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POWER RELATED COMPONENTS OF PHYSICAL FITNESS: A COMPARATIVE STUDY OF GOVERNMENT AND PRIVATE SCHOOLS

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ABSTRACT

The physical fitness trainings, accordingly, have been split into specific aspects in order to attain endurance, coordination, flexibility, speed and strength. Literature review clearly reveals that there is lack of data regarding physical fitness levels in private and government school going children from Pakistan. The present study was conducted with an aim to compare the power-related components (Standing broad jump, Push Ups, Sit Ups, and Hand Grip) of physical fitness of government and private schools' children. Cross sectional study design was used, the study was conducted on male children (n=304, 152 each from private and government schools) located within/outskirts of the main city of Sargodha, Pakistan. Total ten schools (5 private and 5 government) were earmarked and registered in the study. Convenience sampling technique was used. Children between the ages of 9-11 years, Children in primary level of education and children which are the residents of Sargodha were included in the study. There were statistically significant differences between Standing broad jump, Push Ups, Sit Ups, Hand Grip of Private and Government schools' students. Finally, it was concluded that the power-related components of physical fitness of government school children is better than the private schools' children except hand grip test.

Key Words: Physical Fitness, Standing broad jump, Push Ups, Sit Ups, Hand Grip, School-going children

INTRODUCTION

The role of physical fitness allied with vigorous exercise in promoting general health of an individual has been well reported. People with PE and fitness live a healthier and vigorously dynamic life with less vulnerability to many infectious diseases such as cardiovascular pathologies, anxiety, cancer, mental disorders, depression *etc*.

To benefit of physical activity (PA) i.e. physical, psychological and social perspectives for humans have been aptly correlated with assuaged cardio-vascular diseases, cancer, obesity, social anxieties and depressions, and finally the enhanced socio-economic profile (Brunet & Sabiston, 2011). Role of PA in healthy patterns of humans has been elaborated since the ancient times of Hippocrates (400BC). These benefits have been elaborated by researchers separately for many age groups, gender, and for people from

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all walks of life. From childhood to adolescence, it has been linked with educational achievements, mental health and social harmony (Janssen & LeBlanc, 2010). In the same vein, PA has also been of variable benefits to adults and old people bringing them chances of prolonged healthier lives (Haskell et al., 2007).

Apart from its recognized and conventional beneficial facts, a great number of population does not involve into appropriate PA to attain constant and improved lives (Fuezeki, Engeroff, & Banzer, 2017). This rising tendency in bodily inactivity not only causes the enhanced disease prevalence amongst humans but has also levied substantial economic burden, globally (Wen et al., 2011). In order to reduce this pandemic, World Health Organization has presented a worldwide action plan so as to decrease physical inoperativeness to 10% in 2025, taking it to 15% by 2030 and the enactment plans have thus been underway (Ng, Norton, & Popkin, 2009).

Witnessing a high trend of physical inactivity, the researchers, in early 2000s, turned their research directions towards its surveillance. The results have, ultimately, helped all stakeholders to devise concrete strategies and implement them in order to reduce this pandemic. Some of the standard objective measures can be noticed as accelerometers, smart phone apps, mushroom growth of fitness clubs and allied innovative technologies at local and global levels (Aaltonen et al., 2012). Macro-level determinants of physical activity such as governmental support, policy making and infrastructure are yet to be included (Sallis et al., 2016).

The pioneering work aimed towards estimation of data regarding physical inactivity at global/regional level was presented as part of Global Burden of Disease study (Misra et al., 2012). Since then, avenues have opened for such prevalence and surveillance studies. In order to include all activity realms from the people of numerous fields of life, two distinct questionnaires were devised and accepted by the WHO specifically "International Physical Activity Questionnaire" (IPAQ) and "Global Physical Activity Questionnaire" (GPAQ) (Guthold, Stevens, Riley, & Bull, 2018).

From USA, a study (Macera et al., 2005)assessed a PA behavior through questions designed to quantify the frequency of participation in PA in 82,834 adult males and 120,286 adult females. Results revealed that both male and female adults are not active at levels correlated to better health and maintenance of a quality life. A later study (Babakus & Thompson, 2012)utilized systematic mixed-methods review to assess the knowledge of level of PA among South Asian women. It was concluded that these women do not acquire an optimal level of PA for health benefits.

