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Original research article

A study of cortisol in PEM

Dr. Saifuddeen AA
Associate Professor, Department of Paediatrics, Kanachur Institute of Medical Sciences, Mangalore, Karnataka, India

Corresponding Author:
Dr. Saifuddeen AA

Abstract
Marasmus and kwashiorkor, the two most common forms of protein-energy malnutrition (PEM), are caused, respectively, by successful adaptation and failure to adjust to a changing environment [1-5]. Rao have proposed that kwashiorkor is caused by the adrenal cortex's inability to respond adequately to the stresses caused by nutritional deprivation. This inability manifests itself as an inability to mobilize a sufficient quantity of amino acids from muscle in order to maintain normal levels of albumin and apo-protein production in the liver. This condition leads to fatty infiltration of the liver as well as hypoalbuminemia and edema as a subsequent complication. On the other hand, these hepatic responses are avoided in children who have marasmus because of an appropriate response of the adrenal cortex. The fact that increasing serum albumin and liver protein concentrations through the injection of glucocorticoids to malnourished animals inhibits fatty infiltration of the liver further lends support to this concept. This is an attempt to resolve the controversies that have been raised regarding this topic. We evaluated the adrenal cortical reserve in a select group of children with marasmus and kwashiorkor by determining the reaction of blood cortisol to exogenously administered ACTH.
Keywords: PEM, serum, cortisol, tertiary center, pediatric

Introduction
The endocrine modulation of intermediate metabolism is critical to the process of adaptation that occurs in response to a lack of nourishment. Marasmus and kwashiorkor, the two most common forms of protein-energy malnutrition (PEM), are caused, respectively, by successful adaptation and failure to adjust to a changing environment [1-5]. Rao have proposed that kwashiorkor is caused by the adrenal cortex's inability to respond adequately to the stresses caused by nutritional deprivation. This inability manifests itself as an inability to mobilize a sufficient quantity of amino acids from muscle in order to maintain normal levels of albumin and apoprotein production in the liver. This condition leads to fatty infiltration of the liver as well as hypoalbuminemia and edema as a subsequent complication. On the other hand, these hepatic responses are avoided in children who have marasmus because of an appropriate response of the adrenal cortex. The fact that increasing serum albumin and liver protein concentrations through the injection of glucocorticoids to malnourished animals inhibits fatty infiltration of the liver further lends support to this concept [6]. On the other hand, there is no general agreement over how to define the circulating concentrations of adrenocortical hormones in children who have PEM. Plasma cortisol levels tend to rise in all forms of severe PEM, according to the findings of the majority of researchers [7-9]; nevertheless, other people have reported having normal amounts of cortisol in their bodies [10]. Cortisol levels were shown to be much lower in patients with kwashiorkor compared to those with marasmus by other researchers [11].

Aims and Objectives: To study the cortisol levels in PEM

Materials and Methods
This study was done in the Department of Paediatrics, Kanachur Institute of Medical Sciences, Mangalore.
This study was done from Feb 2021 to Jan 2023.

Inclusion Criteria: Only confirmed cases of PEM

Exclusion Criteria
- Patients on chemotherapy, and also on corticosteroids.
- The base line cortisol levels were taken. The levels were again studied after the treatment and compared.
- 30 patients with PEM and 30 controls were selected.

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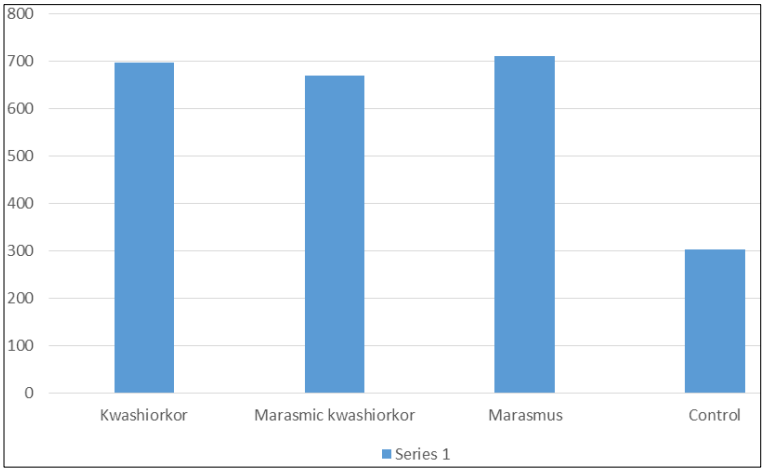
Results

