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RELATION SHIP BETWEEN FEVI% AND PEF% IN PATIENTS WITH OBSTRUCTIVE AIR WAY DISEASES

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SUMMARY

Spirometry is the recommended investigation for diagnosis and categorization of the severity of the air flow limitation, however spirometry is not widely availably, while PEF instrument is cheep portable and easy to operate and maintain, so the PEF is frequently proposed as alternative to FEVI for this purpose, and widely used in general practice as a surrogate for FEVI in assessment of airway obstruction disease. The aims of this prospective study were to evaluate the correlation between FEVI and peak expiratory flow (PEF) values expressed as a percentage of their predicted value; and to assess the factors influencing differences between these two measurements. This study was took place between Ist December 2016 and 1st July 2017 in Baquba teaching hospital. A total of 100 Patients with history suggestive of obstructive airway diseases (gave symptoms of cough, wheezes, shortness of breathe, chest tightness), and their pulmonary function test show obstructive pattern (FEV1/FVC<70%). They were 60(60%) male and 40(40%) female, their age ranged from (16 -82 years) with mean ± SD (51.1±16.51). Careful detailed history and physical examination (including age gender, height and weight), and pulmonary function test were carried out. In order to study the relationship between FEVI% and PEF% we:-

- Compare the value of low FEVI% (<80% of predicted value) with low PEF 80% of predicted value) in relation to diagnosis of obstructive air way diseases.
- In order to see the concordance between FEVI% and PEF% in categorization of severity of airway obstruction we:-

1. Compare the value of FEVI% to value of PEF% in relation to severity of airway obstruction as guided by British Thoracic society.
2. Compare the value of FEVI% to value of PEF% in relation to severity of airway obstruction, using arbitrary severity categories based on 20% FEVI% intervals.

- Measuring the bias(mean of FEVI% - PEF%) and limit of agreement (which is the bias ± (1.96 ><SD)), to see the difference between FEVI% and PEF%, and to see whither PEF% underestimate or over ate FEV %; and to study the effect of different parameters that may affect these measurements (age, gender, height and severity of airway obstruction).

- Measuring the discordance between FEVI% and PEF%, and study factors(age, height, gender, and FEVI value) that may be responsible for FEVI% and PEF% values being > 5% apart from each other.

In screening for obstructive air way diseases using FEVI% and PEF% we found that there was a significant relationship (P value < 0.05) between FEV1 ^{0}/o and PEF% in diagnosis of air way obstruction, (94%) of patients with obstructive airway disease as assessed by FEVI%(had low FEVI (<80% of predicated) were had low PEF%(< 80% of predicated). PEF% and FEVI% severity categories were concordant in only 60(60%) patients, with better concordance as severity of obstruction (based on FEVI%) became more severe. For the entire study population, PEF% underestimated FEVI% by mean of only 0.35%. However, limits of agreement were wide and exceeded ± (14.5). Overall, differences were more marked in females, short patients and in patient with mild airway obstruction. In patients with mild to moderate airway obstruction FEV1 >40%), PEF% tended to underestimate FEVI%•, while in patients with more severe obstruction (FEV1<40%) PEF% tended to overestimate FEV 1%.

A discordance more than 5% apart between PEF% and FEVI% could be considered clinically important error for estimation of severity of airway obstruction, in our study most of patients (70%) had discordance more than 5% apart between PEF% and FEVI% and this discordance more marked in women, short patients and in patients with mild airway obstruction. We conclude that PEF% can reliably excluded airway obstruction, when normal PEF value are present, in spite of that FEVI% and PEF% are not equivalent in many patients, specially women

short patients and those with mild airway obstruction; PEF% underestimate FEVI%; assumption of parity between PEF% and FEVI% must be avoided especially in categorization of severity of airway obstruction; and that the discordance (>5%) more marked in women, short patients and those with mild airway obstruction.

