

**Artigo original**Rodrigo Siqueira Reis¹
Edio Luiz Petroski²**APPLICATION OF THE SOCIAL COGNITIVE THEORY TO PREDICT STAGES OF CHANGE IN EXERCISE FOR BRAZILIAN ADOLESCENTS****APLICAÇÃO DA TEORIA COGNITIVO-SOCIAL PARA PREDIÇÃO DE ESTÁGIOS DE MUDANÇA DE COMPORTAMENTO EM ADOLESCENTES BRASILEIROS****RESUMO**

A adolescência é caracterizada pelo acentuado declínio nos níveis de atividade física. Teorias psicológicas como a teoria cognitivo-social e o modelo transteórico têm sido empregadas para tentar explicar a aderência dos jovens à atividade física regular. No entanto, tais teorias raramente têm sido utilizadas para estudar a atividade física em adolescentes brasileiros. O propósito do presente estudo foi examinar características pessoais, comportamentais e ambientais associadas com os diferentes estágios de comportamento relacionados ao exercício físico em uma amostra de adolescentes brasileiros. Participaram do estudo 488 estudantes do ensino médio (57,5% garotos) com idades entre 14 e 17 anos. Medidas fidedignas e válidas foram empregadas para medir variáveis cognitivo-sociais, atividade física auto-reportada e estágios de mudança de comportamento relacionados ao exercício. A análise múltipla discriminante e a análise de variância (Anova) foram utilizadas para investigar a associação entre as variáveis com os estágios de mudança. A auto-eficácia foi um preditor significativo ($p < 0,001$) para garotos e garotas enquanto o suporte social da família foi preditor apenas para os meninos ($p < 0,001$). A atividade física moderada a vigorosa associou-se consistentemente com os estágios de mudança de garotos e garotas ($p < 0,001$). O padrão irregular das diferenças entre os centróides indicou que as garotas movem-se do estágio de pré-contemplação para manutenção em estágios mais definidos do que os garotos e que os garotos movem-se em menos estágios quando comparados com as garotas. As variáveis cognitivo-sociais foram preditoras dos estágios de mudança relacionados ao exercício, no entanto as fontes de suporte social diferiram entre garotos e garotas.

Palavras-chave: exercício, comportamento do adolescente, psicologia, auto-eficácia, apoio social, teoria psicológica.

ABSTRACT

Adolescence is characterized by a peak decline in physical activity levels. Psychological theories, such as Social Cognitive Theory and the Transtheoretical Model have been applied in order to explain the regularity of youth physical activity adherence. These theories, however, are rarely applied to study physical activity behavior in Brazilian adolescents. Therefore, the purpose of the present study was to examine personal, behavioral and environmental characteristics associated with different stages of exercise behavior among a sample of Brazilian adolescents. The participants were 488 high-school students (57.5% boys) with ages ranging from 14 to 17 years. Valid and reliable instruments were used to measure self-reported physical activity, social cognitive variables and also stages of change in exercise behavior. Multivariate discriminant analyses and One-Way ANOVA were performed to identify associations among these variables and stages of change. Self-efficacy was a significant predictor ($p < 0.001$) for boys and girls while family social support was a predictor only for boys ($p < 0.001$). Moderate to vigorous physical activity was consistently associated with stages of change in boys and girls ($p < 0.001$). There was an irregular pattern of centroid differences which indicated that girls move from pre-contemplation to maintenance stage in a clearer pattern than boys and boys move along fewer stages compared to girls. Although social cognitive variables predicted stages of change in exercise behavior, the source of social support differed for boys and girls.

Key words: physical activity, exercise, adolescent behavior, social cognitive theory, stages of change model, transtheoretical model.

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INTRODUCTION

Physical inactivity is recognized as a worldwide public health problem. Many adolescents are at increased risk of many chronic diseases¹. Some evidence has shown that adolescence is a critical age for physical activity decline. Among the adolescents in the United States, for instance in 2001, 38% of boys and 34% of girls did not meet recommendations for moderate or vigorous physical activity². The proportion of adolescents who do not meet the US recommendations increases for boys (20% to 30%) as well as for girls (28% to 48%) from the 9th to the 12th grade³. These findings combined with other studies indicate that adolescence is a time of peak decline in physical activity levels⁴.