Another study on Taiwanese older adults conducted in an 11 year period was aimed towards assessment of a relationship between PA and cognitive performance (Ku, Stevinson, & Chen, 2012). It was concluded that an optimal level of PA lessened the chances of senility induced decline in mental cognition. Similarly, studies have been conducted on assessment of relationship of levels of PA and diabetes, and it has been confirmed that suboptimal levels of PA are major cause of diabetes in humans (Jayawardena et al., 2012; Sayeed et al., 2007).

Considering the Pakistani perspective, according to a study (Qureshi et al., 2016)81.0% did not do PA and about 50% spent were sedentary for three or more hours a day. Less than 50% of the population had a normal BMI. Therefore, detecting factors associated with participation in PA is necessary to promote PA (Gardner, Vella, & Magee,

2017). Another study (Samir, Mahmud, & Khuwaja, 2011)revealed that 72% of attendants from a health facility of Karachi, Pakistan were physically inactive. Deficiency of enthusiasm and passion, less appropriateness clubs in the expanse and family provision were a few of the aspects taken as key barriers.
The WHO suggests that adults ageing 18-64 years involve for minimum 150 minutes of the moderate-intensity PA in a week or at least 75 minutes of vigorous-strength PA or an comparable of moderate and vigorous-intensity PA to attain health assistances (Organization, 2019). Nevertheless, at least of 15 minutes of PA in a day can lessen death by 14%, possibly adding three years life (Wen et al., 2011).
Keeping the above given review in context allied with scarcity of data regarding various aspects of PA in Pakistan, the present study targets school-going children to assess levels of PA/physical fitness in them.

OBJECTIVE OF THE STUDY: To compare the power-related components of physical fitness of government and private schools
Hypotheses of study: H_a: There is a difference in power-related components of physical fitness of government and private schools. **H_0:** There is no difference in health-related components of physical fitness of government and private schools.

MATERIAL AND METHODS

Cross sectional study design was used. The study was conducted at the private and government schools (5 each) located within/outskirts of the main city of Sargodha, Pakistan.
Sargodha occupies the status of eleventh largest city of Pakistan. This duration coincides with the opening of all educational institutes of Pakistan after a long COVID-19 lock-down. The study was conducted in collaboration with/and by the consent of Punjab School Education Department and various educationists from private education sector of Sargodha. A total of ten schools (5 each from private and government sector) were earmarked and registered in the study. Male children (n=304, 152 each from private and government schools) from 9-11 years (Late childhood) of age were incorporated in the study apropos to relevant consent from parents and school administrations. Approximately 30 children were taken from each school by using convenience sampling technique. Children between the ages of 9-11 years, Children in primary level of education and children which are the residents of Sargodha were included in the study.
The rules and regulations set by the Ethical Committee of University of Lahore were followed while conducting the research and the rights of the research participants were respected.
Apropos to an approval by the Punjab School Education Department, Pakistan and relative administrative units of the schools, a written consent was taken from the parents of the children registered under this study. Furthermore, considering the personal and revealing nature of the research, all the respondents and children were ascertained that the data/results will be kept confidential. The participants were allowed to withdraw from the research at any moment.

Owing to prevailing pandemic of COVID-19, appropriate SOPs were followed as prescribed by the WHO and national government.
Physical fitness of school children was tested using the German motor performance test DMT 6-18. The German motor performance test originally included 8 tests. However, considering the status of Pakistan and the availability of tools, following four (04) power-related components were incorporated in this study: 1) Standing broad jump, 2) Push Ups, 3) Sit Ups, 4) Hand Grip.

DATA ANALYSES AND RESULTS
Data was analyzed using SPSS version 23.0. The study population (school going children) was grouped as type of institution (private and government school goers). Normality of data was ascertained through Shapiro Wilk Normality Test. Difference between private and government school-going children was deduced through Mann Whitney U test. Statistical significance was considered at $P \leq 0.05$.

