Differences in Cognitive and Behavioral Processes of Change by Stages of Physical Activity in Adolescents

SooJin Kang, HakGweon Lee, and YoungHo Kim

Abstract**—**The current study identified the differences in stages of physical activity and in cognitive and behavioral processes of change by those stages among a random sample of Korean adolescents. A total of 671 adolescents randomly selected from junior high and high schools in Seoul were surveyed. Two Korean-version questionnaires were used to identify the stage of exercise behavior and the processes of change construct of adolescents: Stage of Physical Activity Change Questionnaire, and Processes of Change Questionnaire. Results indicated that physical activity pattern of Korean adolescents were different by each stage of physical activity. Female adolescents were more likely to be in the precontemplation and contemplation stage, whereas males were more likely to be in the action and maintenance. In addition, significant differences were revealed in use of processes of change constructs through stages of physical activity. The use of cognitive and behavioral strategies increased form pre-contemplation through maintenance. This study provides some insights into the physical activity habits and the cognitive and behavioral strategies of increasing physical activity levels in the adolescent population.

Keywords**—**Adolescent, behavioral process of change, cognitive process of change, physical activity

I. Introduction

DESPITE the dissemination of health information promoting the benefits of regular participation in physical activity, a large volume of studies indicated that the majority of adolescents around the world either engage in exercise behavior on an infrequent basis or are completely sedentary. According to one Korean study, 16% of adolescents responded that they never exercised. However, in this study, considering the fact that about 34% of adolescents participated in physical activity once per month, a lack of exercise in the adolescents is a crucial factor that might adversely affect their health. More importantly, this study revealed that 62% of the adolescents who participated in regular exercise are doing so for less than 1hour.

In this regard, one model that has achieved wide spread attention from researcher and practitioners regarding a variety of health-related behavior, including exercise, has been the Transtheoretical Model (TTM).

YoungHo Kim(Corresponding author) is a professor in the Seoul National University of Science and Technology, Seoul, Korea (phone:82-2-970-6275; e-mail:yk01@seoultech.ac.kr).

SooJin Kang is a PhD student in SungKyeunKwan University, KyungGi Do, Korea (phone:82-2-970-6369-; e-mail:eostm2000@naver.com).

HakGweon Lee is a lecturer in the Seoul National University of Science and Technology, Seoul, Korea (corresponding author's phone:82-2-970-6369; e-mail:hklee21c@hanmail.net).

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The TTM consisted of five stages of physical activity change. In this model, individuals adopting a new behavior move through a series of stages of change. The model suggests that people progress through five stages: (1) pre-contemplation (no intention to change behavior in next 6 months), (2) contemplation (intention to change behavior within 6 months), (3) preparation (small inconsistent changes), (4) action (active involvement in behavior for less than 6 months), (5) maintenance (sustained behavior change for at least 6 months) . By distinguishing individuals' readiness to change, the model identifies the particular requirement of each stage and thus the nature of intervention that will be relevant at different points in the change process.

Process of change, the most understudied tenant of the TTM, are overt and covert activities that individuals utilize to modify their behavior. The 10 processes are grouped into two high-order factors representing cognitive (i.e., conscious raising, dramatic relief, self-reevaluation, environmental reevaluation, self-liberation) and behavioral (i.e., social liberation, counter-conditioning, stimulation control, reinforcement management, and helping relationships) processes. Cognitive processes obtains information by an individual's own actions, meanwhile information in behavioral processes is obtained from environmental events. People at different stages of change are hypothesized to use distinct processes of change. In the exercise domain, cognitive processes have been found to peak in the contemplation stage and behavioral processes have been shown to steadily increase from pre-contemplation to action, at which point they level off.

In this regard, exercise behavior of the adolescents in the different cultures has frequently been identified on a basis of the TTM. However, the same level of research has not been focused on the Korean adolescent populations. The present study examined the proportion of Korean adolescents in each of the five stages of physical activity change as defined by the TTM, and investigated the differences in cognitive and behavioral constructs by the stage of physical activity.

II. Methods

A. Subjects

750 students (male: 400, female: 350) ranged from 7th to 11th grade who attended junior high and high schools in Seoul, Korea were asked to participate in a survey designed to assess the stage of exercise behavior and processes of change construct. Out of a possible 750, 671 students (male: 357, female: 314) were invited to participate in the study; 89.5% gave their consent and completed the survey form. Only 10.5% of the subjects declined participation. The non-

participants were not significantly different in age or gender from students who participated. The subjects were selected by a random sampling from six schools, geographically located in the northern areas of Seoul. All students in the age cohort were 13-18 yrs (M=15.3 yrs).

