



# The Effect of Physical Activity on Autonomic Nervous System Activity

## Background

The amount of physical activity recommended for adults ages 18-64 is at least 150-300 minutes a week, about 20 to 40 minutes a day, of moderate-intensity or 75-150 minutes, about 10-20 minutes a day, of vigorous intensity<sup>5</sup>. It is also recommended to perform muscle-strengthening activities for 2 or more days a week<sup>5</sup>. Regular physical activity benefits include reduced risk of disease, improved mobility, and strong bones and muscles<sup>1</sup>. Heart rate variability (HRV) is defined as the differences in instantaneous heart rate and R-R intervals<sup>4</sup>. HRV can detect the impact of the autonomic nervous system on the heart. Autonomic dysfunction is the imbalance between the parasympathetic and sympathetic nervous system. The objective of this study is two-fold: (1) to observe the rate of physical activity in college students, and (2) to observe the effect of physical activity on the balance of the ANS in college students. We expect to (1) find high rates of physical activity in students, and (2) improved ANS balance in students who exercise frequently versus those who do not.

## Materials and Methods

### Participants

A total of 20 individuals from Georgian Court University volunteered to participate, of which 3 were males and 17 were females. The average age of participants was 24 years. Of the participants, 45% were White, 20% were Hispanic, 15% were African-American, and 10% were Asian/Pacific Islander in ethnicity.

### Study Design

The study consisted of three phases: completion of questionnaires, anthropometric measurements and HRV measurement using 10 minutes of continuous ECG. Participants completed a general assessment questionnaire which assessed for physical activity, frequency of physical activity and type of physical activity. Participants also completed the International Physical Activity Questionnaire (IPAQ). IPAQ is a standardized questionnaire used for monitoring physical activity and inactivity<sup>3</sup>. HRV data were obtained using the BIOPAC equipment after 10 minutes of continuous ECG. Statistical analysis was done using Acqnowledge and Microsoft Excel software.

