

A Field Study to Assess Physical Activity Levels During Weekdays Among Students in the First Cycle and its Relationship with Lower Limb Muscle Strength

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Abstract:

This study aimed to assess physical activity levels during 3 school days among first cycle students and its relationship with lower limb muscle strength. Twenty-eight students from the Governor of Muscat were participated in this study, (age: 11.8 ± 0.3 years, height: 9.0 ± 148 cm, mass Body: 14.5 ± 34.8 kg, BMI: 5.3 ± 19.2 kg.m⁻² To assess physical activity levels, the ActiGraph GT3X device was used for 3 school days during the week (from 8:00 am to 12:00 pm, daily). All participating performed two tests of lower limb muscle strength (CMJ - FCM). Study results showed that the average physical activity levels of students during 3 school days were (455.9 ± 56.7 minutes) and (26.3 ± 6.6 minutes) for both sedentary physical behavior (SPA) and high-intensity physical activity (VPA), respectively. The results also revealed that the level of moderate and vigorous physical activity level (MVPA) during 3 days of school reached (67.9 ± 17.01 minutes), which is approximately (22.6 minutes per day), meaning that there was a noticeable decrease in the levels of physical activity practiced during school days (3 days). per week for first cycle students. The results also showed that there was no relationship between all physical activity levels (SPA, LPA, MPA, VPA, MVPA) and lower limb muscle strength tests (CMJ - FCM) among the students ($0.05 < p$).

Keywords: Moderate and vigorous physical activity, accelerometer, Muscular power, children and adolescents.

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introduction:

Physical activity is an important part of a healthy lifestyle for all people, as it helps improve general health, physical and muscular fitness, as the world today is witnessing an increasing interest in physical activity and confronting the lack of physical activity and the phenomenon of inactive physical activity that leads to obesity. Obesity is one of the most prominent health challenges. Which confronts individuals in various parts of the world, and its danger is noticeably exacerbated in Gulf societies, especially Omani society. This is mainly due to the tremendous technological development witnessed by these societies, which has led to the spread of the phenomenon of physical inactivity, lifestyle changes, and unhealthy eating habits. Statistics from the Omani Ministry of Health reported that more than 50% of the population suffers from obesity, as a result of increasing reliance on modern technology and excessive consumption of fast food. Which contributed to the spread of the phenomena of lack of movement and physical inactivity, and thus low levels of physical activity (2020, Ministry of Health).

To confront this challenge, society requires urgent action to educate individuals about the importance of changing their lifestyle and motivate them to engage in sports activity regularly. Awareness about the health risks associated with lack of physical activity should also be promoted. Fitness programs must also be supported and environments that encourage physical activity must be provided, whether in schools or public places, as well as their availability near residential neighborhoods to encourage children and adults to practice sports activity.

Today, the world is also witnessing a growing interest in physical activity and its impact on health and fitness. Regular assessment of physical activity level is crucial, especially for students. Regular exercise helps maintain health-related physical fitness indicators, in addition to supporting healthy development in children. Physical activity also provides social, healthy, physical, emotional and mental interaction, which contributes to building an integrated personality. In addition, practicing physical activity regularly helps develop vital and motor capabilities and improve cardiovascular and respiratory functions, in addition to raising the functional capabilities of the body. It also contributes to increasing motor performance and coordinating the normal basic movements that the individual performs during his day (Al-Sharif, 2013).

Many international and national health organizations, including the World Health Organization, have reported that the quality of life and overall health of children and adolescents can be improved by engaging in moderate physical activity on most days of the week. Physical activity maintains the functions of the body's organs, enhances social belonging and integration, and reduces feelings of anxiety and depression, especially among students pursuing their education. The World Health Organization (W.H.O.) has defined physical activity as: “any physical movement undertaken by skeletal muscles that requires the consumption of a certain amount of energy, including activities undertaken during work, play, household tasks, travel and recreational activities” (Paul F. C., et al. , 2020). (2014, Mamish et al.) point out that physical activity is a set of daily movements produced by skeletal muscles that lead to the expenditure of energy, including exercise. Regular physical activity is associated with a lower risk of cardiovascular disease, osteoporosis, obesity, diabetes, high blood pressure, anxiety, stress, and depression (Ibrahim: 2011).