INTRODUCTION

Spirometry is the recommended investigation for diagnosis and categorization of severity of airflow limitation.[1] Spirometry is a well standardized technique, and elaborate guidelines already exist regarding procedure performance, evaluation of test quality, and interpretation of measured parameters.[1][2][3] However, spirometry is not widely available, and the pitfalls of spirometry frequently limit use of this test at the primary care level. Peak expiratory flow (PEF) recording is proposed as an alternative to spirometry for this purpose. The PEF instrument is cheap, portable, and easy to operate and maintain. Guidelines on asthma management focus heavily on categorizing patients based on severity of airflow limitation measured on formal pulmonary function testing. It is suggested that either FEVI or PEF can be expressed as a percentage of predicted values and used for this purpose. Similarly, definition and severity assessment of COPD is now based on measurement of percentage of predicted FEVI (FEVI%) and FEVl/vital capacity (VC), although a need for evaluating the role of PEF in situations and areas where spirometry is not routinely available is recognized. There is, however, no consensus on whether or not FEVI% and percentage of predicted PEF (PEF ^{0}/0) can be used interchangeably in patients with obstructive lung diseases. Most clinicians assume a general parity between these measurements, and some guidelines on asthma management also recommend the same. However, other guidelines also suggest that PEF% may underestimate the degree of airways obstruction assessed by FEVI%.[4][5][6][7] Previous studies addressing comparisons between FEVI% and PEF% have been performed in highly selected patients and have been limited to some extent by inclusion of small number of subjects and inability to examine relationships in different subgroups of patients. We therefore studied adult patients with obstructive ventilator defects to evaluate the correlation between FEVI% and PEF%, and to assess the factors influencing differences between the two measurements. International guidelines recommend that, in addition to symptoms and medication requirements, measurements of forced expiratory volume in one second (FEVI) and peak expiratory flow (PEF) are necessary for the objective assessment of asthma severity. The guidelines suggest that parity exists between measurements of FEVI and PEF when expressed as percentage of predicted normal values, and that asthma severity can be classified as mild, moderate or severe on the basis of FEV% and PEF% measurements of > 80%, 60-80% and < 60% of redacted values, respectively.[7] There could be several reasons for lack of equivalence between FEVI% and PEF %.[8] For one, measured PEF values depend heavily on lung volumes. Any disease process leading to reduced lung volumes will effect a corresponding reduction in measured PEF. This implies that in addition to patients with airway obstruction, those with restrictive lung defects are also likely to have a reduced PEF. Secondly, normal population variability of PEF is quite large,. hence calculation of lower limits of predicted normal based on regression equations leads to values that are much lower than corresponding values for other spirometric indexes like FEVI. Thirdly, while PEF is measured on the first effort-dependent portion of the forced expiratory maneuver and predominantly reflects large airway function, FEVI is determined both by the effort- dependent and effort-independent portions of this maneuver and reflect both large and peripheral airway function.[9] Thus differential changes in FEVI and PEF may be observed, depending on the amount and predominant site of airways narrowing. These factors are likely to lead to a greater discrepancy in patients with COPD and airway collapsibility secondary to the loss of elastic tissue. In these patients, the initial rapid rise in expiratory flow is similar but, as intra thoracic pressure increases, that pressure is transmitted to the segmental and other large airways, which "collapse" and obstruct passage of air through those airways. This result in the rapid reduction in flow after a relatively normal peak has been attained, leading to significantly lower values of FEVI compared to PEF. These issues could lead to a significant discordance if FEVI% values are replaced by PEF% values for purpose of severity classification. As it is, there is no clearly defined objective strategy to categorize severity of airflow limitation based on FEVI% values. Various guidelines on management of asthma and COPD use arbitrary standards for this purpose, adding to the confusion. The FEVI% cutoffs used to categorize mild, moderate, and severe obstruction are variable for Global Initiative for Chronic Obstructive Lung Disease (80% and 30%), British Thoracic Society (60% and 40%), American Thoracic Society (50% and 35%), European Respiratory Society (70% and 50%) and new American Thoracic Society/European Respiratory Society (80% and 50%) Guide lines on COPD.[10][11][12][13][14] Both Global Initiative for Asthma and National Institutes of Health guidelines on asthma use FEVI% cutoffs of 80% and 60% In addition, there are other technical issues related to equipment. Several PEF meters do not show linear responses, with different proportional error at different flow levels.[15] Significant decrease in accuracy and precision has also been reported after regular peak flow meter use.[16] Sub maximal effort during PEF maneuver, supramaximal flow transients occurring early during a forced expiration, and PEF maneuver- induced bronchospasm are phenomena that may account for some of the discrepancies between PEF and FEVI values. The impact of use of PEF on categorization of severity of stable asthma was reported in study conducted by,[6] in which the categorization using PEF% and FEVI% was concordant in only one half of the patients. Misclassification was particularly evident in patients with severe asthma. Significant differences were also reported in a study,[17] of patients with exacerbation of asthma. These differences are likely to be more pronounced in women and in patients with less severe airways obstruction (defined by FEVI%), as is evident from the results of logistic regression analysis conducted by.[18]

AIMS OF STUDY

1-To evaluate the correlation between FEVI and peak expiratory flow (PEF) values expressed as a percentage of their predicted value. 2-To assess factors influencing differences between these two measurements.

