USEFULNESS AND LIMITATIONS OF LUNG FLOWS TO DIAGNOSE RESPIRATORY DISEASES

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BACKGROUND & AIMS

Pulmonologists have devoted a lot of attention to the diagnostic and prognostic significance of lung volumes (FEV1, FEV1/FVC), while lung flows (FEF25-75) are considered less useful tools to define asthma or rhinitis [1].

This study aimed to compare FEF25-75 (forced expiratory flow between 25% and 75% of FVC) in subjects without respiratory diseases (controls), with rhinitis alone, or with asthma, irrespective of rhinitis. In particular, it was verified whether FEF25-75 increases the information on respiratory disorders, provided by lung volumes, such as FEV1 (forced expiratory volume in one second) and the ratio (FEV1/FVC).

METHODS

The present study considered 1293 subjects, enrolled in the Gene Environment Interactions in Respiratory Diseases (GEIRD) Study, an Italian multicenter, multicase-control study [2]. Subjects had been recruited in four centers: Verona (n=840) and Turin (n=281) in the Po valley, Sassari (n=148) in Sardinia and Palermo (n=24) in Sicily. FEF25-75, FEV_1 and the ratio FEV_1/FVC were assessed in 480 controls without respiratory diseases; 366 individuals with rhinitis alone, i.e., without asthma and 447 individuals with asthma, irrespective of rhinitis.

Definitions of cases and controls:

- **controls**: subjects without asthma or rhinitis, who did not report other respiratory symptoms or diseases, and had both pre-bronchodilator FEV_1/FVC >=70% and >=LLN (lower limit of normal) and FEV_1 >70% predicted.
- cases of **rhinitis alone**: subjects without asthma, with one among lifetime nasal allergies, including "hay fever"; lifetime problem with sneezing, or a runny or a blocked nose (without cold/flu); recurrent nasal/eye symptoms in the presence of dust, pollens or animals;
- cases of **asthma, irrespective of rhinitis**: 1) self-reported asthma, plus one among having had an asthma attack in the last 12 months or current use of medications for asthma; or 2) asthma-like symptoms or use of asthma medicines in the last 12 months, plus one among positive methacholine challenge test (PD20 < 1 mg) or pre-bronchodilator FEV_1/FVC < 70% or <LLN with a positive reversibility test (i.e., FEV_1 >12% and >200 mL).

FEF25-75 and FEV_1 were expressed as percentage of the expected value for sex, age, height (FEF25-75% and FEV_1 % predicted). The association between FEF25-75 and respiratory diseases (controls/rhinitis alone/asthma) was evaluated by Kruskal-Wallis test in univariable analysis and by median regression in multivariable analysis, controlling for potential confounders, i.e., center, sex, age, BMI, smoking habits and exposure to passive smoking.

RESULTS

	Controls (n=480)	Rhinitis only (n=366)	Asthma and/or rhinitis (n=447)	p
Age (median, p25-p75)	48.8 (40.5-57.3)	47.0 (38.8-55.0)	44.6 (38.2-52.0)	<0.001
Sex (%)				0.348
Females	47.5	51.4	51.9	
Males	52.5	48.6	48.1	
BMI (median, p25-p75)	25.0 (22.0-27.8)	23.9 (21.9-26.6)	24.5 (21.9-27.4)	0.061
Smoking status (%)				0.034
Non smokers	48.5	47.3	49.3	
Ex smokers	34.4	32.8	26.7	
Current smokers	17.1	19.9	24.0	
Tobacco exposure (%)				0.143
Yes	69.5	70.3	75.0	

Table 1. Main demographic, lifestyle and clinical characteristics of the population under study

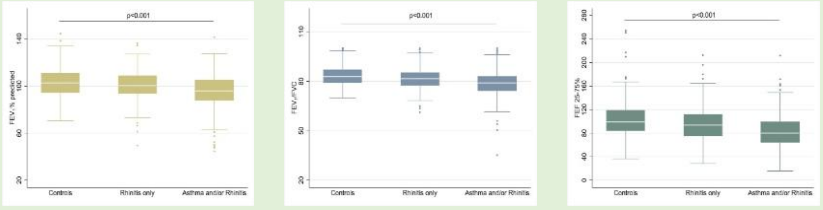

Figure 1. Box-and whiskers plot of lung function parameters according to respiratory disorders: controls, rhinitis only, asthma and/or rhinitis

Case control status	FEV_1 % predicted	FEV_1/FVC	FEF 25-75%
Controls	Ref.	Ref.	Ref.
Rhinitis only	-1.5 (-3.7;0.8)	-1.8 (-2.8;-0.8)***	-7.0 (-11.5;-2.5)**
Asthma and/or Rhinitis	-6.2 (-8.4;-4.1)***	-4.5 (-5.4;-3.6)***	-22.0 (-26.3;-17.7)***

Table 2. Association between case control status with FEV_1% predicted , FEV_1/FVC and FEF 25-75% levels in median regression† . Adjusted by gender, age, body mass index, smoking habits and exposure to passive smoking. *p<0.05; **p<0.01; ***p<0.001

Asthmatic subjects were younger than subjects with rhinitis and controls, and comprised a larger proportion of current smokers and a lower proportion of ex-smokers (Table 1).

FEF25-75% predicted was the highest in controls, intermediate in people with rhinitis alone and the lowest in people with asthma and/or rhinitis (p<0.001). A similar pattern was observed for FEV1% predicted and FEV1/FVC, although the differences among the three groups were less pronounced (Figure 1).

Inter-individual variability, as assessed by coefficient of variation, was much larger as regards FEF25-75 (CV=26.9% in controls, 28.2% in people with rhinitis only and 32.8% in people with asthma asthma and/or rhinitis) than lung volumes (CV = 11.4%, 11.8%, 14.2% for FEV1, and CV = 7.2%, 7.7% and 9.4% for FEV1/FVC).

In multivariable analysis (Table 2), FEF25-75% was significantly decreased in people with rhinitis alone (median decrease = 7%, 95% CI 2.5 – 11.5%) or asthma and/or rhinitis (median decrease = 22.0%, 95% CI 17.7-26.3%) with respect to controls. A similar results was observed for FEV1/FVC while FEV1 % predicted decreased significantly only in asthmatic subjects. FEF25-75% was also significantly affected by sex and age: the median value was 10.0% (6.3-13.7%) higher in men with respect to women, and 18% (8.1-27.9%) lower in people aged 65-84 than 20-44 years.

CONCLUSIONS

FEF25-75 can provide additional information on lung function with respect to lung volumes, especially in mild respiratory diseases such rhinitis without asthma. However, its high inter-individual variability limits its usefulness as a diagnostic tool.

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XI CONGRESSO NAZIONALE
BARI, 15-18 SETTEMBRE 2021