ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 07 | July - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ASSOCIATION OF SPIROMETRIC MEASURES WITH HANDGRIP DYNAMOMETRY IN HEALTHY YOUNG ADULTS.

Physiology

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KEYWORDS

INTRODUCTION:

Hand grip strength (HGS), a simple bedside tool test, is portable, relatively inexpensive, and a reliable measurement of muscular strength (1). Handgrip dynamometry is reliably prognostic; the test is rarely used during routine assessment in pulmonary departments. A few contradictory studies on HGS measurements in patients with obstructive lung disease have appeared. Gosselink *et al.* (2) showed that HGS was reduced in patients with obstructive lung disease, and Puhan *et al.* (3), in a prospective study, found that HGS predicted mortality in patients with obstructive lung disease. In a large primary care study, patients with obstructive lung disease had a lower HGS than a healthy control group (4). Still, the HGSs of patients with moderate to severe obstructive lung disease and controls were similar in another study (2). Marino *et al.* (5) founded that there was no association between HGS and spirometric lung function result, as assessed by the predicted forced expiratory volume per cent in 1 second (FEV_1%) among moderate to severe chronic obstructive pulmonary disease (COPD). Recent studies (6, 7) have found that HGS is not related to lung function parameters such as forced vital capacity (FVC) or FEV_1%. Pulmonary function tests (PFTs) have progressed from tools from carrying out physiological studies to clinical tools for the diagnosis, management, and follow-up of respiratory by providing clear information about the status of person's respiratory system (8). In addition, by estimating the severity of airway obstruction, Spirometric tests are also used to assess pulmonary system and evaluate various therapeutic regimens' results. PFTs are affected by factors including diet, obesity, air pollution, and physical activity level (9). Past two decades, there was positive sprout in economic growth and development worldwide resulted people's nutritional status. While, at the same time, air pollution increased, and people's physical activity deteriorated. This raises the question that norms for lung function need to be revised in relation to socioeconomic development, environmental factors, and lifestyle changes that influence the normative values even within a single generation within an ethnic group living in the same geographical region (9). However, in the last five decades, young adults' anthropometric data have changed significantly due to factors such as increasing body height and body mass index; therefore, whether previously reported population-specific norms for the prediction of PFTs remain valid is a commonly asked question (10). A positive association between physical activity and spirometry has been reported to be attributed to handgrip strength (HGS), particularly in the elderly. In contrast, question arises with the association between HGS and lung function in young adults. Handgrip strength (HGS) is the force produced due to joint activities of the deep– seated and superficial hand and forearm muscles during gripping (11). Studies have reported that it can be used to monitor nutritional intervention, cost effective in healthy young adults (12, 13). HGS has been recommended as a standard instrument in health and nutritional evaluation. Factors like age, height, gender, weight, ethnicity, nutritional status and physical activity levels have been reported to influence handgrip strength (14). Positive association between Physical actiity and spirometric indices shows association between HGS and spirometry (15, 16). The present study aimed to measure Spirometric measures and hand grip dynamometry (HGD) in healthy young adults.

MATERIALAND METHODS:

The present cross-sectional study was conducted on the 150 healthy subjects (students) of 18-25 years age group of both sex in the department of Physiology, Subharti medical college. Meerut (UP).

The data collected under the standard laboratory settings was as follows:

1. Anthropometric parameters (17)

- Age, calculated from date and year of birth given by participants.
- Height using Stadiometer scale.
- Weight using the weighing machine.
- BMI using formula (Weight/ height^2).

2. Lung functions assessment (PFT)

PFT was performed by using computerized Spirometry (Spirotech, model no: CMSP-01). The measurements taken was FVC, FEV1, and FEV1/FVC%. In the context of performing Spirometry, the subject will be asked to reach the laboratory in the morning or 2-3 hours after the last meal. On the day of examination, the subject should not have performed any form of exercise at least for 24hrs before the test. Then test protocol was explained and demonstrated to the subject. The subjects were asked to perform the test three times with a minimum duration of 2 minutes, and the best of three results was taken into consideration. While performing the test, the subjects were asked to sit erect in front of the equipment with a mouthpiece held in between the lips. A soft nose clip was applied on nostril to prevent air escape through the nose. Disposable agents were used in order to avoid the spread of microorganisms. The subjects were asked to take normal respirations followed by instruction to take deep respiration of a minimum period of 3 to 6 seconds. Immediately after this deep inspiration, they need to blow out the air as hard and fast as possible into the mouthpiece. This provides us FVC. Soon after a sufficient gap they were asked to take a deep maximal inspiration. It was ensured that the inspiration is full and unhurried, and the expiration once begun is continued without pause. Amount of air that is forcibly blown out in one second is FEV1. (18)