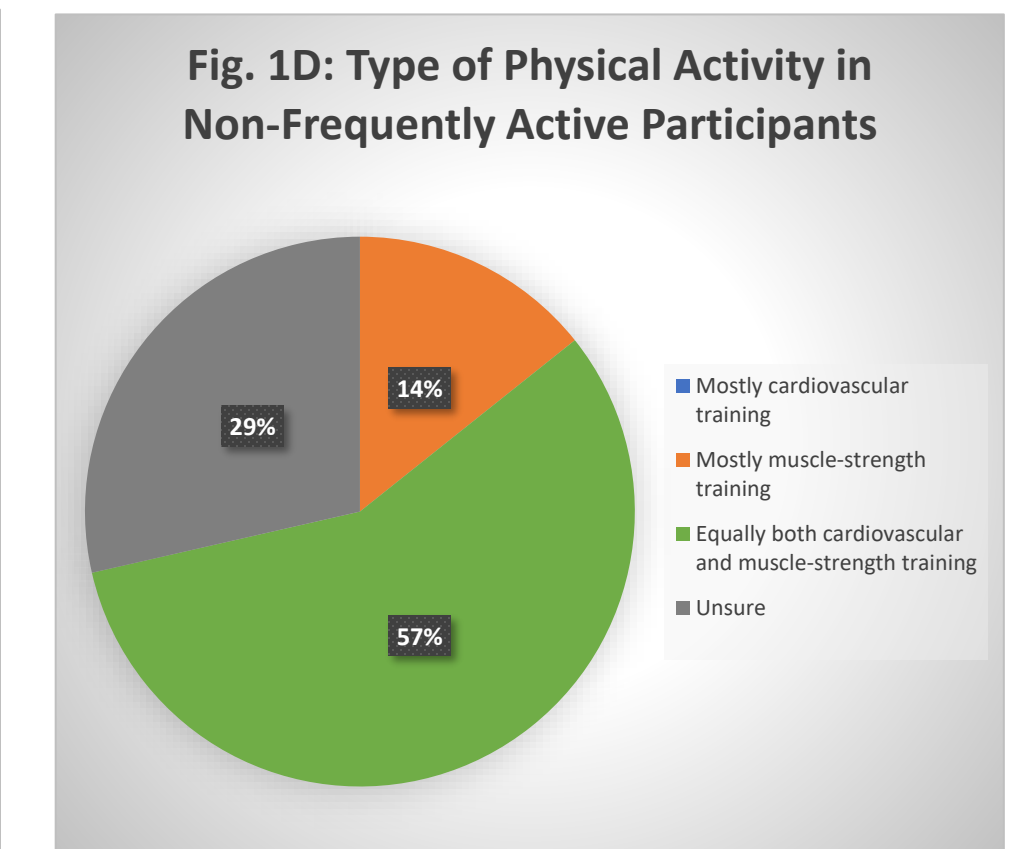
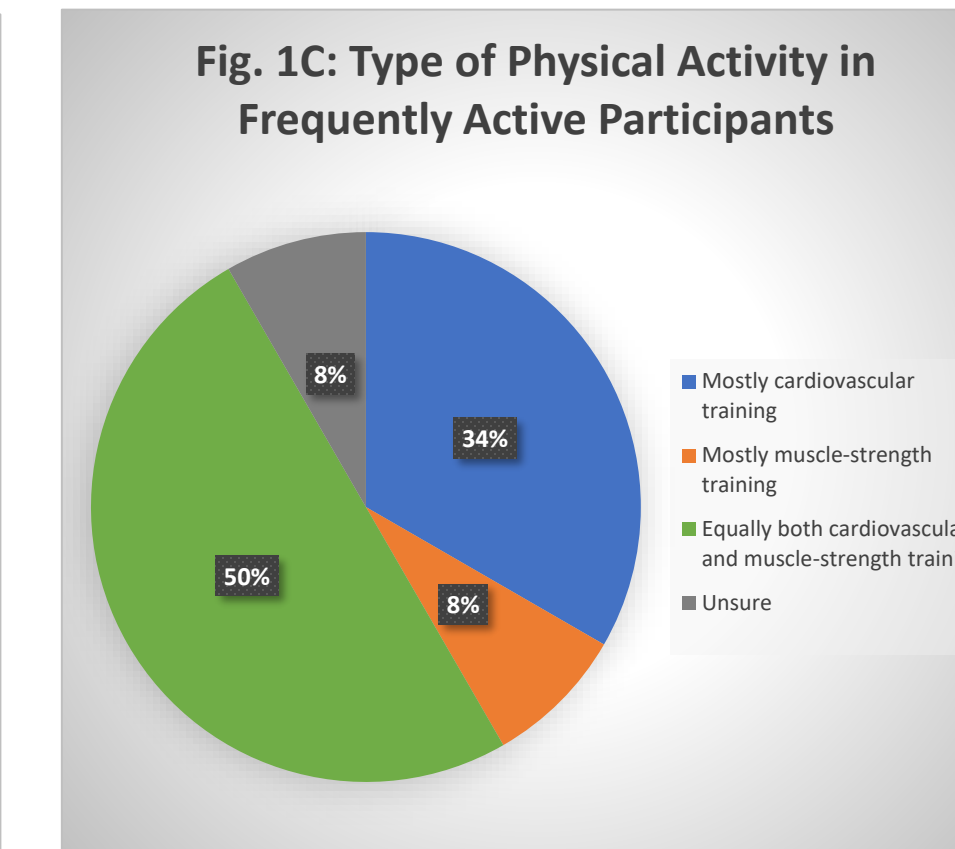
