DOI Number: 10.5958/2320-608X.2019.00056.8

Study of Variations in Handgrip Strength in Asthmatic and Non Asthmatic People

Pooja Sakshi[1], Swati Sinha[1], Manish Shankar[2], Ashok Sharan[3], Tarun Kumar[4], Manish Kumar[5], Sunita[5]

[1]Tutor, Department of Physiology, Indira Gandhi Institute of Medical Sciences, Patna, [2]Associate Professor, Dept. of T.B. & Chest, Indira Gandhi Institute of Medical Sciences, Patna, [3]Professor & Head, Dept. of Physiology, Indira Gandhi Institute of Medical Sciences, Patna, [4]Additional Professor, Dept. of Physiology, Indira Gandhi Institute of Medical Sciences, Patna, [5]Associate Professor, Dept. of Physiology, Indira Gandhi Institute of Medical Sciences, Patna

Abstract

Background: Asthma is a major public health problem worldwide. It causes a deterioration of physical condition and cardiorespiratory capacity. However, little is known about muscular strength differences between patients with asthma and healthy subjects. So this study is focused on determining whether asthma has any effect on muscular strength or not.

Aims and Objective: In this study, we aimed to find the variations in handgrip strength in mild asthmatic and healthy subjects.

Material & Method: This cross sectional study was done to analyze the handgrip strengths in 40 people diagnosed with mild asthma of age 15-40 years, and compare the findings with that of age and sex matched 40 healthy subjects (for control) by using a hand-grip dynamometer (B.D.Instrumations).

Results: This study showed a significant (with $p<0.05$) increase in the body mass index of mild asthmatic subjects. The Maximum handgrip strength was lower in mild asthmatic subject approximately by 6.62%, although it was not significant.

Conclusion: There was a significant increase in BMI when comparing subjects with mild asthma and healthy individuals. The maximum handgrip strength (MHGS) was lower in mild asthmatic subjects, although it was not significant. The height of healthy subjects was positively correlated with the handgrip strength whereas the age was negatively correlated with MHGS.

Keywords: *Asthma, handgrip strength, hand-held dynamometer.*

Introduction

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation. It may be defined by the history of respiratory symptoms such as shortness of breath, chest tightness and cough that varies over the time and in intensity together with expiratory airflow limitation.[1] It has been reported that the airway distensibility in subjects with asthma is lower than normal.[2]

Even in asymptomatic patient airways can be edematous and infiltrated with eosinophils, neutrophils and lymphocytes, with or without increase in the collagen content of the epithelial basement membrane. They can contribute mediators and cytokines to initiate and amplify both acute inflammation and long-term pathological changes.[3]

Patient with asthma undergoes some activity limitation leading to reduced functional capacity. Muscle weakness can be due to reduced motor neuron activity,

Corresponding Author:
Dr Swati Sinha
Tutor (Physiology) IGIMS, Patna, Bihar
drpsnhakshi@rediffmail.com, Mob.: 9661548621

decreased percentage of type 1 fibers and increased percentage of type IIB fibers and reduced activity of enzymes involved in oxidative energy conversion.[4,5]

Drugs like corticosteroid frequently used in asthma have risk for steroid induced myopathy.[6,7]

It has been reported that muscular strength is significantly reduced in moderate to severe asthmatic subjects when compared to healthy subjects.[8,9]

But little is known about muscle strength difference between mild asthmatic subjects and healthy subjects. In this context, the handgrip strength test is a quick and easy-to-perform muscular fitness test that provides useful information about overall muscular strength, and it could potentially be used in the clinical setting. So this study was undertaken to find out the effect of mild asthma on maximum hand grip strength (MHGS).

Aims & Objective

To determine the effect of mild asthma on maximum hand grip strength.

Material & Method

This was a cross sectional study done on 40 male subjects diagnosed with mild asthma of age 15-40 years and 40 healthy age, height, weight and sex matched volunteers (for control). It was carried out in the pulmonary function test laboratory, the Department of Physiology, IGIMS Medical College, Patna.

The study as approved by the ethical committee of the Institute. The study subjects who provided informed written consent were interviewed and a detailed clinical history was taken. Their age, height, weight and sex were recorded.

Inclusion criteria

Subjects were 15 - 40 years of age, diagnosed with mild asthma.

Exclusion criteria

Subjects with any other cardiac or pulmonary disease.

Subjects with any musculoskeletal and neuromuscular disease.

Either current or ex-smokers.

Subjects with inflammatory diseases.

