Café-au-lait spots in schoolchildren

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SUMMARY This paper reports a study of café-au-lait spots of a minimum diameter of 1 cm in 732 white schoolchildren. Three groups were identified, according to the number of café-au-lait spots on each child: (1) those with none (74%), (2) those with fewer than 5 (25%), and (3) those with at least 5 (5 children, 2 considered to be normal, and 3 siblings each presumed to have neurofibromatosis, one having died from leukaemia). Excluding the last group, the number of café-au-lait spots in the sample was not significantly related to age or sex. Some support is given for using the number of café-au-lait spots as an empirical threshold to diagnose neurofibromatosis.

Café-au-lait (CAL) spots, are often noticed in the clinical examination of children of school age. Yet there is no information on CAL spots for such children. Publications relate to neonates, children up to age 5 years (for whites and blacks), and white adults.[1 2]

We report a study of the number of CAL spots in healthy schoolchildren.

Subjects and methods

The 732 children in the study were attending one school in Nottingham. All were white and aged between 4 and 11 years.

The studies. The school was visited by one observer (RGB) for two periods, each during June and July separated by an interval of 4 years. After obtaining parental permission, all children attending were examined for CAL spots: firstly, in 1974 during a comprehensive anthropometric study; secondly, in 1978 during a detailed study of congenital abnormalities.[3] In 1974, 82 (27%) of 301 children had CAL spots. In 1978 there were 109 (25%) of 431 children with CAL spots. The data from each year of study were combined to provide records from 732 children for analysis (367 boys, 365 girls).

Examinations. In each child the entire skin surface (excluding genitalia of the girls) was fully examined in a good light. The CAL spots were recorded by number, accurate anatomical site, and size. Each spot was measured in two dimensions at right-angles to the nearest mm using a steel tape.

Identification of CAL spots. To be recorded as CAL spots the criteria were: a discrete, flat, pigmented area, light brown in colour with clearly defined margins, and skin markings the same as adjacent skin; the minimum broadest diameter to be 1 cm.

Follow-up. The three families of 5 children with at least 5 CAL spots were visited, interviewed, and examined in 1982.

Results

Number of CAL spots. The percentage and number of children with 0 to at least 6 CAL spots are shown in the Figure.

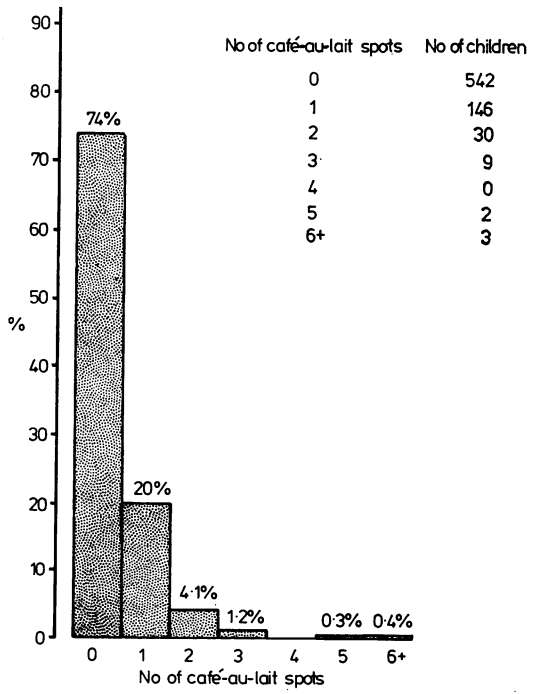

Figure *Percentage of children having 0 to at least 6 café-au-lait spots. Number of children is also shown. Note: 74% had no detectable spots; about 25% had 1 to 3 spots; only 5 children had 5 or more spots.*

After excluding the children with 5 or more CAL spots, there are 233 CAL spots in 185 children. The number of CAL spots in this sample does not have a normal (Gaussian) distribution; it has some characteristics of a Poisson distribution (with respect to means and variances at each year of age for boys and girls separately). A Poisson distribution is attributed to a process in which some kind of 'event' occurs repeatedly but haphazardly—for example a mutation. Using the transformation $\sqrt{x+\frac{1}{2}}$ to convert the Poisson to the normal distribution, an analysis of variance shows that the number of CAL spots in the sample is not significantly related to either age ($P > 0.25$) or sex ($P > 0.25$).

Assuming a random process in the population for their origin, the probability of children having CAL spots is as follows: none, 72·6%; 1, 23·3%; 2, 3·7%; 3, 0·4%; 4, 0·03%; and 5 or more, 0·002%. Comparison of these 'expected' percentages with those in the Figure shows a similarity on the left and a divergence on the right. A goodness of fit test suggests that the distribution is not entirely random due partly to an excess of children with 2 to 3 CAL spots ($\chi^2 = 6.44, 0.01 < P < 0.02$, df = 1, n = 727). Some evidence that the non-random component could be hereditary is provided from the follow-up.

Follow-up. The 2 children with 5 CAL spots are boys' One aged 8 years has the 5 CAL spots without axillary freckling; his sister aged 12 years and his parents are without CAL spots. The other, aged 13 years at 8-year follow-up, has 5 CAL spots without axillary freckling; his brother aged 12 years has 2 CAL spots, and his half brother, aged 6 years, 1 spot. Mother, divorced from his father and remarried, has 3 CAL spots reaching 1·5 cm, and 5 CAL spots reaching 1 cm in diameter—without evident neurofibromatosis in herself or her family.

The 3 children with 6 or more CAL spots are siblings. At 8-year follow-up, they proved to be the only children of a father with 1 spot and a mother with cutaneous manifestations of neurofibromatosis: numerous CAL spots, mollusca fibrosa, and verrucose hypertrophy. The brother (with spots too numerous to count) died of a T-cell type acute lymphoblastic leukaemia at 10 years[4]; the elder sister with numerous CAL spots, at 17 years now has a few mollusca fibrosa on her back; the other sister aged 9 years has 8 CAL spots with bilateral axillary freckling. All three, the only children of this mother, are presumed to have neurofibromatosis.

Discussion

Our choice of 1·0 cm as the discriminant size for CAL spots is arbitrary. It seems a reasonable compromise between the 0·5 cm for children from birth to age 5 years used by Whitehouse,[5] and the 1·5 cm for adults used by Crowe *et al.*[1]

CAL spots, age, and regional distribution. CAL spots are stated to be present soon after birth and to increase in number during the first and second decades of life.[1] Our cross-sectional study does not confirm a significant increase in the number of CAL spots between ages 4 and 11 years.

Our unpublished findings show that CAL spots are appreciably more common on the trunk and buttocks than on the limbs: this confirms the clinical opinion that CAL spots, unlike freckles, are more prevalent in unexposed areas of skin.[1]

CAL spots and the diagnosis of neurofibromatosis. It has been claimed empirically that 5 CAL spots in young children[5] or 6 CAL spots in adults[1] make a diagnosis of neurofibromatosis probable, if not mandatory. In contrast, Riccardi[6] has stated that multiple CAL spots are important but neither necessary nor sufficient for the diagnosis of neurofibromatosis.

Our findings provide some support and reason for using the number of CAL spots as an empirical threshold to diagnose neurofibromatosis.

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