3. Hand grip dynamometry.

The subjects were asked to sit erect on the stool with the arm in a mid

prone position and the elbow flexed at 90 degree. The following parameters were measured sequentially with a rest period of 3 min between each maneuver. Maximum hand grip (Hand grip Dynamometer): The subjects were asked to exert maximum strength. Three sets of readings were taken from both hands alternatively and the best set of values will be documented (Both hands).

RESULTS:

Table 1: Distribution of various parameters.

PARAMETERS		MALE	FEMALE	P - value
AGE (years)		21.88±1.3	19.06±1.8	< 0.0001
HEIGHT (mtr)		1.74±0.06	1.49±0.04	< 0.0001
WEIGHT (Kg)		65.36±9.35	53.32±6.2	< 0.0001
BMI		22.08±3.09	24.01±4.7	< 0.0001
BODY FAT %		12.53±3.53	22.09±5.4	< 0.0001
FVC (litres)		2.77±0.73	2.7±0.46	0.5675
FEV1 (litres)		2.45±0.62	1.84±0.4	< 0.0001
FEV1/FVC (%)		89.73±7.1	91.48±4.7	0.1493
PEFR(L/min)		5.20±1.75	3.97±1.43	0.0002
MVV (litres)		102.36±33.55	78.95±23.8	0.0001
FEF25-75%		3.3±0.97	2.7±0.67	0.0005
HGS (Kg)	Right Hand	43 (7.4)	32 (6.9)	< 0.0001
	Left Hand	41 (6.1)	27 (5.5)	< 0.0001

Significant ($p<0.05$)

Table 2: Correlation of HGS with different spirometric measures in males.

Parameters	r-value	p- value
FVC (litres)	0.7216	<0.001
FEV1 (litres)	0.7181	<0.001
FEV1/FVC (%)	0.2384	<0.05
PEFR(L/min)	0.4951	<0.05
MVV (litres)	0.6553	<0.05
FEF25-75%	0.5792	<0.05

Table 3: Correlation of HGS with different spirometric measures in females.

Parameters	r-value	p- value
FVC (litres)	0.168	0.37
FEV1 (litres)	0.130	0.493
FEV1/FVC (%)	0.139	0.463
PEFR(L/min)	0.16	0.38
MVV (litres)	0.24	0.18
FEF25-75%	0.059	0.75

DISCUSSION:

The result showed that the mean value of HGS was more in males than females in both hands. But the mean values of FVC, FEV_1, PEFR, MVV and FEF25-75% were higher in males than females. There was a significant difference in the mean values of FEV_1, PEFR, MVV and FEF25-75% in males and females. But no significant difference was found in mean values FVC and FEV_1/FVC (%) of spirometric measures in both males and females (Table 1).

There was a significant positive relationship between HGS and spirometric measures of the male participants (Table 2). But the poor positive relation (non-significant) was exist in between HGS and spirometric measures of the female participants (Table 3). The observed significantly higher HGS in males than in females corroborates previous studies done in similar populations (19). Height and weight was also significantly higher of males than females in the present study. This could result from hormonal influences as previously mentioned, which enhance longer bone and muscle growth, thereby encouraging greater muscle contractile units (20).

CONCLUSION:

We found associations between muscle strength as evaluated by HGS and spirometric pulmonary function parameters. HGS might serve as a screening test that could then undergo more extensive exercise capacity testing. It would be useful to measure HGS simply to detect airway diseases in clinics without spirometry. Further well-designed prospective studies on HGS may give us this association with obstructive lung disease and identify the need to evaluate pulmonary rehabilitation outcomes.

Conflicts of interest: None

Acknowledgement:
We thank all volunteers participated in the study.

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