The Ministry of Health (2008) in the Kingdom of Saudi Arabia also indicated the need to link the concept of public health and physical fitness. This is because there is a relationship between the various components of physical fitness and health, and practicing physical activity on a regular basis has a close relationship with reducing the risk of developing many cardiovascular and respiratory diseases and psychological disorders, and it also contributes to improving psychological aspects and overcoming the stresses of daily life (Imad et al. , 2019).

Therefore, the World Health Organization (2020) recommends that children and adolescents aged 5 to 17 years engage in at least 60 minutes per day of moderate to vigorous physical activity; Most of this activity should be aerobic exercise, in addition to focusing on and practicing high-intensity aerobic activities that strengthen muscles and bones at least 3 days a week.

Research problem:

The topic of physical activity and its positive impact on health and fitness is of increasing importance worldwide. Assessing children and young people's daily physical activity, especially students, is crucial due to its role in maintaining physical fitness and supporting healthy development. However, studies have indicated a widespread phenomenon of lack of movement among school students, which may lead to negative health effects. Therefore, there is a need to study the reality of daily and weekly physical activity levels among school students, and analyze the relationship with physical fitness components such as muscular ability, with the aim of developing programs and policies that encourage an active and healthy lifestyle. . (Ali et al., 2017)

Appreciating physical activity during weekdays is crucial, especially for students who are continuing their education. Regular physical activity is also necessary to maintain physical fitness, as it reduces risk factors for the emergence of cardiovascular diseases, diabetes, and obesity. A study (Patrick et al. 2012) indicated that lack of movement leads to a decrease in physical fitness components. Therefore, it is necessary to know the amount of physical activity practiced during school days. Measuring the amounts of physical activity practiced by students at an early age is an essential stage to detect this activity and take the necessary measures to increase it to maintain the individual's general fitness (Mota et al., 2003). This is in addition to the necessity of studying the nature of the relationship between physical activity and the elements of physical fitness, which helps in choosing the appropriate activities to maintain and develop these elements. Achieving the right balance between physical activity and successful study requires a careful assessment of the extent to which physical activity affects the muscular capacity of the lower extremities.

It should be noted that many previous studies have dealt with measuring physical activity using tools and devices that have poor reliability and validity, especially with younger age groups, such as the polar device, observation, questionnaires, and self-interviews (Francis, 2003). . What distinguishes the current study is the use of an accelerometer, which is one of the most reliable field devices for measuring physical activity, as it occupies a large space in scientific research applications in children and adolescents. It measures body movements in terms of acceleration, which can later be used to determine the number of activities and thus estimate an individual's physical activity (Troiano, 2005).

research aims:

The current study aims to achieve the following:

1. Identify the level of physical activity of female students during the three school days.
2. Identify the nature of the relationship between physical activity and lower limb muscular ability testing (CMJ - FCM).

research assumes:

1. There are no statistically significant differences in the activity and amount of physical activity estimated for female students during 3 school days
2. There is a relationship between physical activity and lower extremity muscular ability testing (CMJ - FCM).

Terminology of study:**Physical activity:**

The World Health Organization (2020) defines physical activity as any physical movement performed by skeletal muscles that requires the consumption of a certain amount of energy, including activities undertaken during work, play, performing household tasks, traveling, and engaging in recreational activities.

First cycle: Primary stage/Foundation stage

This stage includes grades one to six, and aims to provide a rich educational environment that encourages students to learn and helps them at the beginning of their academic journey.

Study variables:

Independent variable: lower extremity muscular ability test (CMJ - FCM).

Dependent variable: The amount of physical activity practiced by female students during 5 days a week of official work.

Study Approach:

The researchers used the descriptive correlational approach, which is one of the types of descriptive methods that measures the relationship between variables (dependent and independent), determines the type of relationship (positive or negative), and then predicts the level of importance in a quantitative manner. Form.

