Agents and Actions, vol. 19, 5/6 (1986)

0065-4299/86/060341-03 $ 1.50+0.20/0

Magnesium-deficient hairless rat: spleen cells mitogenic responses and variations in hormonal status

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Abstract

Hairless rats with dermatosis induced with a poor magnesium diet were previously shown to bear biochemical and immunological abnormalities. It was therefore felt of interest to investigate the spleen cells proliferative responses from these rats, both in the rash and the remission phases, when testosterone and parathormone plasma levels were also determined. Results showed that proliferative responses to mitogens and PTH levels were inversely related to the intensity of the dermatosis, whereas testosterone levels were more or less decreased. The role of 1,25 dihydroxyvitamin D_3 in these modifications is questionable.

Introduction

Magnesium-deficient hairless rat develops a dermatosis taking the form of a cyclic rash with erythematous nonfollicular plaques [1]. At the same time, animals show various biochemical and immunological abnormalities [2]. Non steroidal antiinflammatory drugs, anti H_1, anti H_2 and phosphodiesterase inhibitor were shown to be ineffective on the pathology, whereas steroidal antiinflammatory agents and immunosuppressive drugs inhibited the development of the rash [2–3].

The aim of this study was the evaluation of spleen cells mitogenic responses from magnesium-deficient hairless rat both during the rash and the remission phases, when testosterone and parathormone plasma levels were also determined.

Methods

Dermatosis was induced and followed as previously described [3]. Briefly, ninety male hairless rats (Iffa-Credo, France), weighing about 200–250 g were included in these assays. Forty of them fed a 2 g Mg^{2+}/kg diet were used as controls (C), whereas a magnesium deficiency (MD) was induced in the others with a magnesium poor semi-synthetic diet (40 mg Mg^{2+}/kg diet, U.A.R. Epinay/Orge France).

Two sets of experiments were performed in which half of the animals from each group was sacrificed when erythema reached its maximum (rash phase) and the others were sacrificed when the first rash disappeared (remission phase). In the first experiment (20 C and 20 MD) and at each sacrifice, spleens were taken then proliferative responses to mitogens were assayed on spleen cells by ^{3}H-thymidine incorporation as described by Bradley [4]. In the second experiment (20 C and 30 MD) and at each sacrifice, blood was collected and thymus weight determined. Then, testosterone plus dihydrotestosterone (T) and parathormone (PTH) plasma levels were determined by radioimmunoassays (Amersham, Les Ulis, France and ORIS Industrie, Gif-sur-Yvette, France respectively).

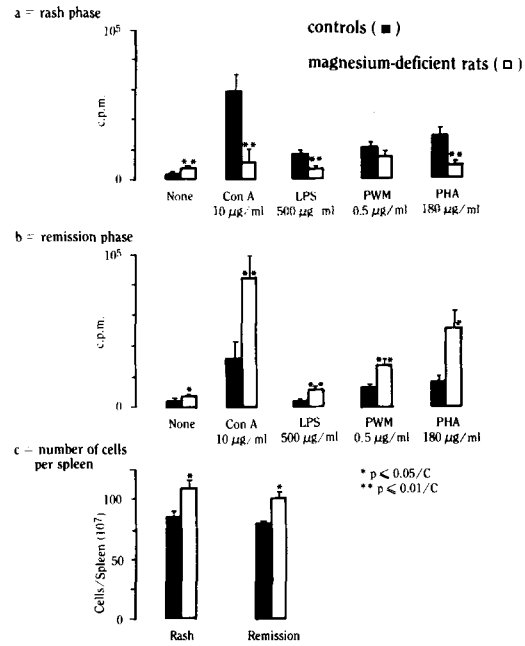

Figure 1
Proliferative responses to mitogens in magnesium-deficient rats.

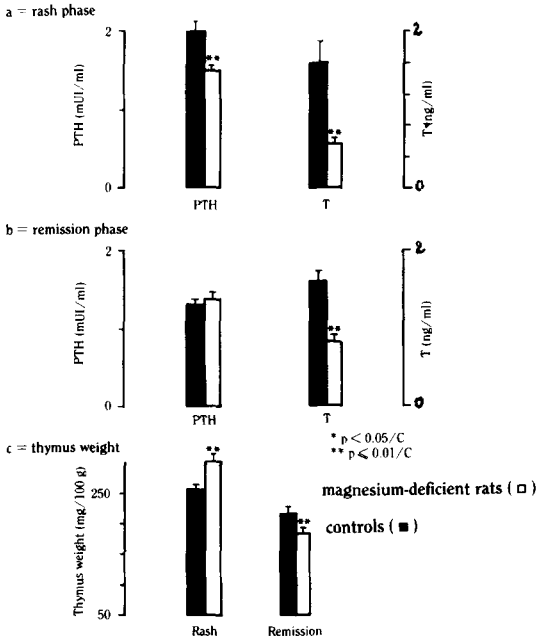

Figure 2
Testosterone (T) and parathormone (PTH) plasma levels in magnesium-deficient rats.

Results

Proliferative responses to mitogens

During the rash phase (index of dermatosis: 3.7 ± 0.2), spontaneous proliferation of MD rats versus C was enhanced and proliferative responses to all assayed mitogens were markedly depressed (Fig. 1a). But, during the remission phase (index of dermatosis: 0.8 ± 0.3), spontaneous proliferation was always enhanced whereas proliferative responses to mitogens in MD rats were also greatly enhanced (Fig. 1b). During both phases, mean number of spleen cells was significantly increased in MD rats versus C rats (Fig. 1c).

T and PTH plasma levels

During the rash phase (index of dermatosis: 3.5 ± 0.1), both PTH and T plasma levels were decreased in MD rats (Fig. 2a) whereas during the remission phase (index of dermatosis: 1.5 ± 0.5), PTH plasma levels in MD rats were normalized and T levels, although less marked than in rash phase, were always depressed (Fig. 2b). In this same experiment, thymus weight, expressed as mg/100 g body weight, was increased in the rash phase and decreased in the remission phase (Fig. 2c).

Discussion and conclusion

These results, unlike Gunther's and Averdunk's data obtained with hairy rats [5], not only show a reduced lectin stimulation of spleen cells but also an enhanced lectin response when lesions resolve. This biphasic response is similar for the four stimulants used and is accompanied in both phases by an increase in spleen cells number. Moreover, the immune response is inversely correlated to the thymus weight. As the T plasma level is decreased throughout the experiment and gonadal steroids regulate immune function [6], variations in T levels might explain, at least partly, the variations in immune response. On the other hand, PTH plasma levels in this experiment are only decreased in the acute phase which is apparently inconsistent with the increase in plasma calcium previously observed [2].

Whether all these data (reduced lectin stimulation, decreased PTH, increased Ca) are related

to modifications in 1,25 dihydroxy vitamin D_3, deserves further investigation.

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