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Profound Heamaological Changes In Rats Fed On Different Diet Formulae: A club To The Basis of Ethnic Leuko-Neutropenia

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ABSTRACT

Persons of African origin reportedly have benign Leuko-neutropenia. This relative roles of vitamin B complex and proteins on the leucocyte counts and distribution in an animal model was investigated inbred adult male and female albino rats weighing between 100-160g (n=50) were randomised into four groups. At the end of six weeks feeding period, blood samples were obtained and total leukocyte count was done. The results of total court show that animals fed in protein supplemented diet had a profound increase in their leukocyte court when compered with the control. The study shows that specific dietary elements can induce profound charges n total and differential leukocyte count.

Persons of African origin reportedly have benign Leuko-neutropenia (Haddy et al; Moore 1958; Rougement 1975; Ezeilo 1972; Williams et al 1991). It has remained hitherto uncertain what may be responsible for this albeit benign condition. Many authors have adduced dietary insufficiency as the basis of the condition. Indeed, the lowest recorded leukocyte counts in a population in the world are of that of the maaban tribesmen who reportedly eat meat once a year (Gray et al 1935). The World Health Organisation (WHO) notes that the diet of Africans is markedly deficient in proteins and vitamins. And these are important requirements for haematopoiesis (Gannong,1999). The relative roles of the deficiencies of these elements on the leukocyte counts, in particular, remain largely uninvestigated but it was shown that dietary cholesterol supplements increased the leukocyte and neutrophil counts in albino rats Ogunranti (1994). And Umapathy and co had shown that chicken mash fed rats had a profound elevation in their lymphocyte counts, which was concomitant with the reduction of neutrophil numbers in contrast to a cowpea-fed group that had a relatively higher neutrophil count Umapathy et al (1987). This report strengthens the case that specific dietary elements have different effects on leukocyte cell lines. This finding emphasizes the possibility that specific dietary elements could be important in leukocyte counts and distribution. Some authors have proposed a genetic origin for leuko-neutropenia (Davis et al, 1967; Sharper et al, 1972). Nutritional neutropenia is a type of neutropenia separately classed by some authors Figueroa (1981). This type of neutropenia is however, characterized by chronic starvation, anorexia nervosa and folate deficiency.

This study aimed at evaluating the relative roles of specific dietary elements of vitamin B complex and proteins on the leukocyte counts and distribution in an animal model. Manipulation of dietary intake of populations for experimental purposes is difficult to achieve. We had to assumethat effects of these elements on the leukocyte profile of animal models could give an insight in the relative roles of diet in the well-known peculiar leukocyte counts and indeed distribution of the African (Ezeilo 1981; Nduka et al, 1988). The goal of thestudywas to ascertain the relative influence of diet on the etiology of leuko-neutropenia of persons of African origin.

MATERIALS AND METHODS

Animal selection and feeding

Inbred adult male and female albino rats (wistar) weighing between 100-160g (n=50) were randomized into 4 groups (A-D) of five males and five females each. The animals in Group A were fed on their accustomed diet of rabbit pellets (Pfizer, Nigeria) for six weeks. This feed was termed the standard diet. And the group served as the control group. Members of groups B-D had this standard diet supplemented with proteins, vitamin B complex or ground peanuts as shown in Table 1. All the

Table 1: the diet formulations for respective animal groupings

Grouping	Group A	Group B	Group C	Group D
Food type	Standard diet Control	Standard diet Plus Vit. B com. 0.1% (w/w)	Standard diet Plus soybean 50% (w/w)	Standard diet Plus peanut 50% (w/w)

animals were allowed free access to tap water and housed under uniform husbandry conditions. The feeding period for all the other groups was equally for six weeks.

Haematological Analysis

At the end of the six weeks feeding period, blood samples were obtained from all the animals by a life-sparing cardiac puncture into EDTA bottles. All samples were analyzed within six hours.

Total leukocyte counting was determined using an automated blood analyzer (Fisher, USA). The differential counting was by counting cell types from Giemsa_ Giemsa_ Grundwal stained slides under the microscope using an improved Neubauer chamber. The counting was registered on an auto-diff counter (Bioscience, UK).

Packed cell volume and Haemoglobin were determined electronically (Fischer, USA).

Statistical Analysis

The mean values for the respective groups were compared relative to the control group values using a students t-test. The P-value was set at $P < 0.05$).

