Ethnic differences in peak expiratory flow rate in Birmingham factory workers

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Summary

Among 698 Birmingham factory workers, Asian men ($n=75$) tended to have lower peak expiratory flow rates (PEFR) than black ($n=156$) or white ($n=138$) men when age, height and smoking habits were accounted for. This trend reached statistical significance in Asian females ($n=20$), despite a small sample size. There were no significant differences in PEFR between blacks and whites of either sex.

KEY WORDS: peak expiratory flow, ethnicity.

Introduction

The study of differences in common diseases in the 3 main ethnic groups in Britain (whites, black West Indians and Asians) has, in recent years, allowed a greater understanding of the diseases themselves. Furthermore, such study has exposed startling differences hitherto unproved and often unsuspected (Beevers, 1981). Admission rates for asthma to a district general hospital serving a tri-racial population were approximately 3 times higher for Asians and twice as high for black West Indians as for whites (Jackson, Bannan and Beevers, 1981). We therefore decided to include measurement of peak expiratory flow rate (PEFR) in a factory screening survey of blood pressure and cardiovascular risk factors being carried out in the same tri-racial community.

Methods

Ten factories and other workplaces were screened representing 72% of those on the payroll. Each

employee was asked to answer a questionnaire concerned with cardiovascular risk factors (including daily cigarette consumption) and ethnic group was noted. Ethnic groups were defined as black (blacks, or their parents, born in the West Indies), white (whites born in the British Isles) or Asian (born, or their parents born, in India, Pakistan, Bangladesh or East Africa). Those not included in these groups were excluded from the analysis. In addition, height, weight, age and PEFR were recorded. A minimum of 3 measurements of PEFR was taken using the Wright miniature peak flow meter (Wright, 1978) and the highest was used in the analysis. If the highest was the last reading, repeated measurements were taken until there was no further increase.

Statistical analysis was performed using the Statistical Package for the Social Sciences version 8.2 on the Queen Mary College (University of London) computer.

Results

Fewer Asians were screened than either blacks or whites and only 20 Asian females were included (Table 1). This was a reflection of the study population rather than a biased sample. Ethnic differences were seen in mean age, height, PEFR and smoking habits (Table 1). Multiple regression analysis was performed with PEFR as the dependent variable and age, height and daily cigarette consumption the continuous independent variables.

When age, height and smoking habits were allowed for using multiple regression analysis, there were no differences in PEFR between blacks and whites. Asian men however had PEFR values 20 litre/min lower than whites and blacks, although this did not reach statistical significance (Table 2). A similar pattern was seen for Asian females with values 48 litre/min lower than other women [$F(1,327)=6.8$, $P<0.01$] (Table 2). Age, age², height

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TABLE 1. Ethnic differences in mean age, height, smoking habits and PEFR of study sample

	Males			Females		
	Black (n = 156)	White (n = 138)	Asian (n = 75)	Black (n = 99)	White (n = 210)	Asian (n = 20)
Age (years)	44.7	41.1	33.2	40.9	38.8	32.3
Height (cm)	168.1	172.9	166.8	159.1	158.3	156.5
Smokers (%)	53.9	50.4	21.3	15.2	49.3	5.0
PEFR (litre/min)	518	525	516	402	401	372

and daily cigarette consumption all had a statistically significant effect on the multiple regression equation for both men and women (Table 2). Although the F value for age in the women fell below the 5% significance level (Table 2), the 2 age terms together make a significant contribution to the equation and account for a greater proportion of variance than age alone.

TABLE 2. Multiple regression analysis of PEFR showing regression coefficient (B), F value and significance level for each independent variable.