Study population:

Study population: Female students of Sheikh Nasser Al Kharousi School in Al Mawaleh, Muscat Governorate, Sultanate of Oman for the academic year (2021-2022 AD).

The study sample:

The study was applied to a purposive sample of students from Sheikh Nasser Al Kharousi School in Al Mawaleh (Muscat Governorate - Sultanate of Oman), numbering (38) students. (10) of them were excluded for not completing the measurements, so that the final size of the study sample was (28) students. Table No. (1) contains age and physical measurements.

(Table 1) Arithmetic means, standard deviations (mean $\pm$ standard deviation), and normal distribution for age, anthropometric measurements, and muscular ability of the lower limbs for the study sample (n = 28)

m	variable	n= 18	Normal distribution
1.	age	0.3 $\pm$ 11.8	0.469
2.	tall	9.0 $\pm$ 148*	0.893
3.	Length of lower limbs (cm)	8.0 $\pm$ 79*	0.786
4.	Body mass (kg)	13.5 $\pm$ 43.4	0.527
5.	Body mass index (kg/m2)	5.3 $\pm$ 19.2	0.982
6.	CMJ (cm)	4.0 $\pm$ 22.8*	0.192
7.	FCMJ (cm)	5.5 $\pm$ 27.6*	0.872

*: There are statistically significant differences ($0.05 \geq p$)

Table (1) shows a description of the study sample in terms of the variables of age, height, length of the lower limbs, body mass, body mass index, and muscular capacity of the lower limbs.

The results were presented in the form of means and standard deviations after the normal distribution of all variables in the sample was verified and confirmed using the Kolmogorov-Smirnov test as specified in the table. The test results showed a normal distribution for all variables.

Data collection tools and means:

First: - Forms: -

- Records of the educational institution for the sample under study.
- A data collection form to record data for female students.

Second: The devices and tools used.

- Cones.
- Stop Watch.
- Metric tape to measure distance traveled.
- A rectameter device for measuring length.
- Tanita device for measuring weight.
- Optojump device to measure the height of the vertical jump.
- ActiGraph GT3X accelerometer.

Third: The tests used.

- Counter movement jump test (CMJ)
- Free countermovement jump: FCM test. (2011, Argus et al)

Scientific coefficients for tests (CMJ CM - FCM CM)

A - Reliability: The researchers applied scientific parameters to the exploratory study sample by applying tests and then re-applying them again after a period of time of one week from the first application. Table (2) shows the reliability factor.

Table (2) Reliability coefficients for tests (CMJ cm – FCM cm)

Variables	Application	Re-application	Sig.	Stability coefficient (ICC)	Confidence %95
CMJ (cm)	4.39±21.09	3.26±22.55	0.408	0.769	0.071–0.943
FCM (cm)	4.39±21.09	3.26±22.55	0.408	0.769	0.071–0.943

Study procedures:

First: Administrative procedures

- Obtaining a request to facilitate a secondment from Sultan Qaboos University to the General Administration of Private and Continuing Education and the Ministry of Education.
- Obtaining the approval of the school and obtaining the approval of the students and their parents to participate in the study.
- Preparing a form for recording measurements, test results, and lists of students' names.

Second: Executive procedures

After obtaining approvals, the researchers conducted a reconnaissance visit and field visits to collect data and provide the necessary facilities to implement the study.

a. Exploratory visit

During the exploratory visit, the researchers did the following:

- Coordinating with the school administration and teachers interested in the study by setting a date and mechanism for implementing the study.
- Identify the challenges that may occur during implementation.

The places where the study will be conducted (indoor gyms) have been identified.

- Talking to the students (sample members) and instilling familiarity in them so that they can wear the device with complete reassurance and comfort.
- Familiarize students with the tests that will be applied.