RESULT

The results are as summarized in Table 2. The results of the total leukocyte count show that animals fed on protein-supplemented diet (group C) had a profound increase in their leukocyte count when compared with that of the control group. Also, the animals (group B fed on vitamin Complex supplemented diet had a significantly elevated leukocyte number relative to the control group (P0.05). There was also increase in the neutrophil and lymphocyte counts for the two groups (fig 1).

In contrast animals fed with peanut-supplemented diet (group D) had a scarcely distinguishable leukocyte count and distribution from those of the control group. There was a reversal of the neutrophil to lymphocyte ratio in the leukocyte distribution of Groups C and B animals when compared with that of the control group. The N: L for the control group is 27:25 whereas those of the vitamin Complex-supllemented group and soyabean-supplemented group are 32:37 and 31:36 respectively. This represents an interesting diet induced change in the leukocyte distribution of albino rats (table 1).

Packed cell volume and Haemoglobin concentration

There were substantial changes in the PCV and Hb concentration for the groups B and C compared with the values for the control group. The animals that were fed on Vitamin B supplemented diet had the most improved Hb and PCV values (table 2). Again, there were little or no differences in the values of Group D and Control group values.

DISCUSSION

This study shows that specific dietary elements can induce profound changes in the total and differential leukocyte count and distribution and of the PCV and haemoglobin concentration of albino rats. Vitamin B complex and proteins are well known requirements for erythropoiesis Dale et al, (1975). It is understandable that these elements can improve the PCV and haemoglobin concentrationas shown on table 1. In contrast, the factors controlling granulopoiesis are poorly defined (Von et al, 1082;Cebon, 1994). The factors responsible for ethnic leuko-neutropenia remain hitherto idiopathic albeit benign (Sahr et al, 1995; Dale, 1994). African and Yemenite Jews have low circulating leukocyte counts due to low absolute neutrophil counts (Ezeilo, 1972; Davis et al, 1967). Ezeilo made a strong case for a dietary origin for this condition Ezeilo, (1974). This study confirms that diet, or more accurately, specific dietary elements have profound effects on leukocye counts and distribution. Ogunranti had shown that cholesterol can induce an elevation in the leukocyte and neutrophil counts in a work on albino rats Ogunranti, (1994). It is known that neutrophil and leukocyte counts change in the same direction Green et al, (1978). Umapathy and co had shown that unspecified dietary compositions could also cause profound changes in the leukocyte distribution in albino rats Umapathy et al, (1987). In particular, they showed and elevation in lymphocyte levels of rats fed on chicken marsh. The elevation inlymphocyte distribution generally leads to reductions in both the leukocyte and neutrophil numbers by competitive-

Groups	A	B	C	D
Leukocyte Cells (u/L)	5500 +158	7083 +248	7200 +132	5230 +70
Neutrophil Cells (u/L)	2712 +85	3120 +132	3200 + 66	2802
Lymphocyte Cell (u/L)	2530 + 76	3812 + 233	3744 +97	2347 +240
Hb (g/dL)	13.25 + 0.56	15.98 +0.66	14.99 + 0.45	12.9 +1.66
PCV	39.8 + 1.33	48 +1.97	44.8 + 1.22	35.7 + 72

coupling (von). The dietary formulary presented to albino rats in this study especially reversed their N: L ratios relative to their control counterparts (table 2: fig1). This in turn caused a relative proportionate down-regulation of their neutrophil counts whereas cholesterol reportedly produced an opposite effects in similar animal models Ogunranti (1994). The implication of these findings is that specific dietary components differentially affected leukocyte cell lines.

It is known that majority of leuko-neutropenic Africans generally have preponderant lymphocyte in their leukocyte distribution Green et al, (1978). It therefore stands to reason that specific lymphocyte promoting dietary elements can as well cause neutropenia with Leukopenia since it is also known that this leuko-neutropenic condition is absent at birth. Much study would be required to identify dietary component(s) in the diet of the African that selectively caused increases in lymphocyte cell lines at the expense of neutrophil. This would give a useful insight into the dietary basis of the hitherto idipatthic leuko-neutropenia of persons of African origin whose diet is reportedly markedly different from that of their Caucasian counterparts (WHO). Animal models represent useful experimental models for this, as it is possible to widely manipulate their dietary components.

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