Plasma Albumin And Fibronectin Levels
As Nutritional Markers
In Egyptian Infants And Children

AHMED N. EL-SHAZLY, M.D.; MOHAMED M. RASHAD, M.D.;
MAHA SALAH EL-DIN*, M.D.; MONA EL-BISHRY, M.D.
AND EMAN ABD EL-HAFEED, M.Sc.

*Pediatric and Clinical Pathology Departments,
Benha Faculty of Medicine,
Zagazig University.
Abstract

The present study included 60 patients with PEM (3-30 months of age) and 20 age matched normal controls. According to McLaren classification of PEM, the nutritional index (NI) of each subject was calculated and the patients were divided into 3 equal groups with mild, moderate and severe PEM. Their plasma fibronectin (FN) levels were measured by single radial immunodiffusion and their plasma albumin concentrations were estimated by a colorimetric method.

PEM proved to have highly significant decreasing effects on both FN and albumin concentrations in plasma. The mean values of plasma FN and albumin levels in each group differed significantly from the corresponding ones in the other groups with one exception, namely, the difference between the mean value of plasma albumin in the group of mild PEM and that in the group of moderate disease. Both plasma FN and plasma albumin levels correlated well with the NI. But, the correlation coefficient of FN ($r=+0.68$) was higher than that of albumin ($r=+0.52$) indicating that plasma fibronectin concentration is more accurate than plasma albumin level in assessing the nutritional status of our infants and children.
Introduction And Aim Of The Work

In Egypt, 2-5% of infants and children below 5 years of age have severe malnutrition. About 47.3% of these patients have protein energy malnutrition (PEM) (Arab Republic of Egypt, 1979).

In 1984, Standstedt et al., observed that parenteral nutrition, for gastrointestinal disorders, raised plasma fibronectin (FN) level in the malnourished patients and not in the well nourished ones indicating the usefulness of plasma FN estimation in assessing the nutritional status. It is the most recent addition to the available protein measurements helpful in diagnosing PEM. Plasma albumin concentration was one of the first biochemical indicators of malnutrition to find almost universal use. So, most nutritional studies still include it as one parameter (Denis, 1989).

The main objective of this study is to measure the plasma FN and albumin levels in the different degrees of PEM in order to evaluate the usefulness of these parameters in picking up patients, assessing the severity of the disease and giving the prognosis in such cases.
Subjects And Methods

The current study included 60 patients with PEM (3-30 months of age) and 20 age matched normal controls (11 males & 9 females). They were chosen from the outpatient clinic of Benha University Hospital during 1990. All were subjected to the following:

- Detailed medical history taking and clinical examination.
- Full blood picture.
- Plasma FN estimation by single radial immunodiffusion (Daniel et al., 1987) using immunodiffusion plates (produced by Behring Co.) which contain the corresponding mono-specific antiserum of rabbits or goats in a ready to use agar-gel layer (Matsuda et al., 1982).
- Plasma albumin level determination by a colorimetric method based on the fact that in a buffered solution, bromocresol green forms with albumin a green complex whose intensity is directly proportionate to plasma albumin concentration.
- Nutritional index (NI) calculation.

\[
NI = \frac{\text{observed weight/length}}{\text{ideal weight/length}} \times 100
\]

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According to McLaren classification of PEM (McLaren & Read, 1972) our patients were divided into 3 equal groups:

- Group with mild PEM (NI = 85-90%); 12 males and 8 females.
- Group with moderate PEM (NI = 75-85%); 7 males & 13 females.
- Group with severe PEM (NI <75%); 12 males and 8 females.

Statistical analysis of the results was performed using the arithmetic mean, standard deviation, standard error, t-test (test of significance), F-test (test of analysis of variance and difference) and correlation test.
Results

Tables (1) to (6) as well as figures (1) and (2) summarize and represent the results of the work done.

From table (1), it is obvious that plasma FN level decreases with the increasing severity of PEM. F calculated (31.27) is much higher than F from table (2.73) indicating a highly significant effect of PEM on FN concentration in plasma. From this test and the correlation test, table (2), we can find a highly positive correlation between plasma FN level and NI ($r=0.68$). The results of t-test are shown in table (3). The differences between the mean value of each group and those of the others are of great statistical significance.

Table (4) shows that plasma albumin level decreases as PEM becomes severer. Since F calculated (13.33) is greater than F from table (2.73), it is clear that PEM exerts a significant effect on plasma albumin concentration. This test and the correlation test, shown in table (5), reveal a positive correlation between plasma albumin level and NI ($r=0.52$). As shown in table (6), the difference between the mean value of the group of mild PEM and that of those with moderate disease is of no statistical significance. Otherwise, the differences between the groups are statistically significant.
Table (1): Results of F-test for fibronectin levels.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Mild PEM</th>
<th>Mod. PEM</th>
<th>Severe PEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (µg/ml)</td>
<td>233.3</td>
<td>173.35</td>
<td>135.05</td>
<td>85.55</td>
</tr>
<tr>
<td>S.D. (µg/ml)</td>
<td>±47.82</td>
<td>±57.71</td>
<td>±54.62</td>
<td>±29.32</td>
</tr>
</tbody>
</table>

F calculated = 31.27; F from table = 2.73

Table (2): Results of correlation test between fibronectin levels (FN) and nutritional index (NI).