Table 1: Cortisol levels before the treatment

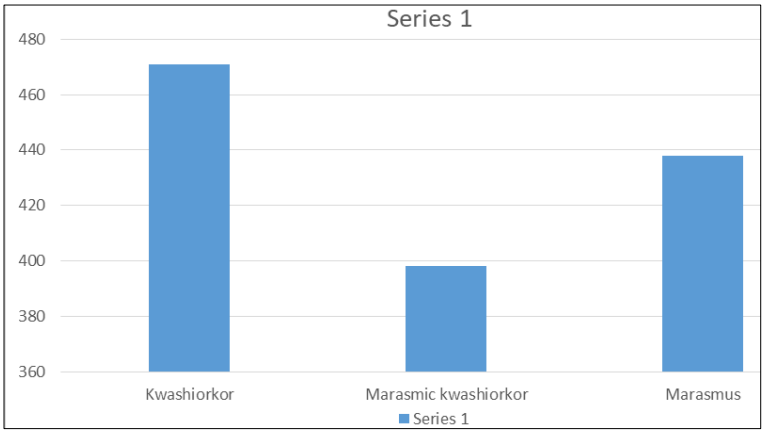
Condition	Cortisol level (nmol/L)
Kwashiorkor	698±121
Marasmic kwashiorkor	671±202
Marasmus	711±110
Control	302±98



Graph 1: Cortisol levels before the treatment

Table 2: Cortisol levels after the treatment

Condition	Cortisol level (nmol/L)
Kwashiorkor	471±238
Marasmic kwashiorkor	398±183
Marasmus	438±147



Graph 2: Cortisol levels after the treatment

Discussion

Regarding the amount of adrenocortical reserve that can be determined by measuring plasma cortisol responses to exogenous ACTH, there is no consensus among PEM researchers. Some researchers have found that children with kwashiorkor have a lower reaction rate than children with marasmus, [12] while other researchers have found the converse to be true [13]. Several publications have shown that hypoglycemia, hypoalbuminemia, infections, and the stress of dietary restriction connect with the cortisol levels in PEM, [10, 14-17]; however, additional evidence regarding the function that is played by these factors is required. We have determined the serum cortisol concentrations in children with various types of PEM before and after nutritional rehabilitation, and we need to correlated these levels with serum glucose levels, albumin concentrations, and amino acid pattern, as well as with the degree of muscle wasting. This is an attempt to resolve the controversies that have been raised regarding this topic. We evaluated the adrenal cortical reserve in a select group of children with marasmus and kwashiorkor by determining the reaction of blood cortisol to exogenously administered ACTH. In all three of the most

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severe forms of severe PEM (kwashiorkor, marasmic kwashiorkor, and marasmus), the levels of cortisol in the serum were greatly high. Due to the fact that the levels of corticosteroid-binding globulin have been observed to be low in all forms of PEM, it was anticipated that the levels of free cortisol would be high. Under normal circumstances, the adrenocortical response was adequate in each of the children who were malnourished, which is in agreement with the findings of other researchers [7, 9]. However, our results are in contrast to those discovered by Smith 11, who discovered that the plasma cortisol levels of children diagnosed with marasmus were noticeably higher than those of children diagnosed with kwashiorkor [11]. Cortisol levels in the blood of the children who had undergone nutritional therapy for four to eight weeks were seen to drop significantly and become indistinguishable from those of normally developing youngsters. These findings provide support for the hypothesis that the underlying functional change is reversible. In spite of the high basal levels that were seen in a few children who had kwashiorkor and marasmus, it was determined that the adrenal cortical response was adequate because there was an increase in cortisol levels that occurred 1 hour after the ACTH injection. In children with kwashiorkor, the adrenocortical response was not found to be decreased, according to our findings.

Conclusion

Cortisol levels in the blood of the children who had undergone nutritional therapy for four to eight weeks were seen to drop significantly and become indistinguishable from those of normally developing youngsters.

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