Therefore, the identification of factors that have the potential to influence adolescent physical activity levels will have an important impact on health of the world population. Several psychological theories, such as Social Cognitive Theory (SCT)⁵ and the Theory of Planned Behavior⁶ have been applied in order to explain the degree of youth physical activity adherence.

A recent review showed that psychosocial factors such as self-efficacy, social support and intention are consistently associated with adolescent physical activity³. Only few studies, however, have applied such constructs in effective interventions for youth.

The Transtheoretical Model (TTM)⁸ has been considered useful to understand and predict health-related behaviors, particularly physical activity⁹. Prochaska and DiClemente⁸ suggested that an individual engaging in a new behavior moves into an orderly progression of five stages, as follows:

- *Pre-contemplation*, where the individual has no intention to change;
- *Contemplation*, where the individual has an intention to change but not in the immediate future;
- *Preparation*, where the individual has an intention to change in the immediate future and might be making small changes;
- *Action*, where the individual is engaged in the behavior for less than six months;
- *Maintenance*, where the individual is engaged in the behavior for more than six months.

Unlike other theoretical approaches, the TTM considers that individuals at different stages of change would have different attitudes, beliefs and motivations with respect to that new behavior. In this way, a variety of strategies are necessary to impact on adolescent exercise behavior. There is substantial evidence supporting the use of the TTM to understand physical activity adherence. In fact, a meta-analysis of 71 published reports showed that stage membership is associated with different levels of physical activity, self-efficacy, pros and cons of decisional balance, and process of change¹⁰.

Social Cognitive Theory (SCT)⁵ provides an interactive model in terms of behavioral determinants, which are categorized in reciprocally influencing characteristics of the person, including cognitions, the environment, and the behavior itself. An individual's behavior is uniquely determined by the interaction of these characteristics.

The SCT emphasizes that a person's behavior and cognitions influence future behavior⁵. Among the assumptions of the SCT is one that an individual is capable of symbolizing behavior, learning by observation, using self-regulation techniques, anticipating expected outcomes of behavior, and reflecting upon and analyzing their own behavior.

The TTM and SCT have been used in western and economically developed countries. To the best of our knowledge, there is no published study that applied these theories in developing countries like Brazil as shown by a literature search in Medline, PsycList and Lilacs (Latin American and Caribbean Health Sciences Literature).

The purpose of the present study was to examine personal, behavioral and environmental characteristics associated with different stages of exercise behavior among a sample of Brazilian adolescents.

METHODS

Participants

The physical activity stages of change (STG) and SCT measures were administered to 488 high-school students, residents of a large city in south Brazil and enrolled in physical

education classes at a federal high school. The questionnaire was administered to groups during their physical education classes. A sub-sample of 48 participants was randomly selected and all the measures were re-administered one week later to assess test-retest reliability.

Measures

Stages of Change

The physical activity criterion was based on the current public health recommendations¹¹ and “regularly physically active” were considered those “engaged in moderate activities at least 5 times per week, duration 30 minutes and/or vigorous activities at least 3 times per week, duration 20 minutes”. The STG measure consisted of five statements in which the respondents chose the situation that best described their current situation⁹. The English translations of the sentences are:

1 – “I am not currently physically active and I do not intend to be in the next 6 months”;

2 – “I am not currently physically active, but I am thinking about being physically active in the next 6 months”;

3 - “I am physically active but not regularly”;

4 - “I have been regularly physically active for less than 6 months”;

5 - “I have been regularly physically active for more than 6 months”;

Self-Efficacy

The Self-Efficacy (EFI) measure consisted of five items designed to measure confidence in one’s ability to maintain regular physical activity in various situations. A 5-point scale was used to rate each item, with 1 indicating “not at all confident” and 5 “very confident”. Test-retest reliability scores were $IC=0.80$ ($CI=0.73-0.88$) for EFI and $k=0.86$ ($CI=0.74-0.91$).

Social Support for Exercise

The Social Support (SOC) measure consisted of five items designed to measure confidence in ones ability to persist at being “regularly physically active” in various situations. A 5-point scale was used to rate each item, with 1 indicating “not at all confident” and 5 “very confident”. These measures showed factorial

validity, validity evidence with self-reported physical activity measures and good test-retest intraclass reliability¹².