<table>
<thead>
<tr>
<th>No.</th>
<th>NI (Mean±S.D.) ( % )</th>
<th>FN (Mean±S.D.) (µg/ml)</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>82.90 ± 15.90</td>
<td>156.81 ± 72.69</td>
<td>r = +0.68</td>
</tr>
</tbody>
</table>

Table (3): Results of t-test for fibronectin levels

<table>
<thead>
<tr>
<th>Group</th>
<th>Mild PEM</th>
<th>Mod. PEM</th>
<th>Severe PEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>59.95 (31.45)*</td>
<td>98.25 (31.45)*</td>
<td>147.7 (31.45)*</td>
</tr>
<tr>
<td>Mild PEM</td>
<td>38.30 (31.45)*</td>
<td>87.8 (31.45)*</td>
<td>49.5 (31.45)*</td>
</tr>
<tr>
<td>Mod. PEM</td>
<td>49.5 (31.45)*</td>
<td>87.8 (31.45)*</td>
<td>49.5 (31.45)*</td>
</tr>
</tbody>
</table>

* = Significant difference
- Values without parentheses are actual differences between means.
- Values between parentheses are the least significant differences.
Table (4): Results of F test for albumin levels.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Mild PEM</th>
<th>Moderate PEM</th>
<th>Severe PEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (gm/dl)</td>
<td>3.59</td>
<td>2.91</td>
<td>2.50</td>
<td>1.96</td>
</tr>
<tr>
<td>S.D. (gm/dl)</td>
<td>±0.74</td>
<td>±0.99</td>
<td>±0.93</td>
<td>±0.57</td>
</tr>
</tbody>
</table>

F calculated = 13.33 ; F from table = 2.73

Table (5): Results of correlation test between albumin levels and nutritional index (NI)

<table>
<thead>
<tr>
<th>No</th>
<th>NI (Mean ± SD)(%)</th>
<th>Albumin (Mean±SD) (gm/dl)</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>82.90 ± 15.90</td>
<td>2.74 ± 1.02</td>
<td>r = + 0.52</td>
</tr>
</tbody>
</table>

Table (6): Results of t-test for albumin levels

<table>
<thead>
<tr>
<th>Group</th>
<th>Mild PEM</th>
<th>Mod. PEM</th>
<th>Severe PEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.69 (0.53)*</td>
<td>1.1 (0.53)*</td>
<td>1.64 (0.53)*</td>
</tr>
<tr>
<td>Mild PEM</td>
<td>0.41 (0.53)</td>
<td>0.95 (0.53)*</td>
<td></td>
</tr>
<tr>
<td>Mod. PEM</td>
<td></td>
<td>0.54 (0.53)*</td>
<td></td>
</tr>
</tbody>
</table>

* = Significant difference.

- Values without parentheses are actual differences between means.
- Values between parentheses are the least significant differences.
Fig (1): Plasma Fibronectin Levels In The Different Groups

Fig (2): Plasma Albumin Levels In The Different Groups
Discussion

In the present study, the mean value of plasma FN level in the control group was 233.3 ug/ml. In mild, moderate and severe PEM, it was 173.35, 135.05 and 85.55 ug/ml respectively. The t-test showed that the differences between the mean of each group and those of the others were statistically significant. F-test showed a highly significant impact of PEM on plasma FN concentration. A positive correlation was found between FN level and NI ($r=+0.68$). Our results are close to those of Sandberg et al., (1985) who reported that the mean value of plasma FN in normal children was 253 ug/ml and that in severe forms of PEM (kwashiorkor and marasmus) it was 96 ug/ml. Moreover, they found a positive correlation between plasma level of FN and the weight deficit among their patients. Also, other studies reported low levels of plasma FN in malnutrition (Scott et al., 1982, Mckone et al., 1985 and Yoder et al., 1987). The drop in plasma FN level seems to be due to reduction in its synthesis rate (Chadwik et al., 1984).

As for plasma albumin concentration, the mean value of our normal controls was 3.59 gm/dl while it was 2.91, 2.5 and 1.96 gm/dl in mild, moderate and severe PEM respectively. Apart from the difference between mild and moderate PEM, t-test showed that the differences between the means of the various groups were statistically significant. F-test showed a significant effect of PEM on plasma albumin level which showed a positive
correlation with the NI ($r=+0.52$). The low plasma albumin levels may be due to peripheral redistribution or increased metabolism (Denis, 1989). Our results agree with those of Jelliffe and Stanfield (1978) who reported low plasma albumin levels in kwashioorokor. Reduced albumin concentrations have been reported to be accompanied with increased morbidity and mortality (Weisberg, 1983; Anderson & Wochos, 1982 and Seltzer et al., 1979). On the other hand, Forse and Shizgal (1980) found that plasma albumin level was often normal in marasmus.

So far, we can conclude that the plasma levels of both FN and albumin are good indicators of the nutritional status. But, since the mean values of plasma albumin levels in mild and moderate PEM are not significantly different and as the correlation coefficient between plasma FN level and NI is higher than that between plasma albumin concentration and NI, we can postulate that plasma FN level is more sensitive than that of albumin in assessing the nutritional status. This may be because the half life of plasma FN (4-24 hours) (Saba et al., 1983) is short if compared with that of plasma albumin (18-20 days). Also, in PEM, albumin is first mobilized from the extravascular pool maintaining its plasma level for some time. So, plasma FN level is very helpful in early detection of PEM while plasma albumin concentration is only valuable in assessing the severity of chronic cases and in estimating the prognosis (Denis, 1989).
References


