PEAK EXPIRATORY FLOW RATE IN A SAMPLE OF NORMAL SAUDI MALES AT RIYADH, SAUDI ARABIA

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هدف الدراسة: هو إيجاد المعدل الطبيعي للقدرة القصوى على الزفير للسعوديين البالغين من الرجال ومقارنته بالمعدل الطبيعي لدى البريطانيين.

طريقة البحث : عملت دراسة مقطعية في خمسة مراكز صحية أولية تمثل مدينة الرياض في الفترة من 15 نوفمبر إلى نهاية ديسمبر 1993م. ستمائة وثمانين رجلا سعوديا والذين انطبقت عليهم صفات سترنجنت للأشخاص الطبيعيين تضمنتهم هذه الدراسة معظمهم تحت سن 54 عاما (94ر4%).

نتائج البحث: كان معدل ومعامل التشتت للعمر والطول للمشاركين في هذه الدراسة هما 28.4 ± 13 و 167.6 ± 6.4 على التوالي. وعمل تحليل للنتائج بخطوات متعددة لتحديد طبيعة خط الانحدار للقدرة القصوى على الزفير بحسب العمر والطول. رسمت خطوط الانحدار ووجد أن القدرة القصوى على الزفير لا تبدأ بالنزول حتى سن 25 عاما. وكلما زاد الطول تزداد القدرة القصوى على الزفير بعلاقة طردية.

الاستنتاجات : وجد في هذه الدراسة أن معدلات القدرة على الزفير لدى السعوديين أقل مقارنة بالبريطانيين. هذه النتائج ستخدم كقاعدة لإيجاد المعدلات الطبيعية للقدرة القصوى على الزفير لسكان المملكة.

الكلمات المرجعية : القدرة القصوى على الزفير، الربو الشعبي، المملكة العربية السعودية.

***Objective**: To find out the normal peak expiratory flow rate for adult Saudi males and to compare our standards with British standards.*

***Methods**: A cross-sectional study was carried out in five primary health care centers representing Riyadh city in the period between 15th November through December 1993. Six hundred and eighty Saudi men who satisfied stringent criteria of normality were included in the study.*

***Results**: The mean and standard deviation of the subjects' age and height were 28.4 ± 13 and 167.6 ± 6.4 respectively. Linear regression analysis was performed through step-wise procedure to determine the form of regression of peak expiratory flow on age and height. Regression curves were obtained and it was found that peak expiratory flow rate did not begin to decline until about the age of 25 years; and as height increased the peak expiratory flow rate increased in a linear relationship.*

***Conclusion**: It was demonstrated that our study group had lower peak expiratory flow rate compared with British people. These findings will serve as a basis for preparing flow rate values for our population.*

***Key Words:** Peak expiratory flow rate, Bronchial asthma, Saudi Arabia.*

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INTRODUCTION

Bronchial asthma is one of the most important and highly prevalent problems in Saudi Arabia. The prevalence of asthma in Saudi Arabia ranges between 10-17% (10% in Riyadh, 13% in Jeddah and Qassim and 17% in Abha); which is higher than the range reported in Western countries.[1,2]

Pulmonary function tests are important in the detection and evaluation of pulmonary dysfunction. Peak expiratory flow rate (PEFR) is the simplest estimate for lung functions. It indicates the severity of airflow limitation.[3,4] Peak expiratory flow rate is measured by peak expiratory flow meter (PEFM) which is a simple and relatively cheap device (cost ranges from 25-40 US dollars). It has a great diagnostic and prognostic value in patients with hyperactive air-way disease.[5-7] It is widely used in general practice in the UK and in family practice in the USA with proved importance in evaluating and monitoring patients with bronchial asthma.[6] Although PEFM is a simple, practical and effective tool for use in the primary health care (PHC) setting, few of PHC practitioners in Saudi Arabia seem to use it.[8]

Many factors can affect the reading of peak expiratory flow rate (PEFR). The age, sex and height are important variables upon which peak expiratory flow depends.[9] Other factors include the diurnal variation[10] and ethnic differences.[11] The degree to which both the instructor and the patient understand the technique of using the flow meter is important and can greatly affect the result. Widely used standard peak flow rates have not been established for our population and the PEFR tables in use are based on studies in the Western countries. Not many local studies on the PEFR of Saudis in PHC clinics have been done.[12,13] The objective of the current study was to identify the normal peak expiratory flow rate for a sample of Saudi males and to compare the findings with British standards.

