Factors Affecting Peak Cough Flow Value on Healthy Young Adults in Indonesia (Mongoloid)

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Abstract

Introduction: *Cough is one of the main human defense mechanisms against respiratory tract infection and aspiration. Until now, there has not been any Peak Cough Flow (PCF) standard value in Indonesia. The preexisting standard PCF values were measured in Brazil (2012) and New Zealand (Caucasian). There were anthropometric differences based on race, which affect PCF. The aim of this study is to determine the PCF of healthy Indonesian adults and affecting factors.*

Methods: *This study used crossectional in design. A number of 30 healthy adult subjects were recruited and analyzed. Chi-Square and multivariate analyses. Screening subjects was measured using spirometry test and cough ability using peak flow meter.*

Results: *The mean PCF was 477.17 (L/min). There was significant correlation between gender (p=0.000), age (p=0.012;r=-0.430), and height (p=0.000;r=0.741) to PCF. Height was the most contributing variable (p=0.003;IK95% 2.37-10.77).*

Conclusion: *The mean PCF in healthy adults was 477.17(L/min). Height was the most contributing factor, followed by age and gender.*

Keywords: *peak cough flow, healthy adults, Indonesia, standard value.*

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Faktor-faktor yang Mempengaruhi Nilai Arus Puncak Batuk pada Dewasa Muda Sehat Indonesia (Mongoloid)

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Abstrak

Pendahuluan: *Batuk adalah salah satu mekanisme pertahanan manusia utama terhadap infeksi dan aspirasi saluran pernapasan. Hingga saat ini, belum ada nilai standar Peak Cough Flow (PCF) di Indonesia. Nilai-nilai PCF standar yang sudah ada sebelumnya diukur di Brasil (2012) dan Selandia Baru (Kaukasia). Ada perbedaan antropometrik berdasarkan ras, yang mempengaruhi PCF. Tujuan dari penelitian ini adalah untuk menentukan PCF orang dewasa Indonesia yang sehat dan faktor-faktor yang mempengaruhi.*

Metode: *Penelitian ini menggunakan desain potong lintang. Sejumlah 30 orang dewasa yang sehat direkrut dan dianalisis. Analisis Chi-Square dan multivariat. Subjek skrining diukur menggunakan tes spirometri dan kemampuan batuk menggunakan peak flow meter.*

Hasil: *PCF rata-rata adalah 477,17 (L / mnt). Ada korelasi yang signifikan antara jenis kelamin (p = 0,000), usia (p = 0,012; r = -0,430), dan tinggi (p = 0,000; r = 0,741) dengan PCF. Tinggi adalah variabel yang paling berkontribusi (p = 0,003; IK95% 2,37-10,77).*

Kesimpulan: *PCF rata-rata pada orang dewasa Indonesia sehat adalah 477,17 (L / mnt). Tinggi badan adalah faktor yang paling berkontribusi, diikuti oleh usia dan jenis kelamin.*

Kata kunci: *aliran batuk puncak, orang dewasa sehat, Indonesia, nilai standar*

Background

Cough can prevent aspiration, stimulate ciliary activity, and clear the airway. The effectiveness of cough can determine the lung problems that will appear next. Voluntary cough consists of deep inspiration, compression that follows the closure of the glottis, and rapid expiration after the glottis opens.[1] The effectiveness of cough depends on physical and mechanical aspects of respiratory muscles, mucus, airway caliber, and laryngeal function. It also depends on the integrity of the neurophysiology pathway for cough.[2]

Peak cough flow (PCF) is the maximum expiratory airflow in a normal cough process. PCF is used to measure patient's cough ability.[3] A study in Brazil in 2012 by Cardoso et al found that PCF in healthy individuals aged 18-40 years was 240-500 L/min with women lower than men. This value was inversely proportional to age.[4] In contrast to studies conducted in New Zealand in the Caucasian, the normal adult PCF values were 360-960 L/min.[5] It shows wide differences in the range of values and possibly due to different anthropometry and race of the two countries.

To date, there have been no studies that reported PCF values in healthy Indonesian adults or in other Mongoloid races. The purpose of this study is to obtain the PCF value and the factors that influence it in healthy young Indonesian adults.

Method

This study used a cross-sectional design. The inclusion criteria in this study were healthy subjects aged 18-40 years, sedentary, Indonesian with both Indonesian parents and voluntarily comply in the research by signing the informed consent after getting an explanation. Subjects were considered to be healthy if the spirometry examination had no restriction or obstruction results, had no history of illness both acute and

chronic phases that could impair the respiratory system, and normal body mass index (BMI) based on Asia Pacific criteria. Subjects with a history of smoking or unable to follow the research and understand the instructions of the technical research were excluded from the study. This research had been reviewed by Ethics Committee of the Faculty of Medicine University of Indonesia and the protocol had been approved (899/UN2.F1/ETIK/2015).