B. Field tests

The researchers implemented the study during the period from 3/2/2022 to 4/13/2022 AD, where the procedures were divided into basic visits:

- First visit: Anthropometric measurements (height, lower limb length, body mass, body mass index) were performed for all students participating in the study.
- Second visit: Application of lower extremity ability tests (CMJ, FCMJ).
- Subsequent visits: The amount of physical activity was calculated by installing an accelerometer (ActiGraph GT3X) on the sample during (5) days a week during school hours. A triaxial accelerometer measuring three planes: vertical, medial, and anteroposterior was used to determine the amount of physical activity undertaken 5 days per week during school hours. The study sample (female students) was asked to place the accelerometer on the right side of the waist in the morning after the end of the school queue at 8:00 am and to take it off before the end of the school day at 12:00 noon.

It is a scale that measures the movement of a body in terms of acceleration. It is considered a safe and light tool, as the weight of the device reaches 27 grams and its dimensions are 1.8 x 3.7 x 3.8 cm. Therefore, it does not represent the burden or sensitivity caused by wearing clothes. It can detect acceleration in the range of 2.0-0.05 g with a frequency response between 2.5-0.25 Hz and has a storage capacity of 1 MB (Trost et al., 2011).

The engine acceleration was timed to record the number of movements for one second “Epoch”. Raw physical activity data from ActiGraph GT3X kinematic accelerometers were downloaded to a computer via ActiGraph 3.2 software. The acceleration time was set to 15 seconds (“squeezing”). The data was then filtered and only 3 days of data were selected for each individual from the study sample out of 5 days due to the lack of all necessary data, as indicated by several studies Zimmo et al. (2017) found that 3 days of data is sufficient to determine the amount of physical activity.

ActiGraph Analysis Tool v3.00 software was used for statistical analysis at each level of physical activity using the cut-off points defined by (Romanzini et al. 2014):

Table 3 Cut-off points for physical activity in children and adolescents according to (Romanzini et al 2014)

m	level Physical activity	Cut off points	
		Grand	Minor
1.	Sedentary (SPA)	720	0
2.	Light (LPA)	3027	721
3.	Moderate (MPA)	4447	3028
4.	Severely Vigorous (VPA)	≥ 4448	

Statistical methods and treatments:

The researchers used the Statistical Package for the Social Sciences (IBM SPSS Statistics 21) program to process the study data:

- Verify the normal distribution of all measurements using the Kolmogorov-Smirnov test.
- Displaying the results in the form of the arithmetic mean and standard deviation (Mean $\pm$ Standard Deviation) for the characteristics of the sample and the dependent variables in the case of a normal distribution of the variables.
- Pearson correlation coefficient to study the nature of the relationship between the amount of physical activity practiced and the test of “muscular capacity of the lower extremities (CMJ - FCM).”
- ICC (Intraclass Correlation Coefficient) to study the reliability of the “Muscular Power of the Lower Limbs (CMJ - FCM)” test.

Show results:

Table (4) Arithmetic means, standard deviations, and normal distribution of physical activity levels for female students during 3 days a week of school hours (n = 28)

m	Activity (dq)	normal	Normal distribution
1.	SPA	56.7 ± 455.9	0.954
2.	LPA	49.5 ± 193.2	0.980
3.	MPA	13.3 ± 41.7	0.824
4.	VPA	6.6 ± 26.3	0.922
5.	MVPA	17.01 ± 67.9	0.919

It is clear from Table (4) that the arithmetic mean of the physical activity levels of female students during the 3 school days ranged between (455.9 and 26.3 minutes) for all levels, and the largest share was for the level of inactivity (SPA) (56.7 ± 455.9 minutes). In contrast, the level of intense physical activity was the lowest (6.6±26.3 minutes). The results also showed that the level of moderate and vigorous physical activity (MVPA) during 3 official working days reached (17.01±67.9 minutes), which is approximately (22.6 minutes) per day.