MATERIAL AND METHODS

Riyadh (the capital of Saudi Arabia) is divided into five main sectors for the provision of the Health Services (i.e., North, South, East, West and Central). A number was given to each center in all sectors, and five primary health care centers were randomly selected to represent different geographical areas. Within each center, patients were enrolled randomly in a systematic way to ensure a good non-biased presentation. The sample size for the centers was nearly the same to make the allocation equal. Subjects included in the study were Saudi males aged 15 years and above, non-smokers who satisfied stringent criteria of normality.[10] These were as follows 1) had never smoked; 2) were not subject to recurrent or persistent expectoration; 3) were not subject to wheezing nor had had an episode of acute bronchitis; 4) had not had asthma or recurrent bronchitis during their childhood; 5) had not had any serious respiratory disease.

Since it was difficult for the subjects to recall one attack of acute bronchitis, this criterion was not used to exclude any. The number of subjects included in this study was 680. Each center was provided with mini-Wright peak flow meter (product of Ciement Clarke International Ltd, England), with disposable mouth pieces. All the mini-Wright peak expiratory flow meters were new and had been calibrated to make sure that they had similar readings. Only males were included in the study to ensure accessibility so that we could deal directly with the subjects and supervise more closely. It was agreed that all the tests be done in the afternoon sessions (4 - 8 p.m.) to avoid the effect of the diurnal variation of peak expiratory flow[10] and get more volunteers.

The Director of each health center allocated one of the male nurses to work with the investigators. To ensure a unified correct procedure, all the nurses were instructed and trained by the assigned investigator on the technique of using the device. A group of subjects were instructed to do the test in front of both the nurse and the investigator to ensure that they perform it correctly and to use this as demonstration for the nurse.

The instructions adopted[14] for using the peak flow meter were as follows: 1) Every subject was asked to do the test three times. 2) Take a full deep breath in. 3) Hold the peak flow meter horizontally and close the lips tightly round the mouth piece. 4) Blow out as hard and as fast as you can in a short sharp blow. 5) Wait one minute between each blow. Take the best of 3 readings. This was recorded on the table along with subject's age and height.

Data were analyzed using Stat Pac Gold statistical analysis package. Linear regression step-wise analysis was performed. The mean was expressed as mean ± 1 standard deviation.

RESULTS

The age distribution of a total of 680 subjects included in this study is shown in Table 1. The mean and standard deviation of their age and height were 28.4 ± 13 and 167.6 ± 6.4 respectively.

Linear regression analysis was performed through step-wise procedure to determine the form of regression of peak expiratory flow on age and height (Table 2). When the data was plotted it became evident that the relation between the variables was curvilinear (Figure 1). It showed that as age increased the PEFR decreased (b = -0.5, T = -2.5, p-value 0.012). However, it showed a positive association between height of the study population and PEFR (b=4.3, T=11.7, p-value < 0.0001). From the multiple regression equation R^2 = 21% and F-ratio + 46%, p-value = <0.0001, i.e., about 21% variability of the PEFR can be determined by the factors in the equation.

***Table 1**: Age distribution of subjects in series*

Age in years	Number	%
< 25	358	52.6
25 – 34	142	20.9
35 – 44	93	13.7
45 – 54	49	7.2
55 – 64	25	3.7
≥ 65	13	1.9
Total	**680**	**100**

***Table 2**: Regression Equations*

Parameter	Coefficient	Value
Constant	bo	-338.5
Age	b1	20.3
Age^2	b2	-0.55
Age^3	b3	0.004
Height	b4	3.81

Equation: PEF (L/min) = -338.5 + 9 + 20.3 age – 0.55 age^2 + 0.004 age^3 + 3.81 height. R2=21%, p-value <0.0001.