Patients

A prospective study took place between 1st December 2016 and 1st July 2017 in Baquba teaching hospital. A total of 100 Patients with history suggestive of obstructive airway diseases (gave symptoms of cough, wheezes, shortness of breathe, chest tightness) attending departments of internal medicine and respiratory medicine of Baquba teaching hospital seeking medical attention for there problem, and send to pulmonary functions laboratory unite to perform pulmonary functions tests. They were 60(60%) male and 40(40%) female, the age ranged was (16 -82 years) with mean ± SD (51.1±16.51) Careful detailed history and physical examination (including age gender, height and weight), and pulmonary functions tests were carried out, all these were registered in questioner prepared by us previously as show in appendix 1. Patients resaving medication that may affect the results were excluded, as were pregnant patients. Patients with FEVI/FVC ratio more than 70%, and those with cardiovascular disease, congenital deformity or other concomitant pulmonary disease that may affect respiratory function test results.[19]

Method

Pulmonary function tests done by: spirmeter (vitalograph, S-model spirometer Cat.20.400), to measure FVC, FEVI, and FEVI/FVC. Wright peak flow meter, to measure PEF, All results were measured as % of predicted value. Forced expiratory volume in one second (FEVI):Volume of maximally fast expiration in 1 second from a point of maximal inspiration. FEVI less than 80% of predicted is considered abnormal (low value).[20] Forced vital capacity (FVC) Is the maximum volume of gas that can be expired after maximal inspiration. FEVI/FVC: Is the ratio of forced expiratory volume in 1 second to forced vital capacity. Normally, the FEVI/FVC, is 70% or more Lower ratios(<70%) indicate an obstructive ventilator disorder.[20] PEF Is the maximum rate of airflow achieved during expiration, PEF less than 80% of predicted is considered abnormal (low value).[20] Forced expiratory volume in one second (FEVI), forced vital capacity (FVC), and peak expiratory flow (PEF) were measured until three reproducible recordings (with a difference of less than 5%) were obtained, of which the highest was used in the analysis. Reference values of FEVI, FVC, and PEF were those of the European Respiratory Society.[21] [22] In Patient with obstructive airway disease (FEVI/FVC <70%) we:1-Compare the value of low FEVI% (<80% of predicted value) with low PEF 80% of predicted value), to see the relation between the two value in screening for airway obstruction and to see if the PEF overestimate or underestimate or go in parity withFEV1. 2-In order to see the concordance between FEVI% and PEF% in categorization of severity of airway obstruction we compare the value of FEVI% to value of PEF% in relation to severity of airway obstruction as guided by British Thoracic society[20], (sever, FEVI <60%; moderate FEVI% 40%- 60%; mild FEVI%>60%. 3-Measuring the bias (mean of (FEVI% - PEF ^{0}/0)) and limit of agreement (which is the bias ± (1.96 ><SD)), to see the difference between FEVI% and PEF%, and if PEF% underestimate or overestimate and to study the effect of different parameters that may affect these measures (age, gender, height and severity of airway obstruction). 4-In order to evaluate if PEF and FEVI could be used interchangeably across different categories of age, height, gender, and severity of airway obstruction, we calculated the limits of agreement between the two estimates using Bland-Altman analysis.[23] 5- See the discordance between FEVI% and PEF% of more than 5% apart, (a discordance >5% could be considered a clinically important error for estimation of severity of airway obstruction)[18] and to study factors(age, height, gender, and FEVI value) responsible for FEVI% and PEF% values being > 5% apart from each other.

RESULT

Patients: During the study period which extended from Ist December 2016 to 1st July 2017, a total of 100 patients with clinical features of obstructive airway disease (cough, wheezes, dyspnoea and chest tightness) and had obstructive pattern of pulmonary function test (FEV1/FVC <70%)were included, they were 60 male and 40female, table (3.1) shows patients characters.

Table (3.1): Patients characters.