Independent variable	B	F*	P
Men			
Age	10.0	10.1	<0.005
Age ²	-0.15	15.1	<0.001
Height	3.1	17.4	<0.001
Cigarettes/day	-1.2	6.3	<0.025
Ethnic group: Asian	-20	1.8	<0.25
Black	-3	0.0	>0.25
Constant	-127	—	—
Multiple R ² = 14.9%			
Women			
Age	4.6	3.5	<0.1
Age ²	-0.08	6.3	<0.025
Height	2.2	11.8	<0.001
Cigarettes/day	-1.3	7.9	<0.005
Ethnic group: Asian	-48	6.8	<0.01
Black	-0.1	0.4	>0.25
Constant	15	—	—
Multiple R ² = 13.3%			

*Men, F (1,362); women, F (1,327).

Discussion

One of the problems of comparing biological variables in different ethnic groups is the formulation of the hypothesis under test. Is an actual difference sought or an independent effect of ethnic group sought? Mean PEFR values were almost identical in the 3 main groups yet smoking habits varied markedly and there were also differences in age and height. We chose to look for independent effects of ethnic group and therefore relied on multiple regression analysis. This technique has been used fre-

quently in the past for both predictive and descriptive purposes.

Gregg and Nunn (1973) used the technique to produce multiple regression equations based on data from strictly 'normal' individuals. From these equations they constructed standard curves showing the relationship between PEFR and age for different heights. Their equations used polynomial terms—age² and age³ for men and age² for women. The cubic term was rejected in our analysis as it did not contribute significantly to the regression equation. The use of the age² term is not merely a statistical manoeuvre as it provides the regression line of PEFR on age with a peak (usually in the fourth decade)—a fact well known to clinicians. The importance of such a term in a multiple regression equation is clear: if an equation without such a term is plotted, it becomes apparent that PEFR either increases or decreases with age throughout the age range—a phenomenon not observed in practice.

We found no differences in PEFR between blacks and whites in either sex and multiple regression analysis confirmed the absence of an independent effect of ethnic group on PEFR.

It has long been established that vital capacities are lower in black than white Americans (Gould, 1869), but a difference in PEFR or forced expiratory volume in 1 s (FEV₁): forced vital capacity (FVC) ratio has not been consistently reported. Abramowitz *et al.* (1965) showed lower FVC and FEV₁ values in American black males but measures of airway obstruction—FEV₁/FVC ratio and PEFR—were similar to white males. Damon (1966) also found no difference in FEV₁/FVC ratio between blacks and whites although mid-expiratory flow rates were lower in blacks than whites.

Amongst Asian men, the mean PEFR was marginally lower than for whites (Table 1) despite being on average 11 years younger. When age and other variables were taken into account, Asian males had PEFR values on average 20 litres/min lower than whites (Table 2). This difference did not reach statistical significance but suggests that there may well be a genuine ethnic difference. Clearly, such a difference would not be of clinical relevance in individual patients. This trend is in keeping with the

findings of Malik, Moss and Lee (1972) who found lower PEFR values among 'normal' West Pakistani males working in the United Kingdom when compared with data collected by other authors in whites all over the world. This study did not compare ethnic groups within the same community. Cotes and Malhotra (1965) compared a variety of lung function tests in whites with those of Indians. Measures of airways obstruction, FEV₁/FVC ratio and airway resistance did not differ when age and size were adjusted for. It is interesting that Miller *et al.* (1970) found similar FEV₁/FVC ratios in African and Indian adults in Guyana.

There is little data available directly comparing white with either black or Asian females. Miller *et al.* (1970) found no difference in FEV₁/FVC ratio between African and Indian females in Guyana. Despite our Asian women being younger, their PEFR values were well below the values for blacks and whites (Table 1). This difference was confirmed by multiple regression analysis (Table 2). Despite the small sample size, the interpretation must be that there is a genuine effect of ethnic group in Asian women. There is no reason to believe that the PEFR readings themselves were spurious because of poor technique. In general, those Asian females that were studied had at least as good a comprehension of English as the Asian males and in both cases

interpreters were used when necessary. Further, when technique is poor, a greater disparity is usually seen between the individual PEFR readings—this was not observed.

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