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Associating Physical Activity Levels to Stress, High Blood Pressure, and High Blood Glucose Risks in Green Park Users

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ABSTRACT

Moreira SR, Cruz LC, Diniz LC, Albuquerque JB, Lima TS, Carvalho FO, Gonçalves MP. Associating Physical Activity Levels to Stress, High Blood Pressure, and High Blood Glucose Risks in Green Park Users. **JEPonline** 2013;16(3):51-58. The purpose of this study was to evaluate the physical activity levels (PAL) and stress (n=93; 38 M and 55 F), PAL and blood pressure (BP) (n=98; 42 M and 56 F), and PAL and blood glucose (BG) (n=91; 36 M and 55 F) in Green Park Users. The International Physical Activity Questionnaire (IPAQ) was used to determine PAL. A Perceived Stress Scale was applied due to an indirect stress level setting. Blood pressure (BP) was automatically measured. Blood pressure was categorized into high and normal BP. Blood glucose measurements were divided into two distinct groups (hyperglycemia and normoglycemia). After gender, age, and body mass index adjustments, the results showed: (a) an association between PAL and high stress (OR=3.21; CI=1.02-10.05; P=0.04); and (b) no significant association between PAL and systolic BP (OR=1.17; CI=0.41-3.34; P=0.75), PAL and diastolic BP (OR=0.68; CI=0.16-2.80; P=0.59) as well as PAL and BG (OR=0.61; CI=0.16-2.21; P=0.45). The findings indicate that Green Park Users ranked as "low PAL" presented an odd ratio 3.2 times higher for high stress level. On the other hand, the Green Park Users, regardless of the PAL did not show high risk for BP and BG.

Key Words: Physical Activity, Stress, Hypertension, Diabetes

INTRODUCTION

Many people throughout the world are surprised when they hear of the link between physical activity and chronic diseases. In particular, regular physical activity decreases the risk of dying from coronary artery disease (15,16). Physical activity reduces the negative effects of stress, thus decreasing the risk of certain physiological and/or psychological disorders (8).

Although exercise physiologists and other professionals are aware of the benefits of regular exercise, society is now recognizing the importance of physical activity as a way to improve health and well-being. Increasingly, more people are looking for the opportunity to engage in physical activity. They understand that exercise helps to correct for hypertension, type 2 diabetes, obesity, and a host of other physical and mental conditions, thus helping to improve the social impact of chronic diseases on governments worldwide (17,21).

While it is well known that stress, hypertension, and type 2 diabetes have multi-factorial origins, the use of exercise in managing the diseases is not just good thinking but fun as well. At this point, it can be said that routine changes in one's lifestyle, such as regular physical activity, can have a positive effect on reducing stress levels and cardiovascular diseases risk factors (10,13,15,27).

An excellent means to increasing daily physical activity is via Green Parks (i.e., places with enjoyable landscape where people can safely interact with nature using the walking and running tracks) (7). No doubt this is why there are more personalized exercise programs in Green Parks, both for males and females of all ages (2,19). Thus, the purpose of this study was to further analyze the association between physical activity level (PAL) with stress, high blood pressure (BP), and high blood glucose (BG).

METHODS
Subjects
The data were collected at Josepha Coelho County Park, which is a public area down town Petrolina, Pernambuco State, Brazil. It offers special places where people can sit and socialize or go for a jog or walk. Approximately 500 adults go to the parks on a regular basis. Although ~187 subjects took part in this study, it became necessary to develop the following exclusion criteria: (a) <18 yrs old; (b) never been assessed for the studied items before; and (c) not a green park user. In the end, 91 to 98 subjects were selected (as described in Table 1). The sample represented 18.2% to 19.6% of the park users. The project was approved by the local university's Ethics Committee, and the subjects signed an informed consent form prior to taking part in the study.

Anthropometric Measurements
The subjects' body mass was measured using a digital scale (Camry®, model EB9013 Brazil) with a 100 gm accuracy. A wooden stadiometer was used to measure height. According to Gaya and Silva (11), it has a 2 mm accuracy. All subjects were measured and weighed without shoes. Body mass index (BMI) was determined by the following equation: body mass (kg) divided by height² (m).

Physical Activity Level (PAL)
The short version (20) of the International Physical Activity Questionnaire's (IPAQ) was used to set a PAL. Subjects categorized as sedentary or insufficiently active were listed in the low PAL extract and those considered active or very active were placed in the high PAL extract.