Variable	Mean	Range
Age	51.1 Year	16-82 Year
Height	163.86 cm	150-181 cm
FEVI%	50.55%	21%-88%
PEF%	50.20%	14%-95%
FEVI/FVC	58.7%	40%-70%

The mean age of patients ± SD was (51.1 ±16.51) years ranged from (16-82) years old, and the mean height was (163.86.)cm, 60(60%) were male with mean age(51.2) years rang from(16-82) years, and with mean height (168.83)cm ranged from(150-181) cm; and 40(40%)were female with mean age (49.7) years rang from (16-81) years, and with mean height (156.4) cm ranged from(148-170)cm.

Table (3.2): Distribution of patients according to age.

Age(Years)	No.	%
16-25	5	5
26-35	16	16
36-45	18	18
46-55	15	15
56-65	30	30
75	16	16
Total	100	100

The highest incidence of obstructive air way disease was at age group 56-65 years, 30(30%) patients, followed by age group 36-45 years, 18(18%) patients, and the lowest was at age group 16-25 years 16(16%) patients as shown in table (3.2). Table(3.3) Shows age and sex distribution of patients that the occurrence of obstructive airway disease in age group 56-65 years was heights in male 21 (70%) patients, while in age group 36-45 years mainly in female, 10(55%) patients.

Table (3.3): Distribution of patients according to age and sex.

Age(years)	Men		Women	
	No.	%	No.	%
16-25	2	2	3	3
26-35	11	11	5	5
36-45	8	8	10	10
46-55	7	7	8	8
56-65	21	21	9	9
≥75	11	11	5	5
Total	60	60	40	40

Table (3.4) shows the height and sex distribution of patients. We notice that 39(39%) patients had height range from 155-160,30(30%) Patients had height from 161-170, 21 (21%) patients at height group 171- 180, and least number at height extremists 8(8%)patients and 2(2%)patients at height group 171-180 and >181 respectivly. At lower height extreme, patients manly female, 8(100%), and at heights extreme, patients manly male 2(100%).

Table (3.4): Distribution of patients according to height and sex.

Height(cm)	Men		Women		Total	
	No.	%	No.	%	No.	%
≤150	0	0	8	8	8	8
150-160	12	12	27	27	39	39
161-170	25	25	5	5	30	30
171-180	21	21	0	0	2	2
≥181	2	2	0	0	2	2
Total	60	60	40	40	100	100

Table (3.5) show that 85(85%) patients had low FEV1%(less than 80% of predicted value) and 85(85%) patients had low PEF% (less than 80% predicted value). From patients with low FEVl%, 5(5/85) patients had high PEF% (more than 80% of predicted value), also from patients with low PEF%, 5(5/85)patients had high FEVI (more than 80%). From 100 patients with obstructive airway disease (FEVI/FVC< 70%), 15(15%) patients had FEVI% more than 80% of predicted value, and 15(15%) patients had PEF% more than 80% of predicted value.

Table (3.5): Relationship between airway obstructions as assessed by FEVI% and PEF%.

FEV1<80 %		FEV1≥80%	Total
PEF<80%	80(80%)	5(5%)	85(85%)
PEF≥80%	5(5%)	10(10%)	15(15%)
Total	85(85%)	15(15%)	100 100%

P. value<0.05.

According to British Thoracic Society (BTS) guide line of classification of severity of airway obstruction we had, 35(35%) patients had severe airway obstruction as assessed by FEVI%(FEVI%, <40% of predicted value), while 25(25%) patients had sever airway obstruction as assessed by PEF%; 40(40%) patients had moderate airway obstruction as assessed by FEVI% (FEVI%, 40% -60% of predicted value), in compare to 45(45%) patients as assessed by PEF%; 25(25%) patients had mild airway obstruction assessed by FEVI% (FEVI%, >60% of predicted value), compare to 30(30%) patient assessed by PEF% as shown in table (3.6).