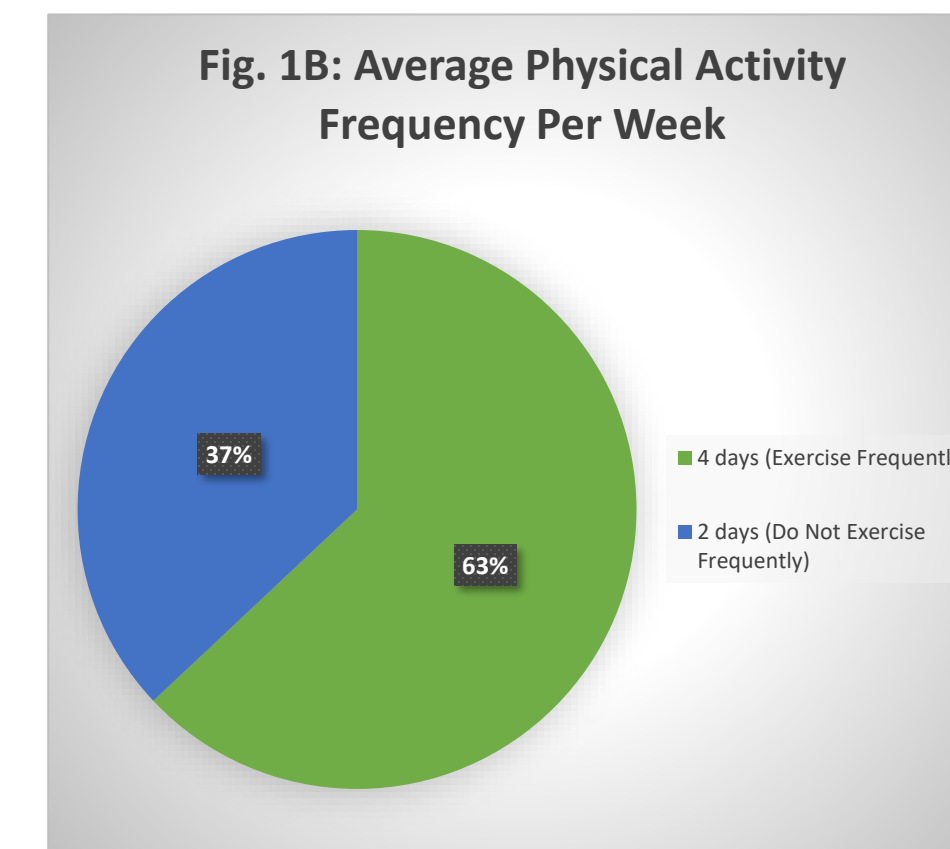
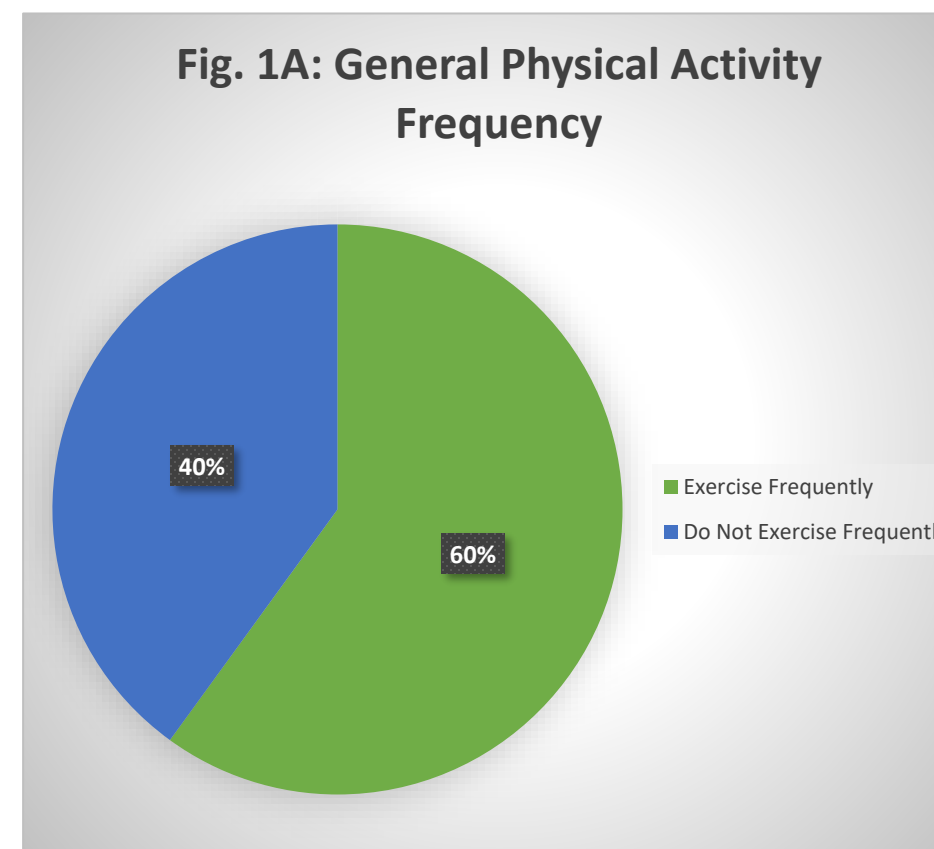
## Results