B. Instruments

For stage of exercise behavior change, stage of Physical Activity Change Questionnaire, developed by Marcus, Selby, Niaura and Rossi was translated in to Korean, and used in the study. In this questionnaire, stage of exercise behavior change was assessed using 5-item, dichotomous scale (yes/no) related to regular exercise behavior and intentions. Regular exercise was defined as exercising three or more times per week for at least 30 minutes each time excepting school physical education because this level of exercise has been shown to be beneficial and is recommended by the American College of Sports Medicine. This questionnaire measures frequency of regular exercise and does not assess vigorous and/or moderate physical activity separately. Individuals were categorized into one of five stages of exercise behavior change described previously. In addition, in a pilot stage test-retest reliability measures were conducted as a measure of instrument stability, and obtained a reliability of .85.

Processes of Change Questionnaire developed by Nigg, Norman, Rossi, and Benisovich was revised for the Korean version, and applied to assess processes of exercise behavior change. The original questionnaire contains 30 items that measure the 10 processes of change. In an initial stage, factor analysis was performed in order to generate a factor correlation matrix of the revised questionnaire, and the 8 sub-factors explaining processes of exercise behavior change were extracted. Then the factor loading of each item in each sub-factor was derived from the principal axis factoring method with Varimax rotation. Throughout these processes, the 6 items that the factor loading is below .50 were deleted form the original questionnaire, and a total 24 items and the 8 sub-factors were finally used in this study as a toll for assessing processes of change of Korean adolescents. In this 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. Cronbach’s coefficient alpha was calculated as a measure of internal consistency for the scale, and alpha levels ranged from .70 to .87. In addition, test-retest reliability measures were performed as a measure of instrument stability, and obtained reliabilities from .69 to .89.

III. Results

A. Stages of Exercise Behavior Change

Fig.1 showed stage of physical activity change distribution overall and as a function of gender. The following stages of exercise behavior 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%). Especially, considering the fact that overall 66.2% of the sample reported being inactive (pre-contemplation or contemplation) or exercise irregularly (preparation), a lack of exercise in the adolescents is a crucial factor that might adversely affect their health. Female adolescents were more likely to be in the contemplation stage ($\chi 2$ = 113.14, df=4, p<.001), whereas males were more likely to be in the maintenance stage ($\chi 2$ = 129.22, df = 4, p<.001).

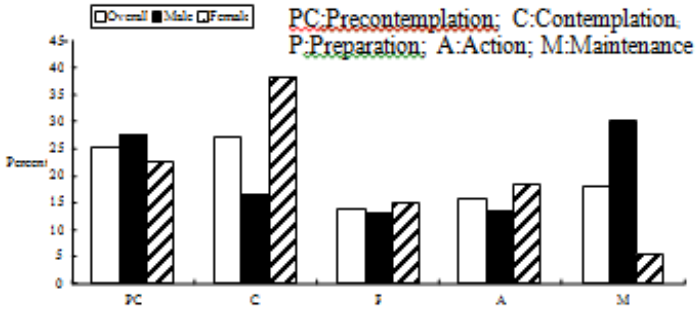

Fig.1 Distribution of Stage of Exercise Behavior

B. Processes of Change by Stages of Physical Activity

Table I indicated that adolescents in pre-contemplation significantly less used most of 8 processes of change than those in other stages of physical activity. In the cognitive processes conscious raising [F (4,666)=4.55, P<.001] and environmental reevaluation [F (4,666)=2.49, P<.05] statically differentiated across stages of exercise behavior. Turkey’s post hoc test revealed such mean differences in conscious raising and environmental reevaluation emerged between adolescents in pre-contemplation, contemplation, and preparation and those in maintenance. A more stable pattern of process of change use emerged for the behavioral strategies. Adolescents in pre-contemplation and contemplation used these processes less than those in more advanced stages of change. Especially, adolescents in the action and maintenance stages used these processes more habitually as compared with those in preparation.

Using the criteria ($\eta 2$) a large effect size observed for conscious raising, helping relationships, and counter-conditioning. Medium effect sizes were noted for environmental reevaluation, reinforcement management, and stimulus control, Dramatic relief and self reevaluation yielded large effect sizes.

TABLE I
MANOVA AND TURKEY POST-HOC FOLLOW-UP ANALYSES RESULTS FOR PROCESS OF CHANGE

Process of Change	Stages of Exercise Behavior							
	PC	C	P	A	M	F (4,666)	η^2	Turkey's HSD[1]
Cognitive Process								
Conscious raising[a]	2.46 (1.02)	2.46 (.99)	2.46 (.91)	2.69 (1.00)	2.89 (1.01)	4.55***	.21	PC,C,P<M
Dramatic relief[c]	2.53 (.98)	2.55 (.95)	2.59 (.88)	2.69 (.86)	2.76 (.91)	1.43	.09	
Environmental reevaluation[b]	2.53 (1.07)	2.54 (1.02)	2.54 (.89)	2.80 (1.00)	2.92 (1.02)	2. 49*	.12	PC,C,P<A,M
Self reevaluation[c]	3.21 (1.03)	3.19 (.98)	3.20 (1.04)	3.40 (.96)	3.46 (.95)	1.83	.03	
Behavioral Process								
Helping relationships[a]	2.64 (1.20)	2.74 (1.21)	2.84 (1.22)	3.13 (1.02)	3.15 (1.18)	3.76**	.22	PC,C,P<A,M
Reinforcement management[b]	3.06 (1.00)	3.14 (1.01)	3.14 (1.11)	3.38 (.87)	3.41 (1.05)	2.66*	.16	PC,C,P<A,M PC<A
Stimulus control[b]	2.21 (1.10)	2.38 (1.07)	2.41 (.90)	2.68 (1.02)	2.76 (1.00)	2.52*	.15	PC,C,P<M PC,C<A
Counter-conditioning[a]	2.30 (1.03)	2.37 (.98)	2.38 (.95)	2.69 (.82)	2.82 (1.00)	3.52**	.21	PC,C,P<A,M