Table 1: ***Comparisons of Standing broad jump of Private & Government School Going Children private (n=152) and government (n= 152)***

	Standing broad jump	
	Private	**Government**
Mean ±SD	1.1 ±0.16	1.3 ±0.19
Median±IQ Range	1.07 ±0.20	1.30 ±0.20
Shapiro-Wilk test (p-Value)	<0.001	
U** – Value	4729	
p – Value	<0.001	

*(*Significant, P≤0.05, **Mann Whitney value)*

Due to the non-normality of the we used a median as a measure of central tendency. From Table 1 it has been observed, there were 152 private school students with Mean ± SD is 1.1± 0.16, Inter quartile range 0.20 median of 1.07 for standing broad jump and 152 government school students with Mean ± SD is 1.3± 0.19, Inter quartile range 0.20 the Median of 1.30 for standing broad jump, over all Mann-Whitney U = 4729, (p <0.05); Mann Whitney U test was used to compare the standing broad jump) of private and government school going children. There were statistically significant differences between standing broad jump) of Private and government schools' student.

Table 2: ***Comparisons of Push Ups in 40 seconds of Private & Government School Going Children private (n=152) and government (n= 152)***

	Pushups in 40 sec	
	Private	**Government**
Mean ±SD	12.2 ±6.54	16.5 ±7.8
Median±IQ Range	11.00±8.75	14.00±10.75
Shapiro-Wilk test (p-Value)	<0.001	
U** – Value	7607.50	
p – Value	<0.001	

*(*Significant, P≤0.05, **Mann Whitney value)*

Due to the non-normality of the data, we used a median as a measure of central tendency. From Table 2 it has been observed that there were 152 private school students with Mean±SD 12.2±6.54, Inter quartile range 8.75 median of 11.00 for Pushups in 40 sec and 152 government school students with Mean ±SD 16.5±7.8, Inter quartile range 10.75 the median of 14.00 for Pushups in 40 sec, over all Mann-Whitney U =7607.5, (p <0.05). There were statistically significant differences between Pushups in 40 of Private and government school's student.

Table 3: ***Comparisons of Sit Ups in 40 seconds of Private & Government School Going Children private (n=152) and government (n= 152)***

	Sit ups in 40 sec	
	Private	**Government**
Mean ±SD	22.2 ±7.35	25.1 ±5.64
Median±IQ Range	23.00 ±7.00	25.00 ±8.00
Shapiro-Wilk test (p-Value)	<0.001	
U** – Value	9312	

p – Value	0.003

*(*Significant, P≤0.05, **Mann Whitney value)*

Due to the non-normality of the data, we used a median as a measure of central tendency. From Table 14.We observed that There were 152 private school students with Mean ±SD 22.2±7.35, Inter quartile range 7.00 median of 23.00 for Sit ups in 40 sec and 152 government school students with Mean ±SD 25.1±5.64, Inter quartile range 8.00 the median of 25.00 for Sit ups in 40 sec, over all Mann-Whitney U =9312, (p <0.05); Mann Whitney U test was used to compare the Sit ups in 40 sec of private and government school going children. There were statistically significant differences between Sit ups in 40 sec of Private and government school's student.

Table 4: ***Comparisons of Hand Grip Test of Private & Government School Going Children private (n=152) and government (n= 152)***

	Hand grip test	
	Private	**Government**
Mean ±SD	20.01±3.78	17.01±3.73
Median±IQ Range	19.42±5.83	16.42±5.82
Shapiro-Wilk test (p-Value)	0.002	
U^{**} – Value	6394.50	
p – Value	<0.001	

*(*Significant, P≤0.05, **Mann Whitney value)*

Due to the non-normality of the data, we used a median as a measure of central tendency. From Table 16. We observed that there were 152 private school students with Mean±SD is 20.01±3.78, Inter quartile range 5.83 median of 5.82 for Hand grip test left hand and 152 government school students with Mean ± SD is 17.01±3.73, Inter quartile range 5.82 the median of 16.42 for Hand grip test left-hand, over-all Mann-Whitney U =6394.50, (p <0.05). Mann Whitney U test was used to compare the Hand grip Test of private and government school going children. There were statistically significant differences between Hand grip Test of Private and government school's student.

DISCUSSION

Any nations or a society's vital segment is its school-going children whose mental and physical development is attained through a multitude of factors such as environment and nutrition. Their growing phase and enhancing gradual mental/cognitive perception require optimal level of PA and resultantly a sound health and physical fitness. Globally, extensive studies have been carried out and reported regarding the level of physical fitness in school-going children and their association with various socioeconomic factors. However, to the best of knowledge, there is a paucity of such literature from Pakistan.