60% of participants reported having exercised frequently at the time of data collection compared to 40% of those who said 'No' to exercising frequently.

Of the 60% that exercise frequently, they exercised on an average of 4 days a week. Of the 40% that did not exercise frequently, they exercised on an average of 2 days a week.

Of the 60% that frequently exercise, about 33% reported performing cardiovascular training, 8% muscle-strength training, 50% reported performing an equal amount of cardiovascular and muscle training, and 8% reported they were not sure what type of physical activity they did. Of the 40% that do not exercise frequently, 12.5% reported performing muscle-strength training, 50% reported performing an equal amount of cardiovascular and muscle training, and 25% reported they were not sure of the type of physical activity they did. 1 participant reported not doing any form of physical activity at all.

(FIGURE 1)



## The Effect of Exercise on Anthropometric Measurements

The average weight and BMI of participants who reported exercising frequently were 72.3kg and 25.3, respectively. A BMI of around 25 is considered overweight. The average weight and BMI for those who reported 'No' to exercising frequently were 69.5kg and 24.3, respectively. A BMI of less than 25 is considered normal weight.

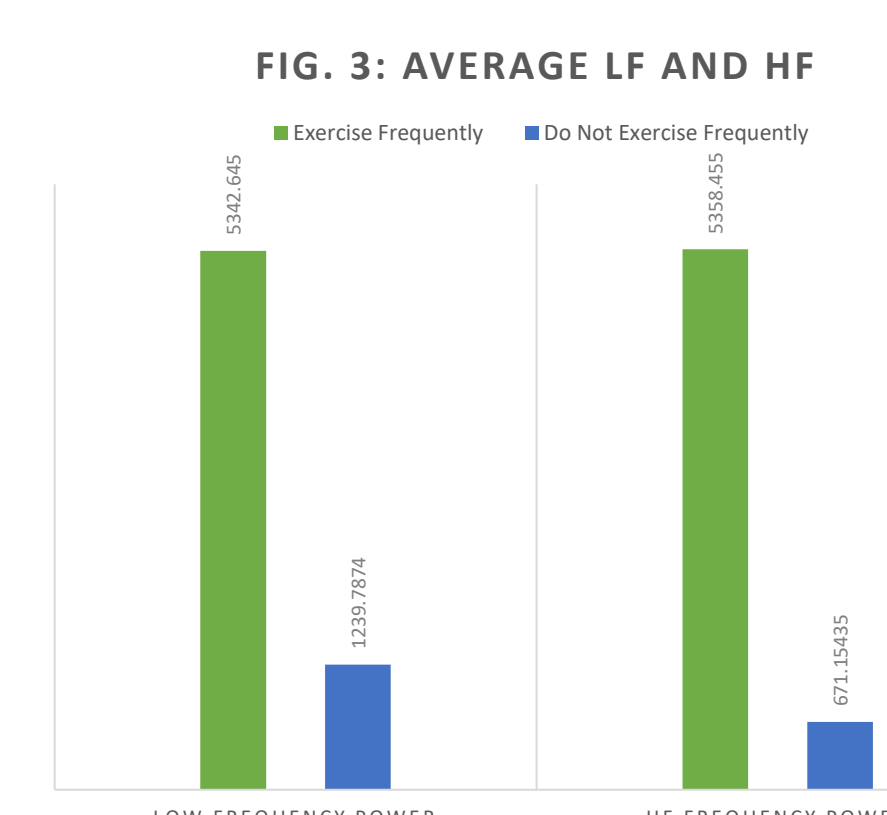
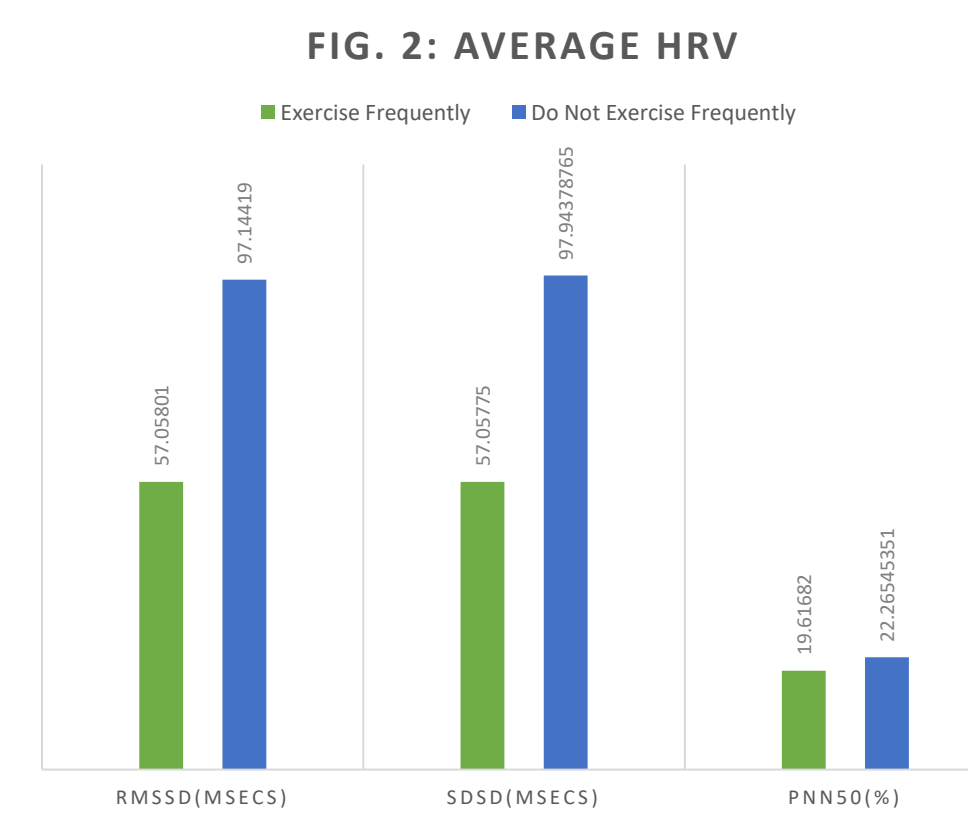
The average waist and hip circumferences in those who exercised frequently were about 84.3cm and 102.1cm, respectively. The circumferences in those who do not exercise frequently were about 82.3cm and 98.6cm, respectively.