Table (5) The relationship between physical activity practiced during the 3 days of the week during school and the test Muscular ability of the lower limbs (n=28)

the test	SPA	LPA	MPA	VPA	MVPA
CMJ	r=-0.250 p=0.333	r= 0.224 p= 0.387	r= 0.087 p= 0.739	r= 0.271 p=0.293	r= 0.172 p=0.510
FCMJ	r= -0.175 p= 0.502	r= 0.226 p= 0.383	r= -0.121 p= 0.644	r= 0.059 p=0.824	r=-0.074 p=0.778

r: correlation coefficient

P: statistical significance

It is clear from Table (4) that there is no relationship between activity levels

Physical ability and lower extremity tests (CMJ, FCMJ) among female students (P < 0.05).

Discuss the results

It is clear from Table (4) that the arithmetic averages of the physical activity levels of female students during the 3 school days ranged between (455.9 and 26.3 minutes) for all levels, and the largest share was for the level of inactivity (SPA) (56.7 ± 455.9 minutes). In contrast, the level of intense physical activity was the lowest (6.6±26.3 minutes). The results also showed that the level of moderate and vigorous physical activity (MVPA) during 3 official working days reached (17.01±67.9 minutes), which is approximately (22.6 minutes) per day.

The results indicate that the level of physical activity among female students was low in general, and that the average daily inactivity time (practicing almost any physical activity) for female students was very high compared to other levels, while the level of vigorous activity was the lowest average. The researchers also found that the average time female students spent in moderate and vigorous physical activities was about 22.6 minutes per day. This is very low compared to global recommendations for at least 60 minutes of moderate

to vigorous physical activity per day for children and adolescents (World Health Organization, 2020).

The results of the current study regarding the level of moderate and vigorous physical activity (22.6 minutes) agreed with the study (2017, Zimmo et al.) in which they measured physical activity during school hours for Qatari children for 5 days during the week. . They found that the average moderate and vigorous physical activity was (13.5±28.2 minutes) per day, which is less than the internationally recommended minimum. It is also consistent with a study (2019, Al-Juhani et al.) conducted on middle school students in the Kingdom of Saudi Arabia, the results of which showed a decrease in overall physical activity levels with an increase in sedentary behavior. The results also agreed with the study (Al-Khawaja et al., 2002), which showed weak adherence to physical activity recommendations among children.

While a study (2003, Mota et al.) indicated that the average time that children spend in moderate and vigorous physical activity is about (138 minutes) per day, which is more than twice the recommended period. It is worth noting that in this study, moderate and vigorous physical activity was measured throughout the day (from 9 a.m. to 9 p.m.) and was not limited to working hours as in our study. It was commented that males were more active in the after-school period, which could explain the current result.

As for sedentary activity, in a study (2017, Zimmo et al.) it reached 8.4±58.1 minutes, which is a much shorter period than the result of the current study (152 minutes) per day, which calls for a reconsideration of quantity and quality. Proposed movement and sports programs and activities within the school. .

The researchers believe that the current results indicate that female students spent a significant amount of time at school in physically sedentary activities, and therefore did not achieve the recommended amount for achieving and maintaining good health. This requires reviewing school programs to increase the opportunities and types of sports and activities. To encourage movement and physical activity. Low levels of physical activity have negative health consequences for children. Therefore, this study calls for increasing awareness of the importance of practicing sports and physical activities regularly among school students. This is done by encouraging them and providing the appropriate supportive environment for this. Biddle et al (2019) assert that physical activity has many benefits for the physical and mental health of children and adolescents.

It is clear from Table (5) that there is no relationship between all levels of physical activity and lower extremity ability tests (CMJ, FCMJ) in students ($P < 0.05$) in all cases. The results indicated a relationship between different levels of physical activity (SPA, LPA), MPA, VPA, MVPA), which the students practiced during 3 school days, and between two tests of the muscular ability of the lower limbs, which are the vertical jump test from stability (CMJ) and the compound vertical jump test (FCMJ).

The values of correlation coefficients with physical activity levels for the results of the vertical jump stability test (CMJ) ranged between ($r = 0.250$) with SPA and ($r = 0.271$) with VPA. Therefore, none of these values reached the level of statistical significance, as all values were ($0.05 < p$), and therefore there is no statistically significant relationship between physical activity levels and CMJ test performance within this sample.