History of hand or wrist surgery in last 3 months

Materials used for the study

The diagnosis of asthma and its assessment of severity were done according to the criteria of the Global Initiative for Asthma (GINA).[1] The following anthropometric Parameters were measured: height (cm), body mass (kg), and body mass index (BMI), which was calculated by_dividing body mass (in kilograms) by the square of the_height (in meters). A hand-grip dynamometer (B.D.Instrumations) was used to measure handgrip strength. For this, warm up was done. The warm up exercises included shaking both hands three times and bending and stretching all fingers three times. When adjusting the grip size, the hand was in line with the wrist and forearm. The grip size of the dynamometer was adjusted until the second joint of the index finger was at a 90 degree angle on the handle. The dynamometer was grasped between the fingers and the palm at the base of the thumb, held in line with the forearm at the thigh level so that it didn't touch the body or any other object during the test. The subject stood with the feet hip width apart with their toes pointing forward. After that, Subject took a breath in before starting the squeeze, then blew out the air during the squeeze.[10]

For the test, dominating hand was tested three times, with a 60- second rest between trials. Grip strength measurements are more accurate when using the mean of three grip trials as compared to either a single grip trial or the highest reading of three trials.[11]

Statistical analysis

All data were expressed as mean ± standard deviation (SD). Statistical significance was accepted at $P<0.05$. Comparison between asthmatic and non asthmatic subjects for all parameters was performed by independent t-test. Spearman correlation coefficients were used to examine the relationships of maximum hand grip strength with age, height, weight and BMI within both groups.

Results

Table-1: Subject characteristics and studied variables

	Asthmatic n = 40	Control n = 40	Significance P
Age (years)	25.75±6.41	31.03±8.3	>0.05, NS
Height (m)	1.64±0.07	1.63±0.07	>0.05, NS
Weight (kg)	63.08±11.9	56.88±8.69	>0.05, NS
BMI (kg/m²)	23.38±3.79	21.57±3.49	<0.05, S
MHGS (kg)	17.78±3.66	19.04±4.59	>0.05, NS

BMI, body mass index, MHGS, Maximum hand grip strength

All values are expressed as Mean ± SD
Analysis of all parameters done by Independent T- test
S- significant, NS-Not significant

No significant difference ($p<0.05$) was observed in the distribution of age, weight and height among the asthmatic and healthy subjects. The body mass index was significantly increased in asthmatic subjects. The Maximum handgrip strength was lower in asthmatic subject approximately by 6.62%, although it was not significant.

Table-2: Pearson correlation between anthropometric variables and maximum hand grip strength in healthy male subjects (n=40)

Parameters	R(correlation coefficient)	Significance P
Age (years)	-0.508	<0.01 (HS)
Height (m)	0.501	<0.01 (HS)
Weight (kg)	0.248	>0.05 (NS)
BMI (kg/m²)	-0.08	>0.05 (NS)

Table-3: Pearson correlation between anthropometric variables and maximum hand grip strength in asthmatic male subjects (n=40)

Parameters	R(correlation coefficient)	Significance P
Age (years)	-0.305	>0.05 (NS)
Height (m)	0.195	>0.05 (NS)
Weight (kg)	-0.107	>0.05 (NS)
BMI (kg/m²)	-0.226	>0.05 (NS)

HS-Highly significant, S- significant, NS-Not significant

Maximum handgrip strength has significant positive correlations with height, whereas age has a significant negative correlation with maximum handgrip strength in healthy subjects.

Discussion

In this study we have taken 40 case of diagnosed mild bronchial asthma patients and 40 healthy subjects, whose MHGS test was done and relevant observation was made. All subjects were male of age 15 to 40 years. It was seen that the parameters weight and body mass index are all increased in asthmatic subjects as compared to healthy subjects, whereas MHGS was decreased in asthmatic subjects. Weight (kg), BMI (kg/m²) and MHGS (kg) in the asthmatic subjects and healthy subjects were 63.08±11.9, 23.38±3.79, 17.78±3.66 and 56.88±8.69, 21.57±3.49, 19.04±4.59 respectively. The BMI was significantly increased in asthmatic subjects.

Peoples with asthma tend to have a sedentary lifestyle and they have a lower aerobic capacity than healthy persons.[12] The fear of breathlessness and of exercise-induced asthma inhibits the participation of many patients[13] in physical activity and sport, which causes a deterioration of their physical condition and cardiorespiratory capacity in relation with healthy people. Moreover, a sedentary lifestyle causes a higher prevalence of obesity among persons with asthma.

