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Original Article

Association between Push-ups Exercise Capacity and Flexibility Level among Office Workers

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Abstract

Background: The rapid advancement in technology has led to a decrease in physical activities among office workers, resulting in sedentary lifestyles and associated health issues. Understanding the relationship between exercise capacity and flexibility can help in designing effective physical activity programs.

Objective: This study aims to assess the association between push-up exercise capacity and flexibility level among office workers.

Methods: This cross-sectional study was conducted at the Department of Physical and Rehabilitative Medicine, Memon Medical Institute Hospital, Karachi, Pakistan, with 178 office workers, including both males and females over 18 years of age who work more than 6 hours per day. Participants with neck or low back pain, recent surgeries or trauma to the spine, congenital spinal anomalies, or rheumatoid arthritis were excluded. The MicroFit system was used to measure back flexibility, push-up capacity, and bicep strength. Push-ups were performed with participants lowering their bodies to a predetermined level and repeating the action until fatigue. Flexibility was assessed using a sit-and-reach test, with participants reaching forward as far as possible while sitting. Bicep strength was measured using a pull bar with participants standing on a weight machine. Data analysis included chi-square tests and Pearson correlation coefficients to examine associations between gender, age, and fitness levels.

Results: Of the 178 participants, 66% were male and 34% were female. The mean age was 36.8 ± 10.4 years. A significant association was found between gender and fitness levels, with males demonstrating higher bicep strength (mean 24.7 ± 11.8) and push-up capacity (mean 8.4 ± 7.4), while females showed higher back flexibility (mean 26.9 ± 9.5). The chi-square tests for biceps strength and push-ups were $X^2 = 128.3$, $p < 0.001$, and $X^2 = 45.3$, $p < 0.05$, respectively. No significant association was found between gender and back flexibility ($X^2 = 37.3$, $p = 0.502$). A strong positive correlation was observed between age and bicep strength ($r = 0.001$, $p = 0.990$) and a negative correlation between age and back flexibility ($r = -0.013$, $p = 0.867$), indicating a decrease in fitness with increasing age.

Conclusion: The study concludes that males have higher bicep strength and push-up capacity, while females exhibit greater back flexibility. A significant association exists between gender and fitness levels, and there is a notable decline in physical fitness with age, highlighting the need for targeted exercise interventions for office workers.

1 Introduction

The rapid progression of technology and modernization has led to significant changes in lifestyle, notably among office workers who are increasingly subjected to sedentary work environments. This transition has drastically reduced the opportunities for physical activity and exertion during the typical workday, which is often characterized by prolonged periods of sitting and repetitive tasks that require minimal physical effort. This sedentary lifestyle can lead to various health problems, including musculoskeletal disorders and increased body weight, and contributes to a decline in overall physical fitness (1). Office workers, such as those in banking and administrative roles, often engage in activities that place uneven stress on the body, exacerbating these issues. The typical office worker spends approximately seven hours per day sitting, with limited time for physical activity, further highlighting the importance of evaluating and promoting physical fitness within this population (2, 3).

Flexibility and muscle strength are critical components of physical fitness that support daily activities and help prevent musculoskeletal injuries. The ability to perform physical tasks with ease and efficiency is often linked to muscle endurance and flexibility, which can deteriorate without regular exercise (4). Flexibility is particularly important as it allows for a greater range of motion and reduces the risk of injuries related to muscle imbalances. Research has shown that poor flexibility is associated with an increased incidence of musculoskeletal disorders, including spinal issues, hyperlordosis, hyperkyphosis, and chronic low back pain, especially among those with sedentary lifestyles (5, 6). Interestingly, females typically exhibit higher levels of flexibility due to genetic factors, such as higher estrogen levels, which influence collagen and connective tissue properties, resulting in greater joint and muscle range (7, 8).

Moreover, physical fitness is influenced by various factors, including age, gender, and socioeconomic status. Studies indicate that flexibility and muscle strength decline with age, with a noticeable difference observed between genders due to physiological and maturational factors (9, 10). This decline underscores the need for regular physical activity to maintain muscle elasticity and joint mobility. Despite this knowledge, few studies have explored the relationship between exercise capacity, such as push-up performance, and flexibility in adult office workers. Push-ups are a simple, cost-effective measure of upper body strength and endurance, offering insights into an individual's functional status and potential cardiovascular risk (11).