According to Economic Survey of Pakistan- 2020-21, at a national level, the enrollment of students has seen an increase of 1.1% for pre-primary education, 2.9% for primary school education, 3.7% for middle education, 2.8% for secondary/high school education, and 2.8% for higher secondary education with a grand total of 55.2 million school enrollments. And in the years to come by, the government of Pakistan aims to enhance the ratio of school enrollments by another 5% in the subsequent year. Considering the lack of research work related to physical fitness and its determinants in Pakistani school-going children, the present study was conducted with an aim to ascertain physical fitness levels (tests for endurance, coordination, flexibility, speed and strength) and anthropometric attributes (height, weight and BMI) among children of private and government schools, and to correlate them with various socioeconomic attributes (father's education, father's income, father's occupation and socioeconomic class).The duration of this study coincides with the opening of all educational institutes of Pakistan after a long COVID-19 lock-down.

The results of this study provide a baseline data both for the government and other stakeholders to strengthen their policies towards better health status of school staff and children. Assuring the optimal physical fitness level in school-goers will result ultimately in better achievements in global sports activities. Discussion presented ahead may be received in the context that this study was conducted immediately after opening of school's post-pandemic lockdown in Pakistan.

The present study included tests for endurance, coordination, flexibility, speed and strength for private and government school-going children to assess bodily fitness. All studied attributes of the present study were significantly different between private and government school-going children except for balance test. Results revealed that aerobic endurance (590±11.8 meters), flexibility (8.7±0.1 inches) and muscular strength endurance in terms of strength (1.3±0.01 meters), push-ups (16.5±0.6) and sit-ups (25.1±0.4) were higher for government school-goers as compared to their counterpart private school-going children. However, speed (6.8±0.05 seconds), left hand grip (20.3±0.3 kg) and right-hand grip (19.7±0.3 kg) were higher for private school goers.

Excessive work has been reported globally to address the issue of devising valid, authentic and repeatable parameters to assess physical fitness in various age populations. An organic and a motor component are normally incorporated for assessing physical fitness. The organic part consists of adaptation/recovery from strenuous exercise whereas the motor part includes development/performance of gross motor abilities(Vanhees et al., 2005). Health-related physical fitness includes cardio respiratory endurance, body composition, muscular strength and flexibility.

Performance-related fitness refers to the abilities associated with adequate athletic performance, and encompasses components such as isometric strength, power, speed–agility, balance and arm–eye co-ordination as consolidated in previous studies(Butte, Ekelund, & Westerterp, 2012; Cadenas-Sanchez et al., 2016).

These results of the present study in general, underline that government school-goers had far better results of physical fitness attributes as compared to private school-goers as shown earlier (Samir et al., 2011). Similar results have been reported in a previous study conducted on bodily fitness among students of rural and urban Lahore, Pakistan which has demonstrated that the push-up test, touch-toe test, flexibility and strength revealed better results for rural students as compared to urban ones (Mahmood, Mujahid, Mahmood, Tariq, & Salam, 2018). Inactivity, lethargic lifestyles, unhealthy dietary patterns and resultant PI in urban population results in obesity and obesity-related non-communicable diseases as affirmed through prior global studies (Gardner et al., 2017; Ramachandran, Chamukuttan, Shetty, Arun, & Susairaj, 2012; Rasinaho, Hirvensalo, Leinonen, Lintunen, & Rantanen, 2007; Sullivan & Lachman, 2017). Our results are also in line with those from other countries/regions of the world such as India (Bishwajit et al., 2017), Thailand (Lee et al., 2012) and Eastern Asia and Europe (Kahan, 2015), A 69% PI has been reported for urban populations as compared to 31% for rural communities of India (Rizwan, Khan, Farooq, Khalid, & Ahmad). While comparing Egyptian and German children in a study, it was reported that strength, coordination and endurance were far better in German children as compared to their Egyptian counterparts(Karim et al., 2015). Environmental conditions, socioeconomic profiles, and PA as core courses in curricula of German schools were deputed as the cause. The results similar to ours have also been mentioned in Egyptian (Abdelkarim, Ammar, Soliman, & Hökelmann, 2017) and Malaysian study (Aboshkair, Amri, Yee, & Samah, 2012). The results on physical fitness attributes of the present study will be discussed ahead in correlation to the socioeconomic determinants/factors which were incorporated in the present study for analyses.

