

ADOLESCENTS' PHYSICAL ACTIVITY AND ITS RELATED COGNITIVE AND BEHAVIOURAL PROCESSES

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ABSTRACT: The purpose of the study was to examine adolescents' physical activity and identify differences in cognitive and behavioural processes according to the stages of physical activity. Participants were 13 to 18 year old students (n = 851, male = 479, female = 372, mean age = 16.0 years) from 5 junior high and high schools who completed measures of the stages of physical activity and change process. The results indicated that 66.2% of adolescents reported being completely inactive (pre contemplation or contemplation) or undertaking physical activity irregularly (preparation). There were significant differences in the stages of physical activity between sexes; male adolescents were more active than females. In addition, cognitive and behavioural processes were significantly associated with stages of physical activity. Specifically, consciousness raising and environmental re evaluation in the cognitive processes differentiated the stages of physical activity. Meanwhile, all four sub-constructs in the behavioural processes continually increased with each subsequent stage. The present study provides convincing evidence that promoting and maintaining physical activity require the practical application of cognitive and behavioural strategies.

KEY WORDS: transtheoretical model, cognitive and behavioural strategy, change process, physical activity, adolescent

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INTRODUCTION

It is widely understood that regular physical activity in adolescence offers numerous health benefits. However, despite the broad dissemination of health information about the benefits of regular participation in physical activity, many studies have found that the majority of adolescents around the world either engage in physical activity on an infrequent basis or are completely sedentary [9,16]. Previous studies aimed at understanding why many adolescents do not participate in physical activity have been conducted without fully considering the psychological factors associated with adolescent physical inactivity [6,7]. Recently, based on the awareness of the importance of regular physical activity and the lack of understanding of the correlates of physical activity, concerted efforts have been directed towards behavioural and cognitive strategies that might be useful for promoting and maintaining physical activity based on the transtheoretical model [4,15].

The transtheoretical model (TTM) is based on a behaviour change theory as has been applied to a variety of health-related behaviours including physical activity [13]. The TTM is conceptualized in terms of several major dimensions, and the core constructs, around which

the other dimensions are organized, is the stage of change. The stage of change represents ordered categories along a continuum of motivational readiness to change physical activity, and highlights the notion that physical activity change is a complex process that takes place gradually through different stages [10].

The model suggests that people progress through five stages: (1) pre contemplation (individuals are physically inactive and do not intend to initiate physical activity within the next 6 months), (2) contemplation (individuals are physically inactive and intend to begin regular physical activity within the next 6 months), (3) preparation (individuals are irregularly active below a criterion level of three or more times per week for at least 30 minutes each time), (4) action (individuals have been regularly active for less than 6 months), and (5) maintenance (individuals have sustained regular physical activity for more than 6 months after initial physical activity) [8].

Another major construct of the TTM is the change process that depicts how shifts in behavioural change occur. Change processes are both covert and overt activities and strategies that individuals

utilize to modify their behaviour [13]. Each process is a broad category encompassing multiple techniques, methods, and strategies traditionally associated with disparate theoretical orientations. The 10 processes are grouped into two high-order factors representing cognitive (i.e., consciousness raising, dramatic relief, self-re-evaluation, environmental re-evaluation, and self-liberation) and behavioural (i.e., social liberation, counter-conditioning, stimulus control, reinforcement management, and helping relationships) processes. The empirical evidence shows that in early stages of physical activity people apply cognitive, affective, and evaluative processes to progress through the stages. In later stages, meanwhile, people rely on commitments, conditioning, reinforcements, environmental control, and support for progressing toward maintenance [10,14].

In this regard, studies of the TTM's applicability in the physical activity domain has been supported across a variety of populations and settings [1,2]. However, most of the previous studies have applied self-efficacy and decisional balance as the constructs [3,6], and little attention has been devoted to exploring the possible relationship between physical activity and the change process. Therefore, it is imperative to identify the effect of change process on the stages of physical activity behaviour before disseminating the effectiveness of the TTM across nations and cultures [12]. The present study examined the proportion of adolescents in each of the five stages of physical activity as defined by the TTM, and investigated the differences in cognitive and behavioural processes according to the stages of physical activity.

MATERIALS AND METHODS

Participants. This study was sponsored by the National Research Foundation, and approved by the university's institutional review board. The participants were 851 students (male = 479, female = 372), age 13 to 18 years old (mean age = 16.0 years), who were enrolled in 5 schools located in SeongBuk-gu, Northern Seoul. Before the field work, a consent form was sent to the participants and their parents. Only the students who returned the consent form signed by themselves and their parents participated in this study. Students were excluded from the study if they had severe learning disabilities.

Measures. Stage of physical activity was assessed using 5 items in a yes-or-no response format related to regular physical activity and intention. Individuals were categorized into one of the five stages of physical activity behaviour change described previously. An original version of the stage of physical activity scale was developed by Marcus et al. [8], and revised for the Korean version [6]. In a pilot stage test-retest reliability measures were conducted as a measure of instrument stability, and obtained a reliability of 0.85.

The change process questionnaire developed by Nigg, Norman, Rossi, and Benisovich [11] was revised for the Korean version, and applied to assess processes of physical activity. The original measure contains 30 items that assess the 10 processes. Factor analysis was performed to verify construct validity of the Korean measure. The principal axis factoring method with varimax rotation was applied to derive the factor loading of each item in each sub-variable. From these processes, among 30 items with 10 sub-variables of the original measure, a total of 24 items and 8 sub-variables excluding 6 items

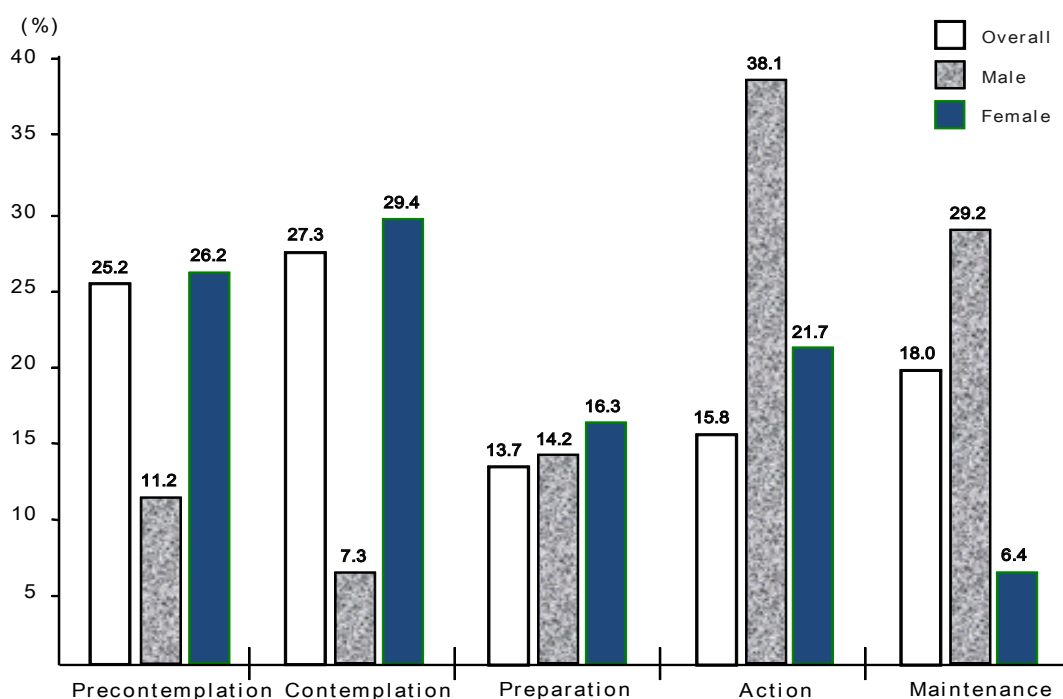


FIG. 1. DISTRIBUTION OF STAGE OF PHYSICAL ACTIVITY

for which the factor loading was below 0.50 were extracted, and finally used to assess cognitive and behavioural change processes. In the revised questionnaire, individuals were asked to recall the past month and to rate the frequency of occurrence of each item, on a 5-point Likert-type scale (ranging from 1, „never”, to 5, „repeatedly”), how frequently each of the processes were used. Test-retest reliability measures were performed as a measure of instrument stability, and obtained reliabilities from 0.69 to 0.89.

Translation and Validation for the Measure. The translation and validation processes for the measures used in this study were adopted from Vallerand's work [17]. Based on Vallerand's suggestions the authors translated the original measures of the stage of change and change processes from the TTM into Korean. Then, the translated measures were given to two bilingual Ph.D. students in the field of exercise psychology, and they retranslated the Korean measures back into English without referring to the original version. In the next step, the authors and the students who participated in the back-translation evaluated the accuracy of the translated items by comparing the concept associated with each item in the original and Korean measures. Based on this process, some minor aspects of wording and/or phrasing were changed, and content validity suitable for the purposes of the study was established. In the final step, the test-retest technique was applied to evaluate the reliability of the revised Korean version of the change process measure. 70 students of similar age to the target participants were subjected to the Korean change process measures on the first administration, and the same measures were applied to 58 students on a repeat administration 2 weeks later.

Statistical Analysis. Frequency analysis with χ^2 -square test was initially conducted to examine the physical activity behaviour distribution of Korean secondary school students. Multivariate F-tests along with post-hoc analyses were performed to identify the differences in cognitive and behavioural processes of Korean students within the hypothesized stages of physical activity behaviour. All statistical analyses applied in this study were performed using SPSS Win 14.0.

RESULTS

Stages of Physical Activity. Figure 1 shows the stage of physical activity distribution overall and as a function of gender. The following stages of physical activity emerged overall: pre contemplation (n=168, 25.2%), contemplation (n=179, 27.3%), preparation (n=93, 13.7%), action (n=108, 15.8%), and maintenance (n=126, 18.0%). In addition, female adolescents were more likely to be in the inactive stage ($\chi^2 = 113.14$, df = 4, p<0.001), whereas males were more likely to be in the active stage ($\chi^2 = 129.22$, df = 4, p<0.001).