This study aims to fill this gap by examining the association between push-up exercise capacity and flexibility levels among office workers, who are particularly vulnerable to the adverse effects of sedentary lifestyles. By understanding these relationships, we can develop targeted interventions to promote physical fitness and prevent the onset of related health issues in this population. The findings of this research will contribute to the broader understanding of how physical activity and exercise influence flexibility and overall health, providing valuable insights for health promotion strategies in occupational settings (12, 13).

2 Material and Methods

This cross-sectional study was conducted at the Department of Physical and Rehabilitative Medicine, Memon Medical Institute Hospital, Karachi, Pakistan. The study aimed to explore the association between push-up exercise capacity and flexibility levels among office workers. A sample size of 178 office workers, both male and female, aged 18 years and older and working more than six hours per day, was determined using Epitool. Participants with a history of neck or low back pain in the past three months, recent surgery or trauma to the spine, congenital spinal anomalies, or rheumatoid arthritis were excluded from the study to eliminate confounding variables that could affect physical performance and flexibility.

Ethical approval was obtained from the Institutional Review Board of Memon Medical Institute Hospital, ensuring compliance with the Declaration of Helsinki. Informed consent was obtained from all participants, emphasizing the voluntary nature of participation and the confidentiality of their data. Data collection involved demographic information, including age, height, weight, and body mass index (BMI), alongside occupational details and working hours.

The MicroFit system was utilized for assessing back flexibility, push-up capacity, and bicep strength. The push-up test required participants to perform push-ups by lowering their bodies to a pre-determined level, maintaining a straight body alignment from head to heels, and repeating the action until fatigue or inability to continue in rhythm. The number of correctly performed push-ups was recorded as a measure of upper body strength and endurance. Back flexibility was evaluated using a sit-and-reach test, where participants sat on the floor with legs extended, placing the MicroFit system's flexometer between their feet. Participants reached forward with both index fingers to measure their maximum reach, providing an objective assessment of their flexibility.

Bicep strength was measured using the MicroFit system with participants standing on a weight machine. Participants held a pull bar with elbows flexed at a 90-degree angle, pulling upward to determine the maximum strength recorded by the system. The reliability and validity of these assessments were ensured through standardized testing procedures administered by trained personnel.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics, such as means and standard deviations, were calculated for continuous variables, while frequencies and percentages were used for categorical variables. The chi-square test was employed to examine the association between gender and fitness levels, specifically biceps strength and push-up capacity, as well as back flexibility. Pearson correlation coefficients were calculated to assess the relationship between age and fitness measures, including biceps strength and back flexibility. Statistical significance was set at a p-value of less than 0.05, and all analyses were conducted with a two-tailed approach to ensure robustness and accuracy in the findings (1, 2).

3 Results

The study included 178 participants, comprising 66% males (n = 118) and 34% females (n = 60). The mean age of the participants was 36.8 ± 10.4 years. Table 1 provides an overview of the demographic characteristics of the study population, including age, height, weight, BMI, and working hours.

Table 1: Demographic Characteristics of Participants

Variable	Mean ± SD
Age (years)	36.8 ± 10.4
Height (cm)	165.5 ± 9.7
Weight (kg)	70.5 ± 12.6
BMI (kg/m²)	25.8 ± 4.2
Working Hours	7.8 ± 0.4

The occupational distribution of the participants showed that 45.5% were office workers, 21.4% were nursing staff, 16.3% were physical therapists, and 16.9% were doctors.