Stress Level

The Perceived Stress Scales (24) was used to determine the stress level for each subject. A 5-point Likert Scale (never, rarely, sometimes, often, and regularly) was scored using a 0 to 4 range. Subjects with an average up to 2.5 were listed in the low stress extract while the subjects over 2.5 were listed in the high stress group.

Blood Pressure (BP) Assessment

All subjects were evaluated after resting for 10 min while sitting in a chair. An automatic blood pressure (BP) monitor (model BP3AC1; Microlife, USA) was placed on the subject's left arm. The equipment was clinically validated by Stergiou et al. (26). The subjects' BP was categorized into two different extracts in accordance to the VI Brazilian Guidelines on Hypertension (28): (a) High BP (systolic BP ≥140 mmHg and diastolic BP ≥90 mmHg); and (b) Normal BP (systolic BP <140 mmHg and diastolic BP <90 mmHg).

Blood Glucose (BG) Assessment

The resting blood glucose (BG) measurement was done while the subjects sat comfortably in a chair. The finger was used to collect blood samples. Monitors and blood glucose test strips were used (Active Accu-Chek™-Roche/SP/Brazil) to place the subjects' BG into two different extracts in accordance with the IV Guidelines from the Brazilian Cardiology Society (14) and the ADA (1): (a) Hyperglycemia (fasting BG ≥100 mg·dL^{-1} or postprandial BG ≥140 mg·dL^{-1}); and (b) Normoglycemia (fasting BG <100 mg·dL^{-1} or postprandial BG <140 mg·dL^{-1}).

Statistical Analysis

Descriptive statistical procedures with mean and standard deviation, minimum and maximum values, and percentage distribution were adopted. An analysis of variance (ANOVA) was used to analyze the subjects' descriptive features. A logistic regression (i.e., using theoretical assumptions of a 2 x 2 table) was applied to calculate odds ratios (OR) between the independent variable (PAL) and the dependent variables: Stress, BP, and BG. The variables were arranged during analysis and in accordance to the extracts previously described. Covariates such as gender, age and body mass index were used to calculate adjusted OR, once they can influence possible variables. We considered confidence intervals (CI) of 95% and $P<0.05$ for statistical significance. The data were processed using the Instata 9.2 version.

RESULTS

Table 1 shows the comparison among the subjects' features observed in the current study with regard to the different analyses that were done. No significant differences were found between the analyzed groups (PAL *vs.* Stress; PAL *vs.* BP; PAL *vs.* BG) due to variables of gender, age, body mass, height, and body mass index. No difference was found when male and female subjects were compared.

Table 2 shows outcomes of OR between PAL *vs.* Stress, PAL *vs.* Systolic BP, PAL *vs.* Diastolic BP and PAL *vs.* BG. After gender, age, and body mass index adjustments, a significant association was found between PAL and High Stress (OR = 3.21; P = 0.04). Subjects with lower levels of physical activity were 3 times more stressed than those with higher levels of physical activity. However, statistical significance was not found when associating PAL to high Systolic BP (OR = 1.17; P = 0.75), PAL to high Diastolic BP (OR = 0.68; P = 0.59), and PAL to high BG (OR = 0.61; P = 0.45).

Table 1. Analysis of the Subjects' Descriptive Features.

	PAL *vs.* Stress	PAL *vs.* BP	PAL *vs.* BG	P value
Gender*				
Male	41% (n=38)	43% (n=42)	40% (n=36)	>0.05
Female	59% (n=55)	57% (n=56)	60% (n=55)	>0.05
Age (yrs)	49.0 ± 16.5 (19.0 – 85.0)	49.8 ± 16.6 (19.0 – 85.0)	49.6 ± 16.7 (19.0 – 85.0)	>0.05
Body mass (kg)	65.9 ± 13.8 (45.5 – 142.5)	66.3 ± 13.5 (45.5 – 142.5)	66.1 ± 13.2 (45.5 – 142.5)	>0.05
Height (cm)	162.0 ± 9.0 (142.0 – 191.0)	162.0 ± 9.0 (142.0 – 191.0)	162.0 ± 9.0 (142.0 – 191.0)	>0.05
BMI (kg·m^{-2})	25.1 ± 4.1 (17.3 – 41.2)	25.2 ± 4.0 (17.3 – 41.2)	25.2 ± 3.8 (18.2 – 41.2)	>0.05

BMI = Body mass index; **PAL** = Physical activity level; **BP** = Blood pressure; **BG** = Blood glucose. *P>0.05 for comparison between Male and Female on same group of variables.