Subjects who met the admission criteria were given an explanation and asked to sign informed consent. The researchers performed history taking to the subjects and examined vital signs (Oxymetri Elitech®, Littman® Stethoscope, tensimeter Regency®), general physical assessment, weight measurements (Seca®), height (Seca stadiometer), and spirometry tests (Chest H1801®). If the spirometry result that has been converted with an Indonesian pneumobile was normal, then the subject was given education about PCF examination by a video followed by PCF examination (Respiro®). This examination was done three times with a break of two minutes between measurements' with the highest result were recorded under condition the highest and lowest difference values were below 10%.

Data processing was performed with SPSS for Windows version 20.0. The mean and standard deviation were calculated for quantitative data if the data were normally distributed. If the data was not normally distributed, the median and range values will be used. The normality test was performed with Kolmogorov-Smirnov test with $p > 0.05$ considered as normal distribution. For categorical data, a Chi-square test or an alternative Fisher Exact test was used if it does not meet the requirements. For numerical data, Pearson correlation test was used if the distribution was normal or Spearman test if the distribution is not normal. Variables in the bivariate analysis with p-value <0.05 will be included in the multivariate analysis test with multiple regression. P-value <0.05 was considered significant in the multivariate test.

Results

A total of 30 individuals (15 males and 15 females) that met the inclusion criteria were recruited in this study. Table 1 shows the age, height, and PCF value. Kolmogorov-Smirnov normality test of all characteristics was $p > 0.05$. The mean age was 28.53 years, the mean height was 164.65 cm, and the mean PCF was 477.17 L/min. Table 2 shows the PCF value based on gender, while Table 3 shows the PCF value based on height. The bivariate analysis showed that there is a significant relationship ($p < 0.05$) between sex, age, and height with the PCF value, as shown in Table 4.

Table 1. Data Distribution

Characteristics	Mean ± SD	Normality Test(KS)
Age, mean ± SD	28,53 ± 3,12	0,074
Height, mean ± SD	164,65 ± 9,51	0,132
PCF	477,17 ± 85,84	0,200

SD = Standard Deviation, PCF = Peak Cough Flow, KS = Kolmogorov-Smirnov

Table 2. PCF Value Based on Gender

Characteristics	n (%)	PCF, mean ± SD
Gender		
Male	15 (50.0)	535.33 ± 72.12
Female	15 (50.0)	419.00 ± 53.02

SD = Standard Deviation, PCF = Peak Cough Flow

Table 3. PCF Value Based on Height

Characteristics	n (%)	PCF, mean ± SD
Height category (cm)		
140-149	1	310.00
150-159	11	421.82 ± 42.44
160-169	7	485.00 ± 85.73
170-179	10	538.00 ± 66.47
180-189	1	590.00

SD = Standard Deviation, PCF = Peak Cough Flow

Table 4. Relationship between Gender, Height, and Age with PCF Value

Variable	*P-value*	Correlation coefficient r
Gender	0.000	
Age	0.018	-0.430
Height	0.000	0.741

Table 5. Multivariate Analysis of PCF Influencing Factors

Variable	*P value*	OR (IK95%)
Gender	0,864	6,91 (-75,35; 89,16)
Age	0,012	-9,38 (-16,53; -2,24)
Height	0,003	6,57 (2,37; 10,77)

Statistical analysis was then continued with multivariate analysis with multiple regression to obtain the factors that most influenced the PCF value. Multivariate analysis showed that the height variable was the factor that most affects the PCF value, followed by the age (Table 5).

Discussion

In male gender, PCF values were in the range of 463 L/min to 607 L/min and in female was 366 L/min to 472 L/min. This higher PCF value in men is supported by research conducted by Cardoso et al, that men have a range of PCF values between 316 to 499 L/min, greater than women with values between 242 to 355 L/min.[4] This is influenced by several factors, such as women have the lower functional residual compared to men. Men also have a greater lung volume. In addition, greater male muscle mass may contribute to greater effort in the process of voluntary cough maneuvers.[6]

In this study, there was a positive correlation between height and PCF value. This can be caused by the difference of vital lung capacity which is physiologically influenced by height. The higher the individual's body height, the higher the lung vital capacity is.[7] This will affect one's inspirational ability which will then affect the ability of cough as assessed by the PCF.

The mean PCF value from this study was 477.17 L/min with a range of 310 L/min to 645 L/min. The PCF value is influenced by gender, height, and age. Research by Cardoso et al in Brazil on adult subjects aged 18-40 years obtained a range of PCF values of 240 L/min to 500 L/min, but this study only assessing sex and age as factors that affect the PCF value.[4] Another study by Lee et al in South Korea with 48 subjects obtained mean PCF value was 447.4 L/min. Unfortunately, this study did not specifically explain what factors influenced the magnitude of the PCF value.[8]

Conclusion

The mean PCF value in healthy young adults at Cipto Mangunkusumo General Hospital is 477.17 L/min. Several factors such as gender, height, and age influence the PCF in healthy Indonesian adults. Men have a higher PCF value compared to women. Height is directly proportional with PCF value, whereas age is inversely correlated with PCF value.

Suggestion

Further research is needed to evaluate the Indonesian PCF value, due to it is affected by height, while the height is affected by a person's race.

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