Physical Activity and Sedentary Behavior

An adapted version of the short form of the Portuguese IPAQ - International Physical Activity Questionnaire¹³ was applied. This instrument was modified so that respondents did not consider the time spent in physical education classes. The minutes per week of vigorous and moderate activity were added to generate a single score (MVPA). IPAQ was also used to estimate minutes per week during walking as transportation. Test-retest intraclass reliability scores were 0.86 ($CI=0.79-0.91$) for MVPA and 0.78 ($CI=0.66-0.86$) for walking as transportation. Specific questions were designed about typical sedentary behavior (SED), and the average hours per week spent watching TV and using a computer were asked. Test-retest reliability score was 0.84 ($CI=0.77-0.90$).

Physical Education Enjoyment

A single item was designed to measure enjoyment in physical education classes (ENJ). A 5-point scale was used to rate the item, with 1 indicating, “don’t like it at all” and 5 “like it very much”. Test-retest reliability score was 0.83 (CI 0.76-0.89).

Data on basic demographic and lifestyle activities were collected. Health perception was determined by a 4-point scale previously used with adolescents². This measure was dichotomized into two categories, “positive” and “negative” health. Social economic level (SES) was estimated by the Brazilian Economic Criteria¹⁴, and later were grouped into three categories A (higher), B (middle) and C (lower).

Data Analyses

Frequency counts, percentage and Chi-square were used to summarize the demographic data and stages of change for adolescents. All analyses were performed using SPSS 11.0 and a significance level of 5%. Analyses were conducted separately for boys and girls.

A multiple discriminant analysis was performed to determine the extent social cognitive (EFI, SOC, ENJ) and personal (MVPA

and SED) characteristics predict the membership in stages of change in exercise behavior (i.e., pre-contemplation, contemplation, preparation, action and maintenance). In this analysis, significant predictors were those variables that significantly loaded into the first discriminant function. A One-Way ANOVA was performed to assess the relationship between STG and the dependent variables. Scheffé post-hoc tests determined the differences among stages.

RESULTS

Demographics and lifestyle characteristics of the sample are shown in table 1. Ages ranged from 14 to 17 years, with similar distribution among boys and girls. Overall, the subjects belonged to either higher or middle SES, were non-smokers and showed good health perception. No differences were found between sexes for these variables. There were, however, more boys in the maintenance stage than girls, while girls were more in the pre-contemplation, contemplation and preparation stages than boys.

Discriminant functions for boys are presented in table 2. EFI (0.82) and MVPA (0.75) were the most important discriminant variables (Wilk's Lambda=0.59; $X^2=122.16$; $p<0.005$). The proportion of between-group variability

accounted by this function was 84.5%. Function 2 accounted for the 12.5% variability and family support was the significant variable. However, this function did not differ from function 1. Scheffé post-hoc revealed significant increases in self-efficacy for physical activity from pre-contemplation through to maintenance stages while family support for exercise increased from pre-contemplation through to contemplation in boys (table 4).

Discriminant functions for girls are presented in table 3. EFI (0.64) and MVPA (0.75) were the most important discriminant variables (Wilk's Lambda=0.60; $X^2=84.06$; $p<0.005$). The between-group variability accounted for this function was 77.4%. Function 2 accounted for 14.6% variability and physical education enjoyment and family support were significantly associated with this function. Scheffé post-hoc revealed significant increases in self-efficacy from contemplation through to the maintenance stages in girls (table 4).

When using discriminant functions, differences among STG groups were determined by comparing group centroids, i.e., the mean of discriminant function scores for each group. The group means for social cognitive variables increased from pre-contemplation through to the maintenance stages for boys and girls (Figure 1).

The group means for the first function

Table 1. Characteristics of Participants in the Study.