## The Effect of Exercise on HRV

The average RMSSD, SDSD and pNN50 in those who frequently exercise were about 57.058, 57.057, and 19.616, respectively. The *p-values* for these averages were 0.526, 0.526, and 0.778, respectively.

The average RMSSD, SDSD and pNN50 in those who do not exercise frequently were about 97.144, 97.943, and 22.265, respectively. The *p-values* for these averages were

(FIGURE 2)



The average Low Frequency and High Frequency in those who exercised frequently were 5342.645 and 5358.455, respectively. The *p-values* for the LF and HF in this group were 0.161 and 0.24, respectively.

The average LF and HF in those who do not exercise frequently were about 1239.787 and 671.154, respectively. The *p-values* for the LF and HF in this group were \_\_\_\_\_

(FIGURE 3)

## Discussion

The objective of this study is two-fold: (1) to observe the rate of physical activity in college students, and (2) to observe the effect of physical activity on the balance of the ANS in college students. The majority of participants were found to be physically active (60%), with an average of 50% more days active compared to those who were not physically active (40%). The students of Georgian Court University were found to be slightly more active compared to the national rates per a study published by the NIH in 2022 that shows that college students exercise at a frequency of about 3 days per week, which meets the minimum recommendation<sup>5</sup>.

The weight, BMI, waist and hip circumferences were higher in frequently active participants compared to those who do not exercise frequently. This is contrary to what is expected. This could be due to increased muscle mass compared to those who do not exercise. Another explanation could be increased physical activity as a result of a higher BMI and a desire to lose weight.

The average RMSSD, SDSD and pNN50 in frequently active participants were lower than in those who do not exercise frequently. This is not expected as these HRV values should be higher in individuals who exercise compared to those who do not. This means parasympathetic NS activity is higher than sympathetic NS activity. These results could be explained by the small sample size and the data was not found to be significant.

The frequency values were elevated in individuals who exercise frequently compared to those who do not. The frequency values for sympathetic and parasympathetic activities were both increased, making it unclear if any autonomic dysfunction does exist.

A recommendation would be to conduct this study with a greater sample to increase the significance of the study. It is also recommended that college students increase their physical activity as it helps to gain and maintain healthy muscle and as well as regulate weight.

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