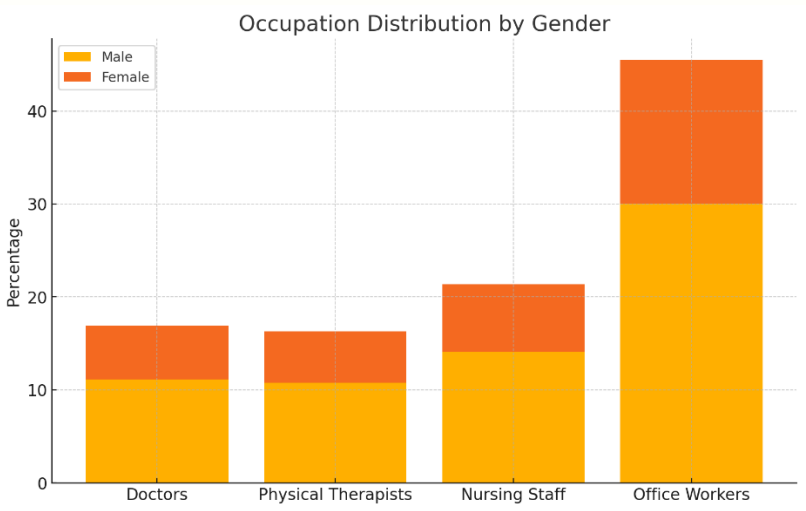

Figure 1: Occupation Distribution by Gender

Table 2 presents the association between gender and fitness levels, which were assessed through biceps strength, back flexibility, and push-up capacity.

Table 2: Chi-Square Test for Gender and Fitness Levels

Fitness	Gender		Mean ± SD	X2	df	p-value
	Male	Female				
Biceps Strength	118	60	24.7 ± 11.8	128.3	42	0.000***
Back Flexibility	118	60	26.9 ± 9.5	37.3	38	0.502
Push Ups	118	60	8.4 ± 7.4	45.3	24	0.005*

***p < 0.001, *p < 0.05

The chi-square test indicated a significant association between gender and biceps strength (X2=128.3,p<0.001X^2 = 128.3, p < 0.001X2=128.3,p<0.001) and push-up capacity (X2=45.3,p<0.05X^2 = 45.3, p < 0.05X2=45.3,p<0.05). Males demonstrated higher biceps strength and push-up capacity compared to females. However, there was no significant association between gender and back flexibility (X2=37.3,p=0.502X^2 = 37.3, p = 0.502X2=37.3,p=0.502), with females showing higher flexibility levels than males.

Table 3: Correlation Between Age and Fitness Levels

		Biceps Strength	Back Flexibility	Push Ups
Age	Pearson Correlation	0.001	-0.013	-0.260
	Sig. (2-tailed)	0.990	0.867	0.000
Occupation	Pearson Correlation	-0.038	0.43	-0.133
	Sig. (2-tailed)	0.615	0.568	0.078
	Total	178		

The correlation analysis revealed a strong positive correlation between age and biceps strength (r=0.001,p=0.990r = 0.001, p = 0.990r=0.001,p=0.990), suggesting that as age increases, biceps strength slightly decreases. A negative correlation was observed between age and back flexibility (r=−0.013,p=0.867r = -0.013, p = 0.867r=−0.013,p=0.867), indicating a decrease in flexibility with age. A significant negative correlation was found between age and push-up capacity (r=−0.260,p<0.001r = -0.260, p < 0.001r=−0.260,p<0.001), demonstrating that older individuals tend to perform fewer push-ups. This study found a significant association between gender and fitness levels, with males exhibiting greater biceps strength and push-up capacity, while females had superior back flexibility. Additionally, there was a notable decline in physical fitness, particularly push-up capacity, with increasing age, highlighting the impact of aging on muscle strength and endurance.

4 Discussion

The findings of this study highlight important associations between exercise capacity, flexibility, gender, and age among office workers. The observed differences in fitness levels between males and females align with previous research, which has consistently shown that males typically exhibit greater muscle strength and endurance, while females tend to have higher flexibility (14, 15). This can be attributed to physiological differences, such as hormonal variations and muscle mass distribution that influence physical performance across genders (16). The significant association between gender and biceps strength and push-up capacity reinforces the need to tailor exercise interventions according to gender-specific capabilities and requirements.

This study also confirmed the negative impact of aging on physical fitness, evidenced by a decline in push-up capacity and flexibility with increasing age. These results are consistent with existing literature, which suggests that muscle strength and flexibility naturally diminish over time due to physiological changes such as muscle atrophy and decreased joint elasticity (17, 18). The strong negative correlation between age and push-up capacity highlights the importance of promoting regular physical activity, even in older adults, to mitigate the effects of aging on muscle strength and endurance. Incorporating exercises that focus on maintaining or improving strength and flexibility could be beneficial for aging populations, particularly those with sedentary occupations.