The results of the combined vertical jump (FCMJ) test indicate that the correlation coefficients with physical activity levels ranged between ($r = 0.175$) w

From the presentation of the previous results, the researchers see that in terms of the strength of the correlation, the correlation coefficients between levels of physical activity and the CMJ test ranged between (-0.250 for SPA, 0.271 for VPA). This indicates a slight trend toward a negative relationship between very light physical activity and muscular ability, while high-intensity activity tends to have a weak positive relationship. While in the FCMJ test it ranged between (-0.175 for SPA, 0.226 for LPA), which indicates that there is no clear trend towards a relationship between physical activity levels and this test.

Statistical significance indicates that the highest value was ($p = 0.293$) for the relationship between VPA and the (CMJ) test, while the rest of the values are not statistically significant at the level of $\alpha \geq 0.05$. The researchers confirm that although there was a slight trend of positive correlation between some levels of physical activities (LPA, VPA, MVPA) and the two tests, the statistical relationship was not statistically significant at the significance level ($0.05 < p$).

This study agreed with the study of Wang et al (2013), which indicated that there is no statistically significant relationship between levels of physical activity and some components of physical fitness, such as muscular strength and cyclic respiratory endurance. It also agreed with the study (2020, Abdel Karim et al.), which found no relationship between levels of physical activity and fitness in children. It also agreed with the study (Howe et al, 2015), which did not find a relationship between physical activity during the school day and grip strength in children.

While the results of this study differed from the study (Al-Saadi et al., 2019), which indicates that there is a relationship between intense activity and muscular ability among students; Physical activity was positively associated with the muscular ability of the lower limbs of the body. It also did not agree with the study of Al-Rabiah and Al-Hayek (2010), which showed a positive and statistically significant correlation between the level of moderate and high-intensity physical activity and the level of physical fitness in a sample of schools. students. He also disagreed with the study (2003, Motta et al.) which showed a relationship between daily physical activity and some physical fitness indicators.

He also disagreed with a study (2019, Larouche. et al) that found a positive relationship between high-intensity sports activities and arm and shoulder muscle strength in adolescents. He also disagreed with the study (2014, Smith et al.) which showed a statistically significant relationship between average daily walking steps and physical fitness rates in children.

While this study did not show a relationship with the muscular ability of the lower limbs. The lack of a relationship may be due to the small sample size of 28 female students compared to other studies, which reduces the ability to detect statistical relationships. It is also noted that the current study only focused on 3 days a week. Including the rest of the days of the week may be useful to obtain a more comprehensive picture of weekly physical activity and its relationship to the components of fitness. In addition, the study only focuses on testing muscular endurance in the lower extremities. It may be useful to add other tests to evaluate different aspects of strength and muscular endurance, to obtain more comprehensive results about the relationship to physical activity.

Conclusions:

Through the results reached by the researchers, the following was reached:

- A noticeable decrease in the levels of physical activity among female students during school hours.

The results of the current study did not show a statistically significant relationship between the levels of physical activity (SPA, LPA, MPA, VPA, MVPA) practiced by the study sample of students and the two muscular ability tests (CMJ and FCMJ).

There is a noticeable decrease in the levels of physical activity practiced during school hours (3 days a week) among first-year students.

Recommendations:

- Conducting further research using larger samples, and measuring physical activity over the course of an entire week, to clarify the true picture of the nature of the relationship between variables.

Conduct a similar search and add physical activity recording days, including weekends.

- Using methods and methods for teaching physical activity, whether when increasing physical activity during school hours.

- Working to improve the muscular capacity of the lower extremities and their functional ability to increase the amount of physical activity.

- Conducting studies on the relationship between the amount of physical activity and aerobic capacity through the shuttle running test at a gradual speed until fatigue.

- Develop policies and programs that encourage students to follow an active lifestyle and practice sports activities regularly. Due to its scientifically proven benefits on physical fitness and overall health.

Conducting studies that include measuring physical activity outside school hours as well, to obtain a more comprehensive picture of students' movement habits.

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