Table (3.6): Disruption of patients according to Severity guided b British Thoracic Society(BTS).

severity	Patients No.(%)	Severity	Patients No.(%)
Sever (FEVI%,≤ $40^{0}/0$)	35(35%)	Sever (PEF%,≤40%)	25(25%)
Moderate (FEVI %,40%-60%)	40(40%)	Moderate (PEF%, 40%-60%)	45(45%)
Mild (FEV≥,60%)	25(25%)	Mild (PEF %, >60%)	30(30%)
Total	100(100%)	Total	100(100%)

Using arbitrary severity categories based on 20% FEVI% intervals, PEF% and FEV1 $^{0}/o$ severity categories were concordant in only 60 instances (60%), with better concordance as severity of obstruction (based on FEVI%) became more severe. Table (3.7) show the concordance between categorization of severity of airway obstruction based on FEVI% and PEF%, we notice that 35(35%) patients had FEVI% less than 40% of predicted, while 25(25%) patients had PEF less than 40% of predicted; 40(40%) patients had FEVI% from 40% to 60% of predicted value, while 30(30%) patients had PEF from 40% to 60% of predicted; 10(10%) patients had FEVI% from 60% to 80% of predicted value, while 20(20%) patients had PEF % from 60% to 80%; 15(15%) patients had FEVI to 100%, while 1000%) patients had PEF from 80% to 100%.

Table (3.7): Concordance between categorization of severity of airway obstruction based on FEVI% and PEF%.

			FEVI%			
PEF%	**0-40**	**40-60**	**60-80**	**80-100**	**>100**	**Total**
0-40	25	0	0		o	25
40-60	10	30	5	0	0	45
60-80	0	10	0	10	0	20
80-100	0		5	5	0	10
>100	0	0	0		0	
Total	35	40	10	15	0	100

Bias is the mean different between FEVI ($^{0}/0$) and FPF ($^{0}/0$) (FEVI% - PEF%), while limit of agreements=(bias ±(1.96 ><SD of bias), for the entire study population, PEF% underestimated FEVI% by a mean of only (0.35%). However, limits of agreement were wide and exceeded ± (14.5%) Overall, differences were more marked in women and in patients at extremes of height as shown in table (3.8).

Table (3.8): Mean Bias and Limits of Agreement between PEF% and FEVI% in the study population (n=100).

	Men		Women		Total	
study population (n=100)	Bias	Limits of Agreement	Bias	Limits of Agreement	Bias	Limits of Agreement
	-0.8	-18.14 to 16.45	2.12	-16.83 to 11.21	0.35	-14.25 to 14.95

Table (3.9) shows the mean Bias and limit of agreements between FEVI % and PEF% in relation to age, we notice that PEF% under estimate FEV1in young age group (16-25 years), and over estimate it in older age group (È75years). However the limit of agreement was nearly equal, where it was ±26 in the young age group, while it was ±25 in old age group (È75). The highest bias was at the age group 16 -25 years, which was (8.8), and the least bias was at the age group (È75) years, which was (-1.52), as shown in table (3.9).

Table (3.9): Mean Bias and limits of agreement between PEF% and FEVI% in relation to age.

		Men		Women		Total
Age(years)	**Bias**	**Limits of Agreement**	**Bias**	**Limits of Agreements**	**Bias**	**Limits of Agreements**
16-25	13.5	-29.46 to+56.46	5.6	-14 to+25.2	8.8	-18.09t0+35.69
26-35	-6.3	-41.79 to+29.19	3.8	-19.72 to+27.32	-3	-34.85 to+28.85
36-45	0.25	-25.23 to+25.73	6.9	-8.32 to+22.12	3.9	-17 to+24.87
46-55	-3.5	-29.79 to+22.79	-5.7	-26.91 to+15.41	-4.7	-27.67to+18.27
56-65	5.2	-26.16 to+36.56	0.7	-18.9 to+20.3	3.9	-24.42to+32.22
≥75	-5.1	-29.6 to+19.4	12.3	+6 t018.57	-1.52	-26.02to +22.98

Table (3.10) shows the mean Bias and limit of agreements between FEVI % and PEF% in relation to height, we notice that PEF% under estimate FEV1in short patients <150 cm, and over estimate it in tall patients >181cm. However the limits of agreement were wide and exceeded ±24% in short patients and exceeded ±22% in tall patients. 0verall, difference were more marked in patients at extremes of height distribution.

Table (3.11) shows the mean Bias and limit of agreements between FEVI % and PEF % in relation to severity of airway obstruction, we notice that PEF % under estimate FEV1in patients with mild airway obstruction (FEVI% > 60%), and over estimate it in patients with severe airway obstruction (FEV1<40 ^{0}/0). However the limits of agreement were wide and exceeded (±29%) in patients with mild severity of airway obstruction (FEVI and exceeded (±12.5%) in patients with severe airway obstruction (FEVI <40%).