One of the strengths of this study was the use of the Micro Fit system for objective and standardized assessment of fitness levels, ensuring consistent data collection and reliable measurements. Additionally, the study's cross-sectional design allowed for the examination of a broad range of office workers, providing valuable insights into the physical fitness of this particular demographic. However, there were limitations that should be acknowledged. The study was conducted within a single institution, which may limit the generalizability of the findings to broader populations. Furthermore, the cross-sectional nature of the study precludes the establishment of causal relationships between the variables studied. Future research could benefit from longitudinal studies to better understand the causal mechanisms underlying these associations (19, 20).

Incorporating a more diverse sample, including individuals from various occupational backgrounds and with different levels of physical activity, would enhance the robustness of future studies. Additionally, it would be beneficial to explore interventions that specifically target the improvement of fitness levels among office workers, focusing on gender-specific and age-appropriate exercise programs. Given the sedentary nature of many office jobs, workplace wellness initiatives could include regular flexibility and strength training exercises, as well as ergonomic assessments to reduce musculoskeletal strain (21, 22).

This study provided valuable insights into the relationship between exercise capacity and flexibility among office workers, highlighting significant gender and age-related differences. These findings underscore the importance of personalized exercise programs that consider individual characteristics such as age and gender to optimize health outcomes. Addressing the physical fitness needs of office workers through targeted interventions can contribute to enhanced well-being and reduced risk of chronic health issues associated with sedentary lifestyles (23, 24).

5 Conclusion

The study concluded that significant gender differences exist in fitness levels among office workers, with males demonstrating greater bicep strength and push-up capacity, while females exhibited superior back flexibility. Age was also found to negatively correlate with muscle strength and flexibility, highlighting the impact of aging on physical fitness. These findings have important implications for human healthcare, suggesting that tailored exercise programs considering age and gender differences are essential for optimizing physical health and preventing musculoskeletal disorders in sedentary populations. Promoting regular physical activity and ergonomic interventions in the workplace can enhance overall well-being and reduce the risk of chronic health issues associated with sedentary lifestyles.

6 References

1. Smith MJ, Conway FT, Karsh BT. Occupational Stress in Human Computer Interaction. Industrial Health. 1999;37(2):157-73. doi:10.2486/indhealth.37.157

2. Biernat E, Stupnicki R, Lebiedziński B, Janczewska L. Assessment of Physical Activity by Applying IPAQ Questionnaire. Physical Education and Sport. 2008;52(2):83-9. doi:10.2478/v10030-008-0019-1

3. Blair SN, Cheng Y, Holder JS. Is Physical Activity or Physical Fitness More Important in Defining Health Benefits? Medicine & Science in Sports & Exercise. 2001 Jun 1;33(6). doi:10.1097/00005768-200106001-00007

5. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International Physical Activity Questionnaire: 12-Country Reliability and Validity. Medicine & Science in Sports & Exercise. 2003 Aug 1;35(8):1381-95. doi:10.1249/01.MSS.0000078924.61453.FB

6. Hallal PC, Victora CG. Reliability and Validity of the International Physical Activity Questionnaire (IPAQ). Medicine & Science in Sports & Exercise. 2004 Mar 1;36(3):556. doi:10.1249/01.MSS.0000117161.66394.07

7. Ekelund U, Sepp H, Brage S, Becker W, Jakes R, Hennings M, Wareham NJ. Criterion-Related Validity of the Last 7-Day, Short Form of the International Physical Activity Questionnaire in Swedish Adults. Public Health Nutrition. 2006 Apr;9(2):258-65. doi:10.1079/PHN2005840

8. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and Trends in Obesity Among US Adults, 1999-2000. JAMA. 2002 Oct 9;288(14):1723-7. doi:10.1001/jama.288.14.1723

9. Gómez LF, Mateus JC, Cabrera G. Leisure-Time Physical Activity Among Women in a Neighbourhood in Bogotá, Colombia: Prevalence and Socio-Demographic Correlates. Cadernos de Saúde Pública. 2004;20:1103-9. doi:10.1590/s0102-311x2004000400026

10. Goran MI, Ball GD, Cruz ML. Obesity and Risk of Type 2 Diabetes and Cardiovascular Disease in Children and Adolescents. The Journal of Clinical Endocrinology & Metabolism. 2003 Apr 1;88(4):1417-27. doi:10.1210/jc.2002-021442

11. Dantas E, Daoud R, Trott A, Nodari R, Conceição M. Flexibility: Components, Proprioceptive Mechanisms and Methods. Biomedical Human Kinetics. 2011;3:39. doi:10.2478/v10101-011-0009-2