Table 2. Odds Ratios (OR) and 95% Confidence Interval (CI) between Green Park Users' Low Physical Activity Level and High Stress, High Blood Pressure, and High Blood Glucose Response.

		n	OR[a]	95% CI[a]	P value[a]
High Stress (Psychosocial Scale)	High PAL	93	1.00[b]		
	Low PAL		3.21	1.02 – 10.5	0.04
High SBP (mmHg)	High PAL	98	1.00[b]		
	Low PAL		1.17	0.41 – 3.34	0.75
High DBP (mmHg)	High PAL	98	1.00[b]		
	Low PAL		0.68	0.16 – 2.80	0.59
High BG (mg·dL^{-1})	High PAL	91	1.00[b]		
	Low PAL		0.61	0.16 – 2.21	0.45

PAL = Physical activity level; **SBP** = Systolic blood pressure; **DBP** = Diastolic blood pressure; **BG** = Blood glucose. [a]Adjusted for the covariates sex, age, and body mass index; [b]Reference category

DISCUSSION

The main findings of this study indicate that Green Park Users who were categorized as low PAL had an odds ratio 3.2 times higher for high stress level. On the other hand, the same Users did not show a significant measure of association between their exposure to low PAL and high BP or hyperglycemia.

The high PAL users appear to benefit from the increased level of activity by experiencing a reduction in their psychosocial stress level. This finding agrees with an earlier report by Pires and colleagues (22) regarding stress and physically active individuals (22). Regular physical exercise in public places (such as a park) increases social interaction (2) that results in an increase in psychophysiogical well-being (3,5). Moreover, physical exercise in open places allows for more contact with nature (19) and a reduction in the stress and anxiety of day-by-day life.

Recently, Silva and colleagues (25) highlighted the primary reasons why people exercise in parks. They reported that the pleasant landscape is especially attractive and gets people outside and active. Hence, given the decrease in stress levels of the more active subjects as well the positive mental and emotion interaction with friends and the environment (as reported by numerous other researchers) (2,7,9,22,25), exercise professionals should strongly advise and promote physical activity programs in public places and parks.

This point of view is also supported by the work of Puterman et al. (23). They believe that chronic stress is linked to detrimental effects on physical health via accelerated aging of the cells. Their work shows that psychological stress is associated with shorter telomeres at the ends of chromosomes. While it appears that exercise might buffer telomere shortening by influencing the balance between oxidative stress and antioxidants (23), it is reasonably clear that individuals who engage in regular physical activity (especially in green areas) are protected from an earlier onset of aging.

Regarding BP, other authors have shown that only the effects caused by viewing nature images – differently from urban images – are enough to develop a better control of the autonomic nervous system (12), which may be reflected in better control of BP. Also, an interesting study of Li et al. (18) showed that after 16 adults (57.4 ± 11.6 yrs) took a walk in forest park, they had significantly reduced blood pressure and urinary noradrenaline and dopamine levels compared to the same 2 hr walk in an urban environment with no trees. Without question, regular physical activity (especially in green areas) appears to lower blood pressure by decreasing the activity of the sympathetic nervous system.

Dayawansa and colleagues (6) studied the effect of cedrol inhalation in human subjects. Cedrol is a crystalline natural substance derived from cedar wood oil. The researchers reported that breathing cedrol resulted in a significant decrease in systolic BP and diastolic BP. Their results suggest that Cedrol may cause suppression of sympathetic activity along with an increase in parasympathetic activity, which could explain the decrease in BP. Although it was not possible to measure the autonomic activity after a "walk in the park" session, it is possible to hypothesize that green park users (performing their physical activities in green areas) present no dangerous resting or exercise high BP even with the different PALs.

Blood glucose is used to produce chemical energy. Problems result when glucose either falls too low (hypoglycaemia that results in a light-headed and weak condition) or rises too high (hyperglycaemia that results in diabetes mellitus and/or neurological problems) (4). While regular physical activity improves the body's response to insulin to lower blood sugar level, it is a matter of speculation that changes in BG can occur due to environment differences (i.e., physical activity in urban area *vs.* green park area). Also, it is likely that it is the environment and not PAL that is determining the subjects' BP and BG. Further studies are needed in order to assess autonomic functions and hormonal responses in Green Park Users who present different PALs.

CONCLUSIONS

The main findings of this study indicate that while the low PAL Green Park Users had an odds ratio 3.2 times higher for high stress level, the same Users did not show a significant measure of association between their exposure to low PAL and high BP or hyperglycemia. Thus, further studies are needed in order to assess park users with different PALs and presenting different variables regarding cardio-metabolic systems. In sum, it is important to point out (as a limitation) that the PALs were indirectly determined via the use of a questionnaire.

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