CONCLUSION

The present study was conducted with an aim to compare the power-related components (Standing broad jump, Push Ups, Sit Ups, and Hand Grip) of physical fitness of government and private schools' children. Cross sectional study design was used for time span of 18 months. The study was conducted on male children (n=304, 152 each from private and government schools) located within/outskirts of the main city of Sargodha, Pakistan. Total ten schools (5 each from private and government sector) were earmarked and registered in the study. Convenience sampling technique was used. Children between the ages of 9-11 years, Children in primary level of education and children which are the residents of Sargodha were included in the study. There were statistically significant differences between Standing broad jump, Push Ups, Sit Ups, Hand Grip of Private and Government schools' students Finally, it was concluded that the power-related components of physical fitness of government school children is better than the private schools' children except hand grip.

REFERENCES

Aaltonen, S., Leskinen, T., Morris, T., Alen, M., Kaprio, J., Liukkonen, J., & Kujala, U. (2012). Motives for and barriers to physical activity in twin pairs discordant for leisure time physical activity for 30 years. *Int J Sports Med, 33*(02), 157-163.

Abdelkarim, O., Ammar, A., Soliman, A. M., & Hökelmann, A. (2017). Prevalence of overweight and obesity associated with the levels of physical fitness among primary school age children in Assiut city. *Egyptian Pediatric Association Gazette, 65*(2), 43-48.

Aboshkair, K. A., Amri, S. B., Yee, K. L., & Samah, B. B. A. (2012). Factors affecting levels of health-related physical fitness in secondary school students in Selangor, Malaysia. *Journal of Basic & Applied Sciences, 8*(1).

Babakus, W. S., & Thompson, J. L. (2012). Physical activity among South Asian women: a systematic, mixed-methods review. *International journal of behavioral nutrition and physical activity, 9*(1), 150.

Bishwajit, G., O'Leary, D. P., Ghosh, S., Yaya, S., Shangfeng, T., & Feng, Z. (2017). Physical inactivity and self-reported depression among middle-and older-aged population in South Asia: World health survey. *BMC geriatrics, 17*(1), 100.

Brunet, J., & Sabiston, C. M. (2011). Exploring motivation for physical activity across the adult lifespan. *Psychology of sport and exercise, 12*(2), 99-105.

Butte, N. F., Ekelund, U., & Westerterp, K. R. (2012). Assessing physical activity using wearable monitors: measures of physical activity. *Med Sci Sports Exerc, 44*(1 Suppl 1), S5-12.

Cadenas-Sanchez, C., Martinez-Tellez, B., Sanchez-Delgado, G., Mora-Gonzalez, J., Castro-Piñero, J., Löf, M., . . . Ortega, F. B. (2016). Assessing physical fitness in preschool children: Feasibility, reliability and practical recommendations for the PREFIT battery. *Journal of science and medicine in sport, 19*(11), 910-915.

Fuezeki, E., Engeroff, T., & Banzer, W. (2017). Health benefits of light-intensity physical activity: a systematic review of accelerometer data of the National Health and Nutrition Examination Survey (NHANES). *Sports medicine, 47*(9), 1769-1793.

Gardner, L. A., Vella, S. A., & Magee, C. A. (2017). Continued participation in youth sports: the role of achievement motivation. *Journal of applied sport psychology, 29*(1), 17-31.

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1· 9 million participants. *The Lancet Global Health, 6*(10), e1077-e1086.

Haskell, W. L., Lee, I.-M., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., . . . Bauman, A. (2007). Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Medicine & science in sports & exercise, 39*(8), 1423-1434.

Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International journal of behavioral nutrition and physical activity, 7*(1), 40.

Jayawardena, R., Ranasinghe, P., Byrne, N. M., Soares, M. J., Katulanda, P., & Hills, A. P. (2012). Prevalence and trends of the diabetes epidemic in South Asia: a systematic review and meta-analysis. *BMC public health, 12*(1), 1-11.

Kahan, D. (2015). Adult physical inactivity prevalence in the Muslim world: Analysis of 38 countries. *Preventive medicine reports, 2*, 71-75.

Karim, O. A., Ammar, A., Chtourou, H., Wagner, M., Schlenker, L., Parish, A., . . . Bös, K. (2015). A comparative study of physical fitness among Egyptian and German children aged between 6 and 10 years. *Advances in Physical Education, 5*(1), 7-17.