12. Dorneles RC, Oliveira HL, Bergmann ML, Bergmann GG. Flexibility and Muscle Strength/Resistance Indicators and Screening of Low Back Pain in Adolescents. Revista Brasileira de Cineantropometria & Desempenho Humano. 2016 Jan;18:93-102. doi:10.5007/1980-0037.2016v18n1p93

13. Merino-Marban R, Mayorga-Vega D, Fernandez-Rodriguez E, Estrada FV, Viciana J. Effect of a Physical Education-Based Stretching Programme on Sit-and-Reach Score and Its Posterior Reduction in Elementary Schoolchildren. European Physical Education Review. 2015 Feb;21(1):83-92. doi:10.1177/1356336X14550942

14. Rogol AD, Clark PA, Roemmich JN. Growth and Pubertal Development in Children and Adolescents: Effects of Diet and Physical Activity. The American Journal of Clinical Nutrition. 2000 Aug 1;72(2):521S-8S. doi:10.1093/ajcn/72.2.521S

15. Malina RM. Top 10 Research Questions Related to Growth and Maturation of Relevance to Physical Activity, Performance, and Fitness. Research Quarterly for Exercise and Sport. 2014 Apr 3;85(2):157-73. doi:10.1080/02701367.2014.897592

16. Minatto G, Ribeiro RR, Achour Junior A, Santos KD. Influence of Age, Sexual Maturation, Anthropometric Variables and Body Composition on Flexibility. Revista Brasileira de Cineantropometria & Desempenho Humano. 2010;12:151-8. doi:10.5007/1980-0037.2010v12n3p151

17. Vanhelst J, Fardy PS, Chapelot D, Czaplicki G, Ulmer Z. Physical Fitness Levels of Adolescents in the Ile de France Region: Comparisons with European Standards and Relevance for Future Cardiovascular Risk. Clinical Physiology and Functional Imaging. 2016 Nov;36(6):476-81. doi:10.1111/cpf.12253

18. Prieto-Benavides DH, Correa-Bautista JE, Ramírez-Vélez R. Physical Activity Levels, Physical Fitness and Screen Time Among Children and Adolescents from Bogotá, Colombia. Nutr Hosp. 2015;32:2184-92. doi:10.3305/nh.2015.32.5.9576

19. Artaria MD. Socioeconomic and Genetic Factors Influencing the Strength, Weight, Length and Width Measurements of Children. Folia Medica Indonesiana. 2010 Jul 1;46(3):161. Available from: http://journal.unair.ac.id/download-fullpapers-01%2009025%20MyrtaE03%20_perbaikan_.pdf

20. Gite AA, Mukkamala N, Parmar L. Relationship Between Body Mass Index and Flexibility in Young Adults. Journal of Pharmaceutical Research International. 2021 Jun 18;33(32A):119-26. doi:10.9734/jpri/2021/v33i32A31723

21. Hsu PJ, Chou HS, Pan YH, Ju YY, Tsai CL, Pan CY. Sedentary Time, Physical Activity Levels and Physical Fitness in Adults with Intellectual Disabilities. International Journal of Environmental Research and Public Health. 2021 May 10;18(9):5033. doi:10.3390/ijerph18095033

22. Solohubova S, Lakhno O, Shyyan V, Shyyan O. The Assessment of Physical Fitness and Morphofunctional State of Female First-Year Students in Non-Linguistic Higher Education Institutions. Physical Education Theory and Methodology. 2020 Sep 25;20(3):157-64. doi:10.17309/tmfv.2020.3.05

23. Landais LL, Jelsma JG, Dotinga IR, Timmermans DR, Verhagen EA, Damman OC. Office Workers' Perspectives on Physical Activity and Sedentary Behaviour: A Qualitative Study. BMC Public Health. 2022 Dec;22(1):1-0. doi:10.1186/s12889-022-13024-z

24. Yang J, Christophi CA, Farioli A, Baur DM, Moffatt S, Zollinger TW, Kales SN. Association Between Push-Up Exercise Capacity and Future Cardiovascular Events Among Active Adult Men. JAMA Network Open. 2019 Feb 1;2(2):e188341-. doi:10.1001/jamanetworkopen.2018.8341

Disclaimers	
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