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CIRCULATING PLASMA LEVELS OF FOLLICLE - STIMULATING HORMONE, LUTEINIZING HORMONE AND TESTOSTERONE IN MALNOURISHED MALE CHILDREN*

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The manifestations and clinical course of the two main types of protein-energy malnutrition (PEM) - kwashiorkor and marasmus are known to involve some derangement of endocrine function. Most studies have reported on the variable responses of cortisol, insulin, growth hormone and thyroid function assessment in both kwashiorkor and marasmus[1-3]. Whether such hormonal changes are related to the actual pathogenesis of PEM or only appear as a result of the severity of the condition is not yet clear[4].

The effect of PEM on the reproductive hormones has not been fully investigated even though gonadal atrophy, delayed sexual maturation and impaired fertility have been reported in malnourished experimental animals[5,6]. The present paper reports on the plasma levels of testosterone, luteinizing hormone (LH) and follicle-stimulating hormone (FSH) as indices of pituitary-testicular function in children with kwashiorkor and marasmus.

Material and Methods

The subjects consisted of 17 malnourished male children aged between 12 and 35 months, who had been admitted to the children's ward at the University College Hospital, Ibadan. By using the Wellcome classification[7], it was determined that eight of the children had kwashiorkor and nine marasmus. Twenty other well-nourished male children of the same age-group admitted for minor elective

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surgery and with no apparent endocrine involvement served as controls. The clinical and biochemical findings of the patients and the controls were recorded. Plasma levels of testosterone, FSH and LH were determined by the radio-immunoassay methods previously described[8]. The International Reference preparations, *68/40* for human LH and *69/104* for human FSH were used as standards. Statistical analysis of the results was made by the analysis of variance.

Results

The results obtained are shown in the scattergram in Fig. 1 and Table I. The mean testosterone level was significantly lower ($p < 0.01$) in the children with kwashiorkor than in the marasmus or control subjects (1.81 ± 0.17; 4.5 ± 0.5; 6.2 ± 0.5 nmol/l, respectively).

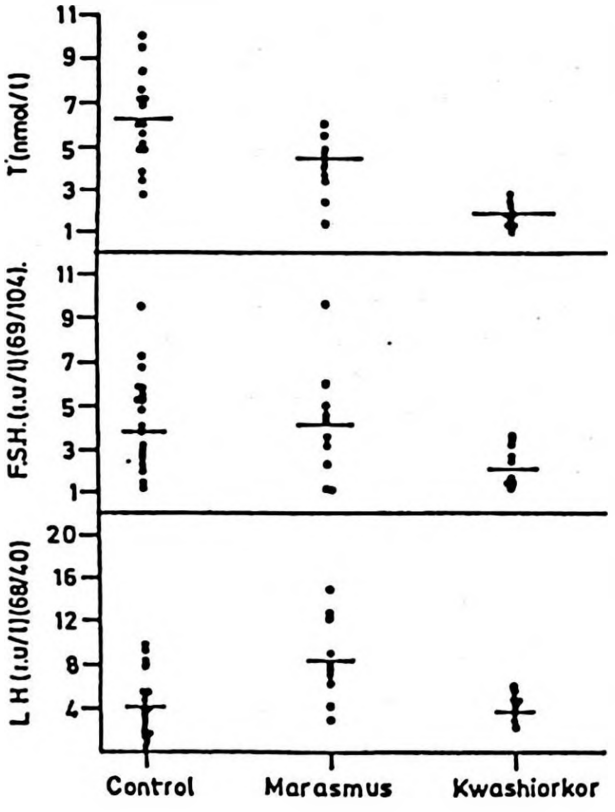

Fig. 1: Plasma levels of luteinizing hormone (LH), follicle stimulating hormone (FSH) and testosterone (T) in children with kwashiorkor and marasmus and in age-matched controls. The mean level of each hormone is indicated by horizontal bars.