Variable	Boys (n=278)	Girls (n=210)	Total (n=488)
Age – years ($X^2=1.37$; $p<0.71$)	%	%	%
14	10.6	12.4	11.4
15	28.6	24.3	26.8
16	49.2	40.0	39.6
17	21.6	23.3	22.3
Social-Economic Level ($X^2=9.32$; $p<0.10$)			
A (high)	38.3	38.3	38.3
B (middle)	55.4	56.1	55.7
C (low)	6.3	5.6	6.0
Smokers ($X^2=0.27$; $p<0.60$)	2.1	2.9	2.4
Positive Health ($X^2=6.01$; $p<0.14$)	89.8	82.0	86.5
Stages ($X^2=20.38$; $p<0.001$)			
Pre-contemplation	4.3	7.1	5.5
Contemplation	20.1	25.2	22.3
Preparation	10.4	20.0	14.5
Action	17.3	18.6	17.8
Maintenance	47.8	29.0	39.8

were used to evaluate the validity of the proposed theoretical order of the exercise stages. The greatest difference ($H=0.75$) in social cognitive variables was observed between recent adopters of regular physical activity and those who were active for more than 6 months. The pattern of the centroid differences was slightly uneven for boys and girls. The difference for boys from pre-contemplation to contemplation ($H=0.4$) was greater than for girls ($H=0.05$). The differences between contemplation and action stages and between action and maintenance stages were similar for boys and girls ($H=0.7$). There was no difference between contemplation and preparation stages for boys while the preparation stage appeared as a specific stage for girls.

Table 2. Multiple discriminant analysis to predict stages of change in exercise behavior for boys ($n=278$).

	Function			
	1 ^a	2 ^b	3 ^c	4 ^d
Self-efficacy	0.82*	-0.05	0.36	-0.01
MVPA (min/week)	0.75*	-0.16	-0.43	0.22
Family Support	0.09	0.70*	-0.02	0.40
Friend Support	0.17	0.40	0.41*	0.38
PE Enjoyment	-0.21	-0.58	0.00	0.72*
Sedentary Behavior	-0.14	0.39	0.31	0.46*
% Variance	84.5	12.5	2.6	0.4

^a Wilks' Lambda=0.59; Chi-square=122.16; $p<0.001$; ^b Wilks' Lambda=0.91; Chi-square=22.16; $p<0.10$; ^c Wilks' Lambda=0.98; Chi-square=4.3; $p<0.82$; ^d Wilks' Lambda=0.99; Chi-square=0.53; $p<0.91$

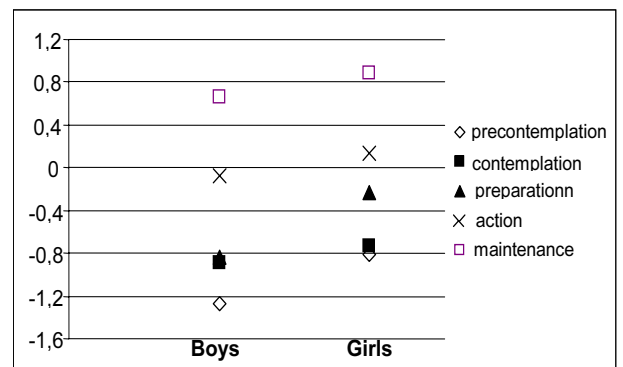


Figure 1. Functions of group centroids (means) of SCT variables according to stages of change for boys and girls

Table 3. Multiple discriminant analysis to predict stages of change in exercise behavior for girls ($n=210$).

	Function			
	1 ^a	2 ^b	3 ^c	4 ^d
Self-efficacy	0.64*	-0.14	-0.56	-0.12
MVPA (min/week)	0.75*	-0.08	0.50	0.01
Family Support	-0.12	-0.47*	0.34	-0.10
Friend Support	0.06	-0.27	0.59*	-0.08
PE Enjoyment	-0.01	0.86*	0.09	0.07
Sedentary Behavior	0.03	-0.19	-0.03	0.95*
% Variance	77.4	14.6	6.7	1.3

^a Wilks' Lambda=0.60; Chi-square=84.06; $p<0.001$; ^b Wilks' Lambda=0.88; Chi-square=21.44; $p<0.12$; ^c Wilks' Lambda=0.95; Chi-square=7.7; $p<0.45$; ^d Wilks' Lambda=0.99; Chi-square=1.30; $p<0.72$

Table 4. Means, standard deviations and Scheffe post-hoc comparisons of self-efficacy (EFI) and social support for physical activity (SOC) by stages of change (STG) in boys ($n=278$) and girls ($n=210$).