Change Processes according to Stages of Physical Activity. Table 1 shows the means, standard deviations, results of MANOVA and Tukey post hoc contrasts for the cognitive and behavioural processes across the five stages of physical activity. In the cognitive processes consciousness raising (F[4, 846]=4.55, p<0.001) and environmental re evaluation (F[4, 846]=2.49, p<0.05) statistically differentiated between stages of physical activity behaviour. Meanwhile, all four constructs in the behavioural processes continually increased with advancing stage, and statistically differentiated between stages of physical activity (F[4, 846] = 3.76 for helping relationship,

TABLE I. MANOVA AND TUKEY POST-HOC ANALYSIS RESULTS FOR CHANGE PROCESSES

Change Process	Stages of Physical Activity					F(4,846)	Tukey's HSD ¹
	PC	C	P	A	M		
Conscious Raising	2.46 (1.02)	2.46 (0.99)	2.46 (0.91)	2.69 (1.00)	2.89 (1.01)	4.55***	PC,C,P<M
Dramatic Relief	2.53 (0.98)	2.55 (0.95)	2.59 (0.88)	2.69 (0.86)	2.76 (0.91)	1.43	
Environmental Reevaluation	2.53 (1.07)	2.54 (1.02)	2.54 (0.89)	2.80 (1.00)	2.92 (1.02)	2.49*	PC,C,P<A,M
Self reevaluation	3.21 (1.03)	3.19 (0.98)	3.20 (1.04)	3.40 (0.96)	3.46 (0.95)	1.83	
Helping relationships	2.64 (1.20)	2.74 (1.21)	2.84 (1.22)	3.13 (1.02)	3.15 (1.18)	3.76**	PC,C,P<A,M
Reinforcement management	3.06 (1.00)	3.14 (1.01)	3.14 (1.11)	3.38 (0.87)	3.41 (1.05)	2.66*	PC,C,P<A,M
Stimulus Control	2.21 (1.10)	2.38 (1.07)	2.41 (0.90)	2.68 (1.02)	2.76 (1.00)	2.52*	PC,C,P<M
Counter-conditioning	2.30 (1.03)	2.37 (0.98)	2.38 (0.95)	2.69 (0.82)	2.82 (1.00)	3.52**	PC,C,P<A,M

*p<0.05; **p<0.01; ***p<0.001.
¹Mean differences for Tukey HSD pairwise comparisons (p<0.05).
 Parentheses are standard deviations.
 PC: Pre contemplation; C: Contemplation; P: Preparation; A: Action; M: Maintenance

3.52 for counter-conditioning, $p < 0.01$; 2.66 for reinforcement management, and 2.52 for stimulus control, $p < 0.05$).

DISCUSSION

This study indicated that the physical inactivity of Korean adolescents could seriously affect their health status in the future, considering the findings that overall more than half of adolescent participants ($n = 66.2\%$) reported being totally inactive (pre contemplation or contemplation) or taking irregular exercise (preparation). This finding might be more broadly understood in a social and contextual viewpoint. Generally, Korean secondary students are required to perform excessive schoolwork due to the dominance of the academic-centred curriculum, and for this reason they do not have enough time to participate in physical activity. However, this interpretation should be considered with caution, because it could not be substantiated from previous studies.

In addition, male adolescents showed a high proportion in the action and maintenance stage, whereas females were more likely to be in pre contemplation and contemplation. This finding is not surprising in light of the consistent relationship between gender and physical activity and was supported by the previous studies, indicating that significantly more male adolescents were in the active stages as compared with their female counterparts [6,18].

The present study showed that the use of cognitive and behavioural processes subsequently increased with advancing stage. In the behavioural processes, the use of individual behavioural strategies continually increased from pre contemplation to maintenance, and of

those behavioural strategies 'helping relationships' and 'counter-conditioning' were significant discriminators among the stages of physical activity behaviour. These findings indicated that as adolescents become more active, they seem to have more significant others who encourage them to consistently maintain physical activity habits, and they are able to replace sedentary behaviours more easily with physical activity [5].

In the cognitive processes, 'consciousness raising' was the best discriminator among all stages of physical activity behaviour. This finding indicates that many adolescents attempt to seek new information and to gain understanding about physical activity. In addition, adolescents in pre contemplation, contemplation and preparation used 'environmental re evaluation' less than those in action and maintenance. This result can be interpreted that adolescents who have no intention to initiate physical activity or perform physical activity irregularly give little thought to how their inactivity affects their social environment.

This study provides much significant information about the possible relationship between cognitive and behavioural processes and physical activity behaviour. As the behavioural and cognitive processes were important variables of stages of physical activity, the results offer further cross-sectional support for the internal validity of the TTM. Overall, the results are in general agreement with the previous findings reported by western countries, and therefore the external validation of the TTM is supported. More importantly, the present study provides convincing evidence that promoting and maintaining physical activity behaviour require the practical application of cognitive and behavioural strategies.

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