In our study, the height of healthy subjects is positively correlated (R=0.501) with the hand grip strength. It could be due to various factors such as with greater heights that would lead to longer arms, with greater lever arm force generation, resulting in an efficient amount of force.[14]

Moreover, the age is negatively correlated (R= -0.508) with MHGS in this group. It can be explained by the decline in musculoskeletal strength and mass associated with aging.[15] MHGS is not significantly correlated with weight and BMI. Koley S *et al.* also reported that weight and BMI is not associated with MHGS in Indian collegiate population.[16]

Conclusion

In conclusion, there was significant increase in BMI when comparing subjects with mid asthma and healthy individuals. The Maximum handgrip strength was lower in mild asthmatic subjects, although it was not significant. The height of healthy subjects was positively correlated with the Maximum hand grip strength whereas the age was negatively correlated with MHGS.

Ethical Clearance- Taken

Source of Funding- Self

Conflict of Interest - Nil

References

1. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention 2018. Available from www..ginasthma.org Date last updated 2018.
2. Ward C, Johns DP, Bish R, Pais M, Reid DW, Ingram C, Feltis B, Walters EH.Reduced airway distensibility, fixed airflow limitation, and airway wall remodeling in asthma. Am J Respir Crit Care Med. 2001 Nov 1;164(9):1718-21.
3. Harrison's principles of internal medicine.Kasper, Dennis L. 19th edition / editors, Dennis L. Kasper, Anthony S. Fauci,Stephen L. Hauser, Dan L. Longo, J. Larry Jameson, Joseph Loscalzo. New York :McGraw Hill Education Medical, [2015].
4. Gosker H, Wouters E, van der Vusse G, Schols AM. Skeletal muscle dysfunction in chronic obstructive pulmonary disease and chronic heart failure: underlying mechanisms and therapy perspectives. Am J Clin Nutr. 2000;71:1033–47.
5. Couillard A, Prefaut C. From muscle disuse to myopathy in COPD: potential contribution of oxidative stress. Eur Respir J. 2005;26:703–19.
6. Cluley S, Cochrane GM. Psychological disorder in asthma is associated with poor control and poor adherence to inhaled steroids. Respir Med. 2001;95:37–9.
7. Fahy JA, Kim K, Liu J, Boushey HA. Prominent neutrophilic inflammation in sputum from subjects with asthma exacerbation. J Allergy Clin Immunol. 1995;95:843–52.
8. Andrade LB, Silva DA, Salgado TL, Figueroa JN, Lucena-Silva N, Britto MC.Comparison of six-minute walk test in children with moderate/severe asthma with reference values for healthy children.J Pediatr (Rio J). 2014 May-Jun;90(3):250-7. doi: 10.1016/j.jped.2013.08.006. Epub 2013 Nov 1.
9. Ramos E, de Oliveira LV, Silva AB, Costa IP, Corrêa JC, Costa D, Alves VL,Donner CF, Stirbulov R, Arena R, Sampaio LM. Peripheral muscle strength and functional capacity in patients with moderate to severe asthma. Multidiscip Respir Med. 2015 Jan 21;10(1):3. doi: 10.1186/2049-6958-10-3. eCollection 2015.
10. Newman AB, Kupelian V, Visser M, et al. Strength, but not muscle mass, is associated with mortality in the health, aging and body composition study cohort. J Gerontol A Biol Sci Med Sci 2006;61:72-7.
11. Hossain MG, Zyroul R, Pereira BP, et al. Multiple regression analysis of factors influencing dominant hand grip strength in an adult Malaysian population. J Hand Surg Eur Vol 2012;37: 65-70.
12. Norman K, Stobäus N, Gonzalez MC, Schulzke JD, Pirlich M. Hand grip strength:outcome predictor and marker of nutritional status. Clin Nutr. 2011 Apr;30(2):135-42.
13. Flood A, Chung A, Parker H, Kearns V, O'Sullivan TA. The use of hand grip strength as a predictor of nutrition status in hospital patients. Clin Nutr. 2014 Feb;33(1):106-14.
14. Sartorio A, Lafortuna CL, Pogliaghi S, Trecate L. The impact of gender, body dimension and body composition on hand-grip strength in healthy children. Journal of Endocrinological Investigation. 2002; 25: 431– 435.
15. Marmon AR, Pascoe MA, Schwartz RS, Enoka RM. Associations among strength, steadiness, and hand function across the adult life span. *Med Sci Sports Exerc.* 2011;43(4):560-567.
16. Koley S and Singh AP. An association of dominant hand grip strength with some anthropometric variables in Indian collegiate population. Anthropol Anz 2009; 67: 21–28.