Variable	Stages					F	Scheffe
	PC	CT	PR	AC	MT		
Boys							
EFI	11.8±5.3	12.3±3.2	12.7± 3.5	14.2± 2.7	16.4± 3.3	20.3*	PC<AC=PR<AC<MT
SOC Friend	20.8± 7.9	31.3±18.8	29.9±18.7	29.9±15.4	33.2±13.4	2.05	No differences
SOC family	18.6±7.0	32.3±18.2	27.3±13.3	30.2±13.6	31.1±13.3	2.69*	PC<CT=PR=AC=MT
Girls							
EFI	11.0±3.3	11.0±3.1	12.8± 3.0	13.3±2.9	14.6± 3.4	10.5*	PC=CT<PR=AC<MT
SOC Friend	34.1±23.4	32.7±17.9	29.3±15.0	34.1±14.7	34.6±13.2	0.78	No differences
SOC family	34.3±22.5	34.5±15.5	30.8±14.7	34.3±11.5	32.7±9.4	0.55	No differences

* $p<0.001$; Note: PC (pre-contemplation); CT (contemplation); PR (preparation); AC (action); MT (maintenance)

DISCUSSION

This study investigated the contribution of social cognitive variables to predict stages of change for exercise and also the potential SCT determinants of regular physical activity as defined by the TTM. Self-efficacy, social support and other SCT variables have also been identified as predictors of regular exercise¹⁵.

There is a lack of studies investigating the SCT and TTM related to physical activity patterns in Brazilian adolescents so that a cross-correlation of our findings was not possible. Almost half of our sample were not regularly active (pre-contemplation, contemplation and action stages). These results are similar to those observed among adolescents in the United States where 38% of boys and 34% of girls did not meet the recommendations for moderate or vigorous physical activity³. Despite the lack of physical inactivity prevalence studies in Brazil, a recent (where is the footnote reference to this study-poor academic form to site without a reference) study showed that 25.9% to 52.5% of young people are physically inactive, similar results to those reported in the adolescent sample in the present study.

Multivariate discriminant analysis was applied to identify social cognitive characteristics most likely to predict the changes in stages of exercise behavior. Self-efficacy and family social support had different contributions as predictors of the stages of exercise behavior. Self-efficacy consistently increased from pre-contemplation through to maintenance stages for both boys and girls.

The association of self-efficacy and social support with physical activity has been well documented^{15,3}. Several studies have reported the increase in EFI across the stages of change in exercise. In the present study the pattern of social support varied for boys and girls. Family support influenced only boys while friend support was not associated with either sexes. This finding corroborates with other studies, where family support predicts physical activity among adolescents¹⁶ and adults¹⁷. The multivariate analysis also demonstrated that MVPA was consistently associated with stages of change suggesting evidence of construct validity of the TTM to physical activity research, as inferred

elsewhere¹⁰. All discriminant functions showed a similar pattern for boys and girls, indicating that self-efficacy was the main predictor although the stages of change were expected to have a higher correlation with physical activity measures⁹. Therefore, it is reasonable to label function 1 as an "self-efficacy function".

Group centroids were examined for boys and girls. The largest difference between action and maintenance stage showed that there are specific characteristics associated with exercise behavior in these two stages. These results are similar to those reported by Wallace¹⁰ in college students. The irregular pattern of centroid differences observed in this sample points out that the order of the stages did not follow an interval but an ordinal scale. It suggested that girls move from pre-contemplation to maintenance in more defined stages and that boys move in fewer stages than girls. These findings may suggest that boys could find some difficulties to progress from pre-contemplation to maintenance, however, the results are limited to the cross-sectional nature of data.

CONCLUSION

The decrease in the physical activity level observed during adolescence has led several researchers to focus on how this behavior can be changed. It is critical to understand how SCT and TTM can be applied to design intervention programs to help adolescents change their exercise behavior.

In our best knowledge, this was the first study to investigate both the SCT and the TTM related to physical activity in Brazilian population. This research has provided some usable evidence for designing strategies to increase the physical activity levels among adolescents. While self-efficacy seems to influence all adolescents, social support has a different impact for boys and girls. In this study, family support is more important for boys, indicating that different support strategies should be applied in interventions. Social support, however, had only a marginal contribution for both boys and girls progressing through the stages. Physical education classes should be also included as a strategic component, particularly for girls, because it showed a greater influence when

moving through the stages. However, some limitations such as the variability of the socio-economic level and the physical activity history should be taken into consideration in future studies.

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