

ORIGINAL ARTICLE

Analysis of Social Cognitive Theory in predicting Physical Activity Among Adolescents in Depok City, West Java Province, Indonesia: Structural Equation Modeling Approach

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ABSTRACT

Introduction: The proportion lack of physical activity (PA) among adolescents worldwide is increasing. Many studies have analyzed the behavioral determinants of PA among adolescents, but research that analyzes the relationship of all determinants in a conceptual framework is still limited. Social Cognitive Theory (SCT) is one of the concepts that is used as the basis for developing interventions to increase PA in the population. The purpose of this study was to examine the direct and indirect effect of SCT constructs on PA among adolescents in Depok City. **Methods:** A cross sectional study was conducted. A total of 351 high-school students (aged 14-19 years) completed the questionnaire. The PA level was measured using the Three-Day PA Recall (3DPAR) questionnaire and the data obtained were converted into METs using the Youth Compendium of Physical Activities. Structural Equation Modelling (SEM) was applied to analyze the relationship between SCT variables and PA in adolescents. **Results:** Self-efficacy had positive effects on outcome expectation ($\rho=0.880$, P-value 0.000), self-regulation ($\rho=0.243$, P-value 0.000), social support ($\rho=0.910$, P-value 0.000) and PA ($\rho=0.489$, P-value 0.000). Self-efficacy had negative effect on perceived barriers ($\rho=-0.919$, P-value 0.000), Outcome expectation had positive effects on PA ($\rho=0.919$, P-value 0.000) and self-regulation ($\rho=0.137$, P-value 0.026). Self-regulation had positive effect on PA ($\rho=0.188$, P-value 0.004). Social support had positive effect on self-regulation ($\rho=0.320$, P-value 0.000). Perceived barriers had negative effect on self-regulation ($\rho=-0.248$, P value 0.003). **Conclusion:** Self-efficacy had the strongest effect on PA, but did not have indirect effect on PA through outcome expectations and self-regulation.

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INTRODUCTION

Globally in 2016, 81% of adolescents aged 11-17 years did not participate in at least 60 min of moderate-to-vigorous physical activity (PA) on 3 days per week. A previous study by Guthold et al, on 1.6 million adolescents from 146 countries, reported that 4 out of 5 teenagers did not engage in PA for at least 60 minutes per day (1). In Indonesia in 2018 the prevalence lack of PA increased to 33.8% from 26.1% in 2013 for population group aged ≥ 10 years (2,3). In West Java Province, adolescents aged 10-14 years had a prevalence of physical inactivity of 68.95% and 54.30% in the 15-19-year age group.

There is a decrease in vigorous PA of about 7% annually between the stages of child and adult development, and a decrease in moderate PA of 6% annually over the same period (4). The decrease in PA during the transition stage from child to adolescent is caused by changes in beliefs about barriers to PA and changes in self-efficacy to overcome these obstacles as well as changes in perceptions of social support from parents and friends (5).

Based on data released by The Lancet, lack of PA is one of the leading risk factors of mortality and morbidity related to non-communicable diseases (6). Lack of PA contributes to 1.6 million deaths annually (7). Health problems caused by physical inactivity in adolescents and adults are estimated to cost around \$67.5 billion in lost productivity and medical expenses (8).

Several studies have been conducted to examine the determinants or factors that influence PA among adolescents. Support and influence of parents and friends are positively related to PA behaviour in adolescents (9,10). Perceived barriers such as lack of time, feeling lazy, tired and lack of confidence in body image become a challenge for adolescents in carrying out PA. Besides that, environmental conditions and facilities also affect adolescents in carrying out PA (11–13). A systematic review conducted in China also concluded that self-efficacy was the most important predictor for adolescents in determining PA (14).

There have been many studies that examined the determinants of PA in adolescents, but research that analysed the relationship of all determinants in a conceptual framework is still limited. One of the important steps in developing an effective PA enhancement intervention is to understand the relationship and interaction of all the determinants that influence PA behaviour within a conceptual framework (15). Interventions based on behavioural theory have been shown to be more effective (16).

Social cognitive theory (SCT) is a model that integrates personal, behavioural and environmental factors that can be used to understand health behaviour (17). SCT is the most widely used and accepted concept as a model for understanding PA behaviour (18). This concept is also often used as the basis for developing an intervention to increase PA in a population, although the results obtained are not always consistent (19,20). The SCT framework emphasizes the determinants of self-efficacy, outcome expectations, self-regulation, and environmental factors in explaining the occurrence of a behaviour (21). The relationship between these determinants is considered to be able to explain the behaviour of PA in adolescents, either directly or indirectly through the mediation process (22). The purpose of this study was to analyse the direct and indirect effect of Social Cognitive Theory constructs on adolescent's involvement in PA in Depok City, Indonesia.

MATERIALS AND METHODS

Study Population

The cross-sectional study was carried out from December 2021 to May 2022 in 14 high schools in Depok City, West Java Province, Indonesia. These schools were randomly selected based on clusters representing each sub-district in Depok City. The research was conducted after obtaining permission and approval from the Ethics Commission and the West Java Education Office. Researchers distributed questionnaire using Google Form link. In this questionnaire, the researcher has included an explanation of how to fill out the questionnaire along with a phone number that can be contacted if there are things the respondent wants to ask. A total of 351 students (aged 14-19 years)

completed the questionnaire themselves after providing approval from teachers and parents as well as filling in informed consent.

Variable Measure

To measure the amount of PA carried out by adolescents, researcher used Three Day Physical Activity Recall (3DPAR) instrument developed by the University of South Carolina (23). 3DPAR is a self-report instrument adapted based on the Previous Day Physical Activity Recall (PDPAR) questionnaire. This instrument divides 1 day (24 hours) into 34-time blocks per 30 minutes from 07.00 to 24.00 thus minimizing memory bias and ensuring accurate recording of PA. The amount of physical activity reported by respondents were converted into METs using the Youth Compendium of Physical Activities. Outcome expectations and perceived barriers were measured with a questionnaire that has been developed by L. Robbins et al (24). The questions have been tested for validity and reliability. Indicators for measuring outcome expectations consist of 10 statements with a 4- point Likert scale (1=strongly disagree to 4=strