</td>
<td>trace</td>
<td>0.10</td>
</tr>
<tr>
<td>19</td>
<td>40 F</td>
<td>Lacerated injury with severe head injury</td>
<td>trace</td>
<td>0.10</td>
</tr>
<tr>
<td>20</td>
<td>33 M</td>
<td>Crush injury involving right leg and right hand</td>
<td>trace</td>
<td>0.22</td>
</tr>
<tr>
<td>21</td>
<td>35 M</td>
<td>Severe head injury, the patient unconscious</td>
<td>0.27</td>
<td>0.15</td>
</tr>
<tr>
<td>22</td>
<td>48 M</td>
<td>Peptic perforation, general condition low</td>
<td>0.33</td>
<td>0.10</td>
</tr>
<tr>
<td>23</td>
<td>26 F</td>
<td>Crush injury (automobile accident)</td>
<td>trace</td>
<td>0.16</td>
</tr>
<tr>
<td>24</td>
<td>25 M</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.18</td>
</tr>
<tr>
<td>25</td>
<td>22 F</td>
<td>Crush injury (machine) on the palm of the left hand</td>
<td>0.27</td>
<td>0.07</td>
</tr>
<tr>
<td>26</td>
<td>26 M</td>
<td>Severe lacerated injury involving right leg</td>
<td>trace</td>
<td>0.22</td>
</tr>
<tr>
<td>27</td>
<td>35 F</td>
<td>Burn (approximately 20%)</td>
<td>trace</td>
<td>0.28</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Age &amp; Sex</td>
<td>Nature of the stress</td>
<td>L-AA mg/dl</td>
<td>DHA mg/dl</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>-----------------------------------------------------------</td>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>28</td>
<td>25 F</td>
<td>Severe lacerated injury involving both legs</td>
<td>0.27</td>
<td>0.21</td>
</tr>
<tr>
<td>29</td>
<td>25 M</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.24</td>
</tr>
<tr>
<td>30</td>
<td>42 F</td>
<td>Severe head injury, the patient unconscious</td>
<td>0.44</td>
<td>0.24</td>
</tr>
<tr>
<td>31</td>
<td>18 M</td>
<td>Crush injury (machine) involving right leg</td>
<td>trace</td>
<td>0.10</td>
</tr>
<tr>
<td>32</td>
<td>19 F</td>
<td>Burn (approximately 40%)</td>
<td>trace</td>
<td>0.20</td>
</tr>
<tr>
<td>33</td>
<td>18 M</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace</td>
<td>0.16</td>
</tr>
<tr>
<td>34</td>
<td>26 F</td>
<td>Severe lacerated injury involving right leg</td>
<td>0.33</td>
<td>0.13</td>
</tr>
<tr>
<td>35</td>
<td>28 F</td>
<td>Severe lacerated injury involving both legs</td>
<td>0.25</td>
<td>0.23</td>
</tr>
<tr>
<td>36</td>
<td>19 M</td>
<td>Crush injury (machine) involving right hand</td>
<td>0.28</td>
<td>0.14</td>
</tr>
<tr>
<td>37</td>
<td>26 M</td>
<td>Burn (approximately 40%)</td>
<td>0.30</td>
<td>0.14</td>
</tr>
<tr>
<td>38</td>
<td>20 M</td>
<td>Severe head injury, the patient unconscious</td>
<td>0.23</td>
<td>0.13</td>
</tr>
<tr>
<td>39</td>
<td>23 M</td>
<td>Lacerated injury involving both legs, both legs badly damaged</td>
<td>0.36</td>
<td>0.12</td>
</tr>
<tr>
<td>40</td>
<td>32 M</td>
<td>Lacerated injury with severe head injury</td>
<td>0.40</td>
<td>0.12</td>
</tr>
</tbody>
</table>
### Table 1.12 (Contd.)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Age &amp; Sex</th>
<th>Nature of the stress</th>
<th>L-AA mg/dl</th>
<th>DHA mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>24 M</td>
<td>Severe lacerated injury involving right leg with autoamputation of right great toe</td>
<td>trace 0.16</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>15 F</td>
<td>Trauma over spine, resulting in paraplegia</td>
<td>trace 0.22</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>25 F</td>
<td>Severe head injury, the patient unconscious</td>
<td>trace 0.12</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>18 M</td>
<td>Electrical burn (approximately 20%)</td>
<td>trace 0.28</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>25 M</td>
<td>Electrical burn (approximately 15%)</td>
<td>trace 0.12</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>42 M</td>
<td>Severe lacerated injury involving right leg</td>
<td>trace 0.18</td>
<td></td>
</tr>
</tbody>
</table>

\[ n = 46 (30M, 16F) \]

Plasma L-AA \[ 0.08 \pm 0.14 \text{ S.D.} \]

Plasma DHA \[ 0.17 \pm 0.06 \text{ S.D.} \]

In all the cases blood samples were drawn within 24 hrs of the trauma, injury or burn. Vitamin C tablet and steroid intake in all the cases were nil.
Results

The results indicate that there is a sharp fall in plasma AA level in different stress conditions. The results also show that the mean plasma DHA level in different stress conditions is significantly higher ($P < 0.001$) than that of normal human beings. However, the mean plasma DHA level is relatively lower than the mean blood DHA level in stress conditions. The reason for this has been discussed in Chapter-III, Section B.
CHAPTER—I

SECTION — C

BLOOD AND PLASMA ASCORBIC ACID AND DEHYDROASCORBIC ACID

IN HUMAN SUBJECTS BEFORE SURGERY, AFTER SURGERY AND

AFTER RECOVERY FROM SURGERY

*****************************************************************************
It has been indicated earlier (Tables 1.2 through 1.12) that in different stress conditions the blood and plasma AA levels fall markedly and this is accompanied by an increase of blood and plasma DHA levels. The object of the present study is to find out whether the blood and plasma levels of AA reappear and DHA disappear after removal of the apparent stress condition. For this investigation, patients admitted to the hospital for undergoing major surgical operations were studied. Estimations of blood and plasma AA and DHA levels were carried out in three stages: (1) before surgery (2) after surgery (3) after recovery from surgery.
Table 1.13

Blood k DHA levels of surgical patients before surgery, after surgery and after recovery from surgery.

<table>
<thead>
<tr>
<th>Amount</th>
<th>Day of surgery</th>
<th>After surgery</th>
<th>Amount</th>
<th>Day of surgery</th>
<th>After surgery</th>
<th>Amount</th>
<th>Day of surgery</th>
<th>After surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIIM</td>
<td>1.25</td>
<td>0.86</td>
<td>0.78</td>
<td>1.05</td>
<td>0.68</td>
<td>0.69</td>
<td>1.06</td>
<td>0.67</td>
</tr>
<tr>
<td>VIIM</td>
<td>1.26</td>
<td>0.87</td>
<td>0.79</td>
<td>1.06</td>
<td>0.69</td>
<td>0.69</td>
<td>1.07</td>
<td>0.67</td>
</tr>
<tr>
<td>VIIM</td>
<td>1.27</td>
<td>0.88</td>
<td>0.80</td>
<td>1.07</td>
<td>0.70</td>
<td>0.70</td>
<td>1.08</td>
<td>0.67</td>
</tr>
<tr>
<td>VIIM</td>
<td>1.28</td>
<td>0.89</td>
<td>0.81</td>
<td>1.08</td>
<td>0.71</td>
<td>0.71</td>
<td>1.09</td>
<td>0.67</td>
</tr>
</tbody>
</table>

Blood samples were drawn 3 to 4 weeks after surgery.
Table 1.14

<table>
<thead>
<tr>
<th>Group</th>
<th>Trace</th>
<th>0.08</th>
<th>0.10</th>
<th>0.12</th>
<th>0.14</th>
<th>0.16</th>
<th>0.18</th>
<th>0.20</th>
<th>0.22</th>
<th>0.24</th>
<th>0.26</th>
<th>0.28</th>
<th>0.30</th>
<th>0.32</th>
<th>0.34</th>
<th>0.36</th>
<th>0.38</th>
<th>0.40</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50.0</td>
<td>72.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
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<tr>
<td></td>
<td>40.0</td>
<td>46.0</td>
<td>40.0</td>
<td>30.0</td>
<td>20.0</td>
<td>20.0</td>
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<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
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<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>30.0</td>
<td>24.0</td>
<td>20.0</td>
<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
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<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>20.0</td>
<td>16.0</td>
<td>10.0</td>
<td>8.0</td>
<td>5.0</td>
<td>5.0</td>
<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
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<td>15.0</td>
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<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>10.0</td>
<td>6.0</td>
<td>5.0</td>
<td>2.0</td>
<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
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<td>10.0</td>
<td>15.0</td>
<td>10.0</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Note: Data were mean ± SD of 6 samples.
Table 1.15
Blood A<sub>2f</sub> DBA levels of surgical patients before surgery, after surgery and after recovery from surgery. Exogenous vitamin C intake is nil in all the cases.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Before Surgery</th>
<th>After Surgery</th>
<th>After Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholecystectomy</td>
<td>0.76 ± 0.06</td>
<td>0.70 ± 0.00</td>
<td>0.70 ± 0.00</td>
</tr>
<tr>
<td>Appendectomy</td>
<td>0.76 ± 0.06</td>
<td>0.70 ± 0.00</td>
<td>0.70 ± 0.00</td>
</tr>
<tr>
<td>Gastrojejunostomy with vagotomy</td>
<td>0.76 ± 0.06</td>
<td>0.70 ± 0.00</td>
<td>0.70 ± 0.00</td>
</tr>
<tr>
<td>Prostatectomy</td>
<td>0.76 ± 0.06</td>
<td>0.70 ± 0.00</td>
<td>0.70 ± 0.00</td>
</tr>
</tbody>
</table>

*Between 24-48 hr after surgery.

*Blood samples were drawn 3 to 4 weeks after surgery.
Between 24—48 hr after surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>DHA</th>
<th>24 hr</th>
<th>48 hr</th>
<th>72 hr</th>
<th>96 hr</th>
<th>120 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostatectomy</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Appendectomy</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
</tr>
<tr>
<td>Gastropenecatomy with vagotomy</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Epinephroscopy</td>
<td>0.26</td>
<td>0.26</td>
<td>0.26</td>
<td>0.26</td>
<td>0.26</td>
<td>0.26</td>
</tr>
<tr>
<td>Gastropenecatomy with vagotomy</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
</tr>
<tr>
<td>Prostatectomy</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Choledocoectomy</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Hemicolectomy</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Table 1.16

Plasma AA, DHA levels of surgical patients before surgery, after surgery and after recovery.
Results

The surgical patients were divided into two separate groups. The patients belonging to the first group received intravenous injections of vitamin C at doses varying from 250 mg to 1000 mg per patient per day for seven days after surgery. (Table 1.13 and Table 1.14). The patients belonging to the second group (Table 1.15 and Table 1.16) did not receive any exogenous supply of vitamin C.

The results (Tables 1.13 through Table 1.16) showed that immediately after surgery the blood and plasma AA levels fell markedly with a concomitant rise in DHA levels. This observation was made in both the groups/patients irrespective of whether they received exogenous vitamin C or not. After recovery from surgery, which took 3 to 4 weeks, the blood and plasma AA levels reappeared and the DHA disappeared.

The results indicate a high turnover of AA in surgical stress.
CHAPTER—I

SECTION— D

BLOOD AND PLASMA ASCORBIC ACID AND DEHYDROASCORBIC ACID

LEVELS IN HUMAN SUBJECTS AFTER RECOVERY

FROM TRAUMA
It has been shown in the previous Section (Chapter I, Section C) that after recovery from surgery, the blood and plasma AA levels reappear with a concomitant disappearance of DHA levels. In the section results have been presented (Table 1.17) to show that after recovery from trauma also, the blood and plasma AA levels reappear and the DHA disappears.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>VV/DMA</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>VV/DMA</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>VV/DMA</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>VV/DMA</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Note:** The patient recovered in 21 days after the trauma from which Blood and Plasma, VV and DMA levels were recovered from trauma.

Table 1.17
<table>
<thead>
<tr>
<th>Nature of the trauma from which the patient recovered</th>
<th>Blood</th>
<th>Plasma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autoamputation of both legs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-abdominal stab injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe lacerated injury involving both legs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe crush injury involving left hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe lacerated injury (automobile accident)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical burn (approximately 30%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe head injury</td>
<td>16</td>
<td>26 M</td>
</tr>
<tr>
<td>Burn (approximately 25%)</td>
<td>17</td>
<td>29 N</td>
</tr>
<tr>
<td>Severe head injury</td>
<td>16</td>
<td>25 P</td>
</tr>
<tr>
<td>Severe crush injury (machine)</td>
<td>15</td>
<td>25 P</td>
</tr>
<tr>
<td>Severe head injury</td>
<td>16</td>
<td>26 P</td>
</tr>
<tr>
<td>Burn (approximately 25%)</td>
<td>14</td>
<td>46 M</td>
</tr>
<tr>
<td>Severe head injury</td>
<td>12</td>
<td>46 F</td>
</tr>
<tr>
<td>Severe lacerated injury involving both legs</td>
<td>15</td>
<td>24 F</td>
</tr>
<tr>
<td>Autoamputation of both legs</td>
<td>11</td>
<td>40 M</td>
</tr>
</tbody>
</table>

Table 1.17 (contd.)
<table>
<thead>
<tr>
<th>Date: 1.17 (continued)</th>
<th>Nature of the treatment from which the patient recovered</th>
<th>Sex</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crush Injury Involving Both Legs (automobile accident)</td>
<td>Crush Injury Involving Right Leg and Right hand</td>
<td>M</td>
<td>26</td>
</tr>
<tr>
<td>Crush Injury (mechanical) Involving Right Foot</td>
<td>Crush Injury (mechanical) Involving Right Hand</td>
<td>M</td>
<td>26</td>
</tr>
<tr>
<td>Bomb Injury, Right and Left Thighs badly damaged</td>
<td>Bomb Injury, Right Leg and Right Hand</td>
<td>M</td>
<td>26</td>
</tr>
<tr>
<td>Inter-abbdominal stab Injury</td>
<td>Crush Injury (mechanical) Involving Right Hand</td>
<td>M</td>
<td>26</td>
</tr>
<tr>
<td>Crush Injury (mechanical) Involving Right Leg and Right hand</td>
<td>Crush Injury Involving Right Leg and Right hand</td>
<td>M</td>
<td>26</td>
</tr>
</tbody>
</table>

Table 1.17 (continued)
Blood samples were drawn from the patient before discharge from the hospital, usually took 4 to 6 weeks after the occurrence of trauma. Vitamin C intakes were nil in all the cases. Blood samples were drawn from the patient before discharge from the hospital, usually took 4 to 6 weeks after the occurrence of trauma. Vitamin C intakes were nil in all the cases.

### Table 1.17 (Contd.)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Sex</th>
<th>Age (yr)</th>
<th>Trauma Type</th>
<th>Nature of the trauma from which the patient recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>M</td>
<td>62</td>
<td>0.50</td>
<td>Crush Injury (machine)</td>
<td>Lacerated Injuries with severe head injury</td>
</tr>
<tr>
<td>26</td>
<td>M</td>
<td>62</td>
<td>0.50</td>
<td>Crush Injury (machine)</td>
<td>Lacerated Injuries with severe head injury</td>
</tr>
<tr>
<td>25</td>
<td>M</td>
<td>61</td>
<td>0.60</td>
<td>Crush Injury (machine)</td>
<td>Lacerated Injuries with severe head injury</td>
</tr>
<tr>
<td>24</td>
<td>M</td>
<td>61</td>
<td>0.60</td>
<td>Crush Injury (machine)</td>
<td>Lacerated Injuries with severe head injury</td>
</tr>
<tr>
<td>23</td>
<td>M</td>
<td>61</td>
<td>0.60</td>
<td>Crush Injury (machine)</td>
<td>Lacerated Injuries with severe head injury</td>
</tr>
</tbody>
</table>

**Blood:**
- AA: 0.57 ± 0.09 S.D., mg/dl.
- DHA: 0.10 ± 0.06 S.D., mg/dl.

**Plasma:**
- AA: 0.48 ± 0.07 S.D., mg/dl.
- DHA: 0.04 ± 0.01 S.D., mg/dl.
Results presented in Chapter I, Section A and Chapter I, Section B indicate a sharp fall in blood and plasma AA level under various stressful conditions and a corresponding significant increase in blood DHA level. The plasma DHA level was also found to be higher ($P < 0.001$) in different stressful conditions the mean plasma DHA value was relatively low.

The data presented in this Section (Section D, Chapter I) indicate reappearance of blood and plasma AA after recovery from various stress conditions. Blood and plasma DHA returns almost to normal level.
CHAPTER I

SECTION E

EFFECT OF STRESS HORMONES ON AA METABOLISM IN GUINEA PIGS AND RABBITS
ACTH, cortisone and adrenaline are stress hormones. Release of these hormones are increased under stress conditions. Since there was a marked fall in plasma AA level in various stress conditions, it was of interest to see whether the fall in plasma AA level was an effect of different stress hormones. Therefore, stress hormones were injected in guinea pigs and rabbits singularly and conjointly, and plasma AA and DHA levels were estimated at regular intervals.

The results indicated that single administration of ACTH (5 units/animal S.C.), hydrocortisone (8 mg/animal, S.C.) or adrenaline (25 μg—100 μg/animal, S.C.) had no significant effect on the plasma AA levels of guinea pigs (n = 8) 0.63 ± 0.04 mg/dl and rabbits (n = 4) 0.58 ± 0.07 mg/dl.

The results also indicated that ACTH injected at doses of 2 units b.d. per guinea pig for 4 days had no significant effect on plasma AA level. Similarly, five repeated doses of adrenaline (25 μg/guinea pig at 30 min interval) had no significant effect on plasma AA level of guinea pigs. Moreover, conjoint effect of β-methasone (0.5 mg/rabbit, S.C.) and five repeated doses of adrenaline (50 μg/rabbit at 30 min interval) had no significant effect on the plasma AA level.
Effect of cyclic AMP

Cyclic AMP was also found to be ineffective in stimulating the rate of oxidation of AA to DHA in the liver mitochondria of guinea pigs (loc. cit., Chapter IV). This in vitro experiment corroborated the observation that plasma AA level was not altered by administration of different stress hormones.