Table(3.10): Mean bias and limits of agreement between PEF% and FEVI% in relation to height in cm.

	Men		Women		Total	
Height(cm.)	**Bias**	**Limits of Agreement**	**Bias**	**Limits of Agreement**	**Bias**	**Limits of Agreement**
< 150	0	-32.15 to+29.55	2.7	-19.34 to+24.74		-19.35 to24.75
151-160	-1.3	-32.15 to+29.55	2.2	17.92 to +22.3	1.17	-22.64 to24.98
161-170	1.6	-29.20 t032.40	0.2	-24.64 to+25	-0.9	-28.67 to30.47
171-180	-0.1	-32.51 to+32.23	0	0	-0.14	-32.51 to32.23
>181	-13	-37.89 to11.89	0	0	-13	-37.89 to11.89

Table (3.11): Mean bias and limits of agreement between PEF% and FEVI% in relation to severity of obstruction.

	Men		Women		Total	
Severity	**Bias**	**Limits of Agreement**	**Bias**	**Limits of Agreement**	**Bias**	**Limits of Agreement**
FEV1>60%	8	-31.79to+47.79	6.8	-23.77 to+37.37	7.6	-21.9to+37.11
FEV1%40-60%	-1.2	-28.33 to+25.83	2.4	-15.74 to+20.54	0.74	-22.09 to+23.57
FEV1%<40%	-3.9	-16.05 to+8.05	-2	-17 to +13	-3.37	-16.11 to+9.37

Discordance >5% could be considered a clinically important error for estimation of severity of airway obstruction, the discordance result in our study was more marked in women, patients with short height, and those with less severe airway obstruction.

In table (3.12) we notice that 70% of patients had a discordance of more than 5% apart between FEVI % and PEF ^{0}/0. This discordance more clear in females, since we notice that from 40 females 35(87.5%) patients had discordance more than 5% apart between FEVI% and PEF%, and the remaining 5(12.5%) patients had discordance less than 5%; while in males we notice that from 60 patients 35(58%) patients had discordance more than 5% apart between FEVI% and PEF%, and the remaining 25(42%)patients had discordance less than 5%; and the association was statically significant (P. value <0.05).

Table (3.12): Discordance between FEVI% and PEF% in relation to sex.

FEVI% - PEF%	No. % of women	No. % of men	Total
>5%	35(87.5%)	35(58%)	70(70%)
≥5%	5(12.5%)	25(42%)	30(30%)
Total	40(100%)	60(100%)	100(100%)

P. value <0.05.

Table (3.13) shows the discordance between FEVI% and PEF% in relation to height, we notice that 6(75%) patients from eight patients with short length(≤150 cm), had a discordance of more than 5% apart between FEVI% and PEF%, and 2(25%)patients had a discordance of less than 5%, while in patients with long length (≥181cm),1(50%)patients had a discordance of more than 5% apart between FEVI % and PEF%, and 1(50%) patients had a discordance of less than 5%, and the association was statically significant (P. value <0.05).

Table (3.13): Discordance between FEVI% and PEF% in relation to height.

FEVI% - PEF%	Height ≤150 cm	Height ≥181cm	Total
>5%	6 (75%)	1(50%)	7(70%)
≤5%	2(25%)	1(50%)	3(30%)
Total	8(100%)	2(100%)	10(100%)

P. value <0.05.

Table (3.14) shows the discordance between FEVI% and PEF% in relation to severity of airway obstruction, we notice that in (25)patients with mild airway obstruction (FEVI >60%) most of them 20(80%) patients had discordance more than 5% apart between PEF% and FEVI%, and the remaining 5(20%)patents had discordance less than 5%; while in (35) patients with severe airway obstruction (FEV1<40%)most of them 25(57%) had a discordance less than 5% apart between FEVI% and PEF%, and the remaining 15(43%) patients had a discordance more than 5%, and the association was statically significant P. value <0.05.

Table (3.14): Discordance between FEVI% and PEF% in relation to severity of airway obstruction.

FEVI% - PEF%	FEVI<40%	FEVI>60%	Total
>5%	20(57%)	20(80%)	40 (66%)
≤5%			20(34%)
Total	35(100%)	25(100%)	60(100%)

P.va1ue<0.05.

