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Haematological Reference Intervals in a Multiethnic Population

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Abstract

Introduction: Similar to other populations, full blood count reference (FBC) intervals in Malaysia are generally derived from non-Malaysian subjects. However, numerous studies have shown significant differences between and within populations supporting the need for population specific intervals.

Methods: Two thousand seven hundred twenty five apparently healthy adults comprising all ages, both genders and three principal races were recruited through voluntary participation. FBC was performed on two analysers, Sysmex XE-5000 and Unicel DxH 800, in addition to blood smears and haemoglobin analysis. Serum ferritin, soluble transferrin receptor and C-reactive protein assays were performed in selected subjects. All parameters of qualified subjects were tested for normality followed by determination of reference intervals, measures of central tendency and dispersion along with point estimates for each subgroup.

Results: Complete data was available in 2440 subjects of whom 56% (907 women and 469 men) were included in reference interval calculation. Compared to other populations there were significant differences for haemoglobin, red blood cell count, platelet count and haematocrit in Malaysians. There were differences between men and women, and between younger and older men; unlike in other populations, haemoglobin was similar in younger and older women. However ethnicity and smoking had little impact. 70% of anemia in premenopausal women, 24% in postmenopausal women and 20% of males is attributable to iron deficiency. There was excellent correlation between Sysmex XE-5000 and Unicel DxH 800.

Conclusion: Our data confirms the importance of population specific haematological parameters and supports the need for local guidelines rather than adoption of generalised reference intervals and cut-offs.

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Introduction

The reference interval for Full Blood Count (FBC), one of the commonest baseline investigations, is usually from manufacturers of haematology analysers or publications. However, as FBC parameters are known to vary between populations, ethnicities, age and gender, a population specific interval is clinically sound and desirable [1–10] (Table 1).

FBC reference intervals in use in Malaysia are generally from non-Malaysian populations; the only locally derived interval was based on 199 subjects, 45 years or younger and of unspecified race [11]. As a reference interval for adults should be derived from an adequate number of subjects, all ages and all ethnicities (if in a multiracial population), we embarked on this study to establish a comprehensive reference interval for Malaysian adults. Our hypothesis was that there would be race, gender and age associated differences.

Materials and Methods

Subject recruitment

Based on the standard deviation values of haemoglobin reported by Roshan et al [11] and setting the type I error and type II error at 0.05 and 0.20 respectively, we calculated a minimal sample size of 1200 subjects (considering 0.10 g/dL as the minimal significant difference between the sample mean and the true population mean, and an attrition rate of 20%). To facilitate the subject recruitment process, we divided the population into 12 subgroups, based on gender (males, females), ethnicity (Malay, Chinese, Indian) and age group (above and below 60 years for males; pre-menopausal and post-menopausal for females). In each subgroup, we tried to recruit at least 120 subjects but the number could only be achieved in female subjects and Chinese male subjects less than 60 years old. The reasons for not achieving the target of 120 subjects in the other subgroups were exclusion due to the presence