The regression curves were drawn for six heights, and standardized to 167 cm (Figure 1). The peak expiratory flow began to decline around the age of 25 (Figure 2). The height was plotted versus the peak expiratory flow and showed that there was a relatively linear relationship (Figure 3).

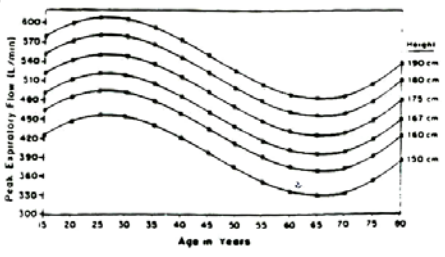

***Figure 1:** Peak expiratory flow in normal males*

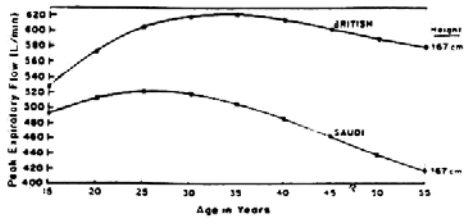

***Figure 2**: Comparison of PEF in normal subjects between British and Saudi study*

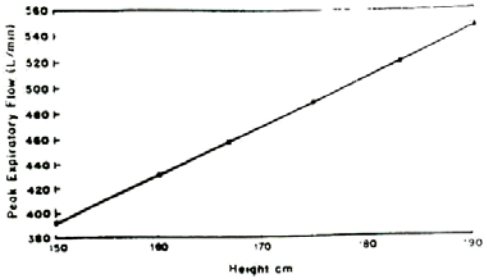

***Figure 3**: Peak expiratory flow rate in normal Saudi males*

DISCUSSION

We found that as the age increased beyond 25 years the PEFR significantly decreased. In calculating regression equations for peak expiratory flow on age and height, it was assumed that there was a linear relation between the fall of peak expiratory flow and advancing age. A similar assumption was made by most investigators who have published normal values of peak expiratory flow including Gregg and Nunn.[10]

In this study, it was clearly shown that a linear fall of peak expiratory flow occurred only after the age at which maximal peak expiratory flow was attained and if adolescents were included in the series the shape of regression became curvilinear. This finding is supported by a study done by Graff-lonnevig et al for Saudi children aged 6-16 years.[12] Our findings suggest that peak expiratory flow began to decline at the age of 25 years while the decline occurred at the age of 35 years in British reports.[10] Since our series contained too few subjects over 65 years of age (1.9%) the regression curves had a high peak expiratory flow rate for that particular age group. Studies of peak expiratory flow rate in the elderly have shown that the rate in elderly had a lower standard than younger age groups.[15,16]

The comparison of the peak expiratory flow rates in this study with that of Gregg and Nunn[10] demonstrated clearly that peak expiratory flow rates for Saudi males were lower than those of British males. This is supported by other local studies for other respiratory functions.[13] Graff-Lonneving et al found that peak expiratory flow rate measured in Saudi children by means of the mini-Wright peak flow meter were significantly lower than in children from Europe and North America.[12]

However, a significant positive association was found between the height of the study population and the PEFR. The multiple regression equation R^2 = 21% and fraction = 46% with p-value <0.0001, indicates a significant dependency of the PEFR of the study population on their age and height.

One limitation of the current study was the non-inclusion of female subjects since certain cultural difficulties in performing the measurements were envisaged. The other limitation was that the computed equation was reliable in predicting only 21%, for the whole range of age groups. However, this study has shown that Saudi Arabian male adults living in Riyadh have lower peak expiratory flow rate than adults of different racial origins living in UK.

There is a need for baseline normal values for peak expiratory flow rate for both children and adults in Saudi Arabia, and the data obtained from this study can be used as a base-line for future studies for the preparation of standard charts for our population. Further

studies without the limitations of this study i.e., to include females and a wide range of patient characteristics are required.

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