Table (3.15) shows the association between the discordance between FEVI% and PEF% and age, we notice that 2(40%) patients from patients with age years had a discordance of more than 5% apart between FEVI% and PEF%, and 3(60%) had a discordance of less than 5%, while in patients with age È75 years 8(50%) patients had a discordance of more than 5% apart between FEVI% and PEF%, and 8(50%)patients had a discordance of less than 5% apart between FEVI % and PEF%, and the association was statically not significant P. value >0.05.

Table (3.15): Discordance between FEVI% and PEF% in relation to age.

FEVI% - PEF%	Age≤25years	Age≥75 ears	Total
>5%	2(40%)	8(50%)	10(48%)
≤5%	3(60%)	8(50%)	11(52%)
Total	5(100%)	16(100%)	21 (100%

P. value >0.05.

DISCUSSION

In patients with obstructive lung disease, both FEVI% and PEF% are widely used to estimate the degree of pulmonary impairment. In general, FEVI measurements are preferred as these are much more reproducible (Asthutosh).[18] However, spirometry is not widely available in developing countries such as Iraq, and there is a need to assess if similar information could be acquired using PEF measurements, which are cheaper and much more widely available. In regard to age and sex distribution, in the present study we notice that obstructive airway diseases more common in two age group which were in young age group and old age group, in young age group percentage of female to male nearly equal, while in older age percentage of male to female high and this results is in agreement with other results (Minor et al[24]; Stark et al[25]; Khalfa[26]; Teichtahl et al[27]; Kornohen et al[28]; Agresti(29);), the possible explanation for this is that in early age group the most common cause of obstructive airway diseases is asthma, and in asthma in children male more than female while in mid age group, number of male nearly equal to number of female, while in older age group female affected more frequent. 1n old age group COPD most common cause of obstructive airway disease due to smoking as stetted by other studies(mentioned above) in agree with our study. Afew investigators(Harrison[30]; Kelly[31]; Vugham[4]; Teeter[5]; Thiadens[7]) have looked at correlation between PEF and FEVI in cross-sectional studies. The correlation between absolute values of PEF and FEVI values was rather low in one study which performed by (Harrison[30]) In general, the correlation between PEF% and FEVI% has been moderate, with correlation coefficients ranging from 0.5 to > 0.8 as stated by (Vugham[4]; Teeter[5]; Sawyer[6]; Thiadens[7]; Ashutosh[18]) and this in agreement with our study where we find that the correlation between low PEF %(<80% of predicted) and low FEV1%(<80% of predicted) in screening for obstructive airway diseases was high moderate with correlation coefficients 0.8, and the relation was statically significant(P value <0.05), In only one follow-up study, (Kelly[31] individual correlation coefficients were found to be 0.98 which was high In our study we find that 85(85%) patients with obstructive airway diseases had low FEVI%, and at the same time we find that 85(85%) patients had low PEF%, but 5 patients from patients with low FEVI% had high PEF% and 5 patients from patients with low PEF % had high FEVI%, the relation was statically significant (P value <0.05), and this results in agreement with other studies Thiadens[7]; Ashutosh[18]) which stated that PEF testing has the properties to be a good screening to exclude airway obstruction and that the coloration between PEF% and FEVI% was moderate, however a numerical summary of information does not imply that PEF% can be used as a surrogate for FEV1%. Scatterplots from various reports show considerable difference in FEVI% and PEF% values in individual patients, although most coordinates lie close to the line of identity. According to British Thoracic Society (BTS) guide line of classification of severity of airway obstruction, and by using arbitrary severity categories based on 20% FEVI% intervals, we found that PEF% and FEVI% severity categories were concordant in only 60 instances (60%), with better concordance as severity of obstruction (based on FEVI%) became more severe this result come in agreement with Ashoutosh[18]; Sawyer[6]; (Harrison[30]; Vugham[4]; Choi[17]; Ashoutosh[18]) found that when he using arbitrary severity categories based on 20% FEVI % intervals, PEF% and FEI% severity categories were concordance in only 48.9% of instances, with better concordance on severe airway obstruction, and these results are in agreement with our study Sawyer[18] found that there was agreement in only 49.9% of measurements between PEF% and FEVI% in classification of severity of airway obstruction, and PEF and FEVI when expressed as percentage predicted, are not equivalent, and this results are close our results. Choi[17]; found that there was considerable variability between measurements of FEVI and PEF when expressed as % predicted values; PEF% and FEVI% are not equivalent and PEF% should not used as a surrogate for FEVI% in classification of severity of airway obstruction and these results are in agreement with our results. British guideline recommend that in asthma and chronic obstruction pulmonary diseases measurements of FEVI and PEF and parity exist between them when expressed as percentage predicted normal values; and that asthma severity can be classified as mild moderate or severe on the basis of FEVI and /or PEF, and this disagrees with our study. For entire study population, PEF% under estimated FEVI% by amean of only (0.35%). However, limits of agreement were wide and exceed(±14.5%). Over all difference were more marked in young patients, in women and in patients at extremes of height distribution, this In agreement with results obtained by previous investigators Ashoutosh[18] Teeter[5]; Sawyer[6]; Choi[17]; Harrison.