The mean LH level of the marasmus subjects was higher ($p < 0.002$) than in both the controls and the kwashiorkor subjects, however there was no significant difference between the latter groups (8.8 ± 1.2; 4.3 ± 0.8; 4.0 ± 0.3 i.u/l, respectively).

TABLE I: Testosterone, LH and FSH Levels in Malnourished Children

	Testosterone (nmol / l)	LH (i.u./l)	FSH (i.u./l)
Normal	6.2 ± 0.5	4.3 ± 0.8	3.66 ± 0.48
Kwashiorkor	1.81 ± 0.17	4.0 ± 0.3	2.32 ± 0.32
Marasmus	4.5 ± 0.5	8.8 ± 1.2	4.09 ± 0.78

The mean FSH levels in both the control (3.66 ± 0.48 i.u./l) and marasmus subjects (4.09 ± 0.78 i.u./l) were significantly higher ($p < 0.02$) than that obtained in the kwashiorkor subjects (2.23 ± 0.32 i.u./l). There was no significant difference recorded between the mean FSH levels in both the marasmus cases and the controls.

Discussion

The results of the present study indicate that impairment of pituitary-gonadal axis function may accompany the other endocrine manifestations of protein-energy malnutrition. Kwashiorkor was found to be apparently associated with primary hypogonadal function as evidenced by the laboratory findings of low testosterone and elevated LH levels. The derangement in kwahiorkor appears more marked. The low levels of testosterone in this condition is not accompanied by any increase in LH, and FSH levels are depressed. This finding may be indicative of a defect in the feedback control of the pituitary-gonadal axis in kwashiorkor.

Earlier studies have tended to produce variable results. Perhaps because the exact nature of the malnutrition studied was not always clearly defined. In a study of endocrine disturbances in chronic human malnutrition, low levels of bioassayable pituitary gonadotropins have been observed[9]. Hypopituitary function may also be inferred from the studies of Olusi et al[2], although in this case, LH concentrations in the kwashiorkor and control subjects were not significantly different. Pimstone[10] also found no alterations in the basal levels of LH and FSH in malnourished children but observed poor responses of these hormones to gonadotropin-releasing hormone (LH-RH) stimulation, thus demonstrating a depletion of gonadotropin stores in these conditions.

Recent results of Lunn et al[3], which indicated that the pathogenesis of kwashiorkor in Gambian and Ugandan children differed mainly in the degree of the development of hypoalbuminemia would suggest that the well-known variations in the degree of dysproteinemia between kwashiorkor and marasmus and its consequential effects on hormone binding proteins and hence, free hormone concentrations, may be important in the etiology of the endocrinopathy that develops.

Indeed, the observation of low plasma testosterone in the presence of normal LH levels in this study may be explained on the basis of low sex-hormone binding globulin (SHBG), which has not been determined in this study, and low pituitary stores of gonadotropins in spite of normal or even elevated LH levels in kwashiorkor. On the other hand, it is very difficult to determine low pituitary stores of gonadotropins when carrying out the LH-RH test on marasmus cases and in the presence of normal or even elevated LH levels in kwashiorkor.

Summary

The effect of protein-energy malnutrition on the pituitary-gonadal axis was examined and discussed. In the seventeen cases of malnutrition, eight were of the kwashiorkor type while nine were of the marasmic type. Although it was found that the mean LH levels in the children with marasmus were higher ($p < 0.002$) than in both the controls and the kwashiorkor patients, and the mean FSH levels in both the marasmus subjects and the controls were significantly higher ($p < 0.02$) than that obtained in the kwashiorkor patients, the mean testosterone levels were significantly lower ($p < 0.01$) in those with kwashiorkor than in the marasmus or the control subjects. The results obtained from this study suggest that protein-energy malnutrition in children may induce some changes in the endocrine status or it may lead to an impairment in pituitary gonadal axis function. These changes are apparently more extreme in kwashiorkor than in marasmus.

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