*P<.05; **P<.01; ***P<.001.
[a]Large effect size; [b]Medium effect size; [c]Small effect size
[1]Mean differences for the Turkey HSD pairwise comparisons (p<.05).
Parentheses are standard deviations.
PC:Precontemplation; C:Contemplation; P:Preparation; A:Action; M:Maintenance.

IV. DISCUSSION

The purpose of the present study was to test the effectiveness of cognitive and behavioral processes of change of the TTM to understanding physical activity change among the secondary school students in Korea. A small number of studies have applied the TTM to examine stage of physical activity change among adolescents. Moreover, available data based on the TTM have been mostly conducted in the western countries. However, the same level of research has not been focused on the Korean adolescent populations.

The study identified that physical inactivity of Korean adolescents could seriously affect their health status in the future, considering the findings that overall 66.2% of the sample reported being inactive (pre-contemplation or contemplation) or exercise irregular (preparation). These findings agree with previous studies. The high rates of physical inactivity among Korean adolescents might be extensively caused by the social and environmental limitations such as a lcm of available facilities and times for exercise, a social context neglecting exercise and Physical Education, and excessive schoolwork due to dominance of academic-centered curriculum.

In addition, male adolescents showed a high proportion in the maintenance stage, whereas a high proportion of females were in contemplation as compared with their counterparts. This finding is not surprising in light of the consistent relationship between gender and exercise behavior. There was approximately a 21% difference in the proportion of male and female adolescents in the maintenance stage and 22% in contemplation. This finding was supported by one study, demonstrating that males were significantly more likely to be in the action or maintenance stages compared with their female counterparts.

The present study showed significant differences in the use of cognitive and behavioral processes of change, with a clear indication of increased use of processes associated with advancing stage. These findings are similar to those found by previous studies. The use of cognitive strategies increased from pre-contemplation through maintenance. As demonstrated by the Turkey's hoc test, significant differences across stages of exercise behavior were observed in conscious raising and environmental reevaluation. In the cognitive processes, conscious raising was the best discriminator among all stages of exercise behavior. This finding indicates that many adolescents seek new information about exercise. In addition, adolescents in pre-contemplation, contemplation and preparation used environmental reevaluation less than those in action and maintenance. This result can be interpreted that adolescents who have no intention to initiate exercise or exercise irregularly give little thought to how their inactivity affects their social and environment.

For the behavioral strategies, the overall sub variables of the behavioral processes seemed to be more stable to exercise behavior change, and increased from pre-contemplation thorough maintenance. These findings indicate that behavioral strategies are important in exercise adoption and maintenance. All four strategies had statistically significant effect sizes, especially helping relationship and counter-conditioning showed the high effect sizes. This finding implies that as adolescents become more active, they seem to give more become more active, they seem to have more significant other who encourage them to consistently

maintain exercise habits, and are able to substitute sedentary behaviors more easily with physical activity.

There are a number of issues that need to be considered in understanding the implications of the findings obtained from the present study. This study adopted only gender as the demographic factors which can possibly affect exercise behavior change of the adolescents. Hence, it cannot identify the potential influence of other demographic factors such as age, family income and parent education on adolescent's exercise behavior change.

The primary focus of this study was to explore the stages of exercise behavior change. The primary focus of this study was to explore the stages of exercise behavior in the Korean adolescents and the possible impact of processes of change constructs on the exercise stage. Therefore, interaction effects between stages of exercise behavior and demographic factors have not been considered.

A potential limitation is that the behavioral and psychological questionnaires used in the study rely on the self-report format. The results, therefore, may be subject to self-report bias, resulting in some unspecified amount of misclassification as to the respondent's actual state of readiness. However, population –based interventions must rely on self-report to a large extent since there is frequently no direct contact between the subject and the investigator. The accuracy of self-report has been extensively investigated in the area of health-related behaviors, where it has been found to be very accurate.

In spite of such methodological limitations, the findings of this study offer the first evidence suggesting the possibility of TTM to explaining Korean adolescents' exercise behavior. This study provides much needed information about Korean adolescents in terms of their exercise behavior and aspects of the processes of change constructs which relate directly to exercise behavior change. Furthermore, the present study provides starting points for interventions aimed at increasing physical activity levels, and a baseline level from which to evaluate these interventions.

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