Ku, P.-W., Stevinson, C., & Chen, L.-J. (2012). Prospective associations between leisure-time physical activity and cognitive performance among older adults across an 11-year period. *Journal of Epidemiology, 22*(3), 230-237.

Lee, I.-M., Shiroma, E. J., Lobelo, F., Puska, P., Blair, S. N., Katzmarzyk, P. T., & Group, L. P. A. S. W. (2012). Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *The Lancet, 380*(9838), 219-229.

Macera, C. A., Ham, S. A., Yore, M. M., Jones, D. A., Kimsey, C. D., Kohl III, H. W., & Ainsworth III, B. E. (2005). PEER REVIEWED: Prevalence of Physical Activity in the United States: Behavioral Risk Factor Surveillance System, 2001. *Preventing chronic disease, 2*(2).

Mahmood, T., Mujahid, Z., Mahmood, W., Tariq, K., & Salam, A. (2018). Comparison of Physical Fitness Between Rural and Urban Physical Therapy Students Studying in Lahore, Pakistan. *Annals of Punjab Medical College, 12*(2), 112-116.

Misra, A., Nigam, P., Hills, A. P., Chadha, D. S., Sharma, V., Deepak, K., . . . Khanna, K. (2012). Consensus physical activity guidelines for Asian Indians. *Diabetes technology & therapeutics, 14*(1), 83-98.

Ng, S. W., Norton, E. C., & Popkin, B. M. (2009). Why have physical activity levels declined among Chinese adults? Findings from the 1991–2006 China Health and Nutrition Surveys. *Soc Sci Med, 68*(7), 1305-1314.

Organization, W. H. (2019). *Global action plan on physical activity 2018-2030: more active people for a healthier world*: World Health Organization.

Qureshi, A. I., Palesch, Y. Y., Barsan, W. G., Hanley, D. F., Hsu, C. Y., Martin, R. L., . . . Suarez, J. I. (2016). Intensive blood-pressure lowering in patients with acute cerebral hemorrhage. *New England Journal of Medicine, 375*(11), 1033-1043.

Ramachandran, A., Chamukuttan, S., Shetty, S. A., Arun, N., & Susairaj, P. (2012). Obesity in Asia–is it different from rest of the world. *Diabetes Metab Res Rev, 28*, 47-51.

Rasinaho, M., Hirvensalo, M., Leinonen, R., Lintunen, T., & Rantanen, T. (2007). Motives for and barriers to physical activity among older adults with mobility limitations. *Journal of aging and physical activity, 15*(1), 90-102.

Rizwan, B., Khan, M. A., Farooq, S., Khalid, S., & Ahmad, B. Prevalence of Physical Inactivity Among The Students of University Institute of Diet and Nutritional Sciences, University of Lahore.

Sallis, J. F., Bull, F., Guthold, R., Heath, G. W., Inoue, S., Kelly, P., . . . Hallal, P. C. (2016). Progress in physical activity over the Olympic quadrennium. *The Lancet, 388*(10051), 1325-1336.

Samir, N., Mahmud, S., & Khuwaja, A. K. (2011). Prevalence of physical inactivity and barriers to physical activity among obese attendants at a community health-care center in Karachi, Pakistan. *BMC Res Notes, 4*(1), 174.

Sayeed, M., Mahtab, H., Khanam, P., Latif, Z., Banu, A., & Khan, A. (2007). Prevalence of diabetes and impaired fasting glucose in urban population of Bangladesh. *Bangladesh Medical Research Council Bulletin, 33*(1), 1.

Sullivan, A. N., & Lachman, M. E. (2017). Behavior change with fitness technology in sedentary adults: a review of the evidence for increasing physical activity. *Frontiers in Public Health, 4*, 289.

Vanhees, L., Lefevre, J., Philippaerts, R., Martens, M., Huygens, W., Troosters, T., & Beunen, G. (2005). How to assess physical activity? How to assess physical fitness? *European Journal of Preventive Cardiology, 12*(2), 102-114.

Wen, C. P., Wai, J. P. M., Tsai, M. K., Yang, Y. C., Cheng, T. Y. D., Lee, M.-C., . . . Wu, X. (2011). Minimum amount of physical activity for reduced mortality and extended life expectancy: a prospective cohort study. *The Lancet, 378*(9798), 1244-1253.