[30] Choi[17] found that the limit of agreements between PEF% and FEVI% values wide and exceeded 24%, and this closed to our results. In the present study we found that in patients with severe airway I obstruction (FEVI < 40% of predicted), PEF% overestimated FEVI%, whereas exactly the opposite happened in patients with less severe airway obstruction, also Sawyer[6] found that PEF% values were higher than corresponding FEVI% values, particularly in patients with moderate to severe asthma. 1n another study conducted by Vaughan[4] stated that most patients could generate higher PEF% values than FEVI% values, although very few patients had severe airway obstruction. In regard to discordance between FEVI% and PEF%, discordance >5% could be considered a clinically important error for estimation of severity of airway obstruction, the discordance result in our study was more marked in women, patients with short height, and those with less severe airway obstruction. Overall, PEF% and FEVI% were > 5% apart in 70%, thus, only a minority of patients(30%) had PEF% and FEVI% values close to each other this results coincide with other data from previous studies. (Ashutosh[28]; Teeter[5]; Sawyer[6]; Choi[17] they also show that limits of agreement are wide and point toward absence of parity between FEVI% and PEF% found that PEF% underestimated FEVI% by a mean of 0.7% and the limits of agreement were wide and exceeded ± 25%. In our own data set, limits of agreement were - 14.2 to + 14.9, this means that for a given value of PEF%, corresponding FEVI% could be 14.9% lower or 14.2% higher. These values render substitution of PEF% for FEVI% useless in routine I clinical practice. Our results are at slight variance with observations in other reports. The mean difference between FEVI% and PEF% in this study was only 0.35%. Previous study conducted by (Ashutosh[18]) shown slightly higher difference(o.7%), other studies(Teeter[5]); Sawyer[6]) have shown a much wider mean difference, with FEVI% being lower than PEF% by 9.1 to 17.2%. This possibly is related to the selection and size of study populations enrolled in these studies. Most of these studies(Teeter[5]; Sawyer[6] included small number of patients (25 to 101 patients). Some studies(Kelly.[31] Sawyer[6] recorded multiple paired observations on each subject and analyzed each pair as a separate unit. Both factors preclude generalization of results. Some studies(Kelly[31]; Vaughan[4]; Sawyer[6]) also included patients who, although suffering from an obstructive lung disease, did not have airflow limitation at time of evaluation. It is clear from these results that if international guidelines are followed and PEF% is used as a surrogate for FEVI%, then severity of obstruction may be wrongly categorized in a large proportion of patients. The impact of use of PEF on categorization of severity of stable asthma was reported in study conducted by, (Sawyer[6]) in which the categorization using PEF% and FEVI% was concordant in only one half of the patients. Misclassification was particularly evident in patients with severe asthma. Significant differences were also reported in a (Choi[17]) of patients with exacerbation of asthma. These differences are likely to be more pronounced in women and in patients with less severe airways obstruction (defined by FEVI%), as is evident from the results of logistic regression analysis conducted by (Ashutosh[18]). This has far-reaching implications for developing and resource-poor countries where facilities or conducting spirometry are not freely available, and physicians rely mainly on clinical features and/or PEF estimation to assess severity of airflow limitation.

CONCLUSION

- PEF measurements can reliably exclude airway obstruction
- FEVI & PEF values when expressed as percentage of % predicted values are not equivalent in many patients, especially women, short patients and those with mild airway obstruction.
- In general PEF $^{0}/0$ underestimates FEVI% &limit of agreement between them wide.
- In severe airway obstruction PEF% underestimate FEVI%, while in mild airway obstruction PEF% overestimate FEVI%.
- (75%) of patients had discordance between FEVI% and PEF% more than 5% apart, and these are marked in women, short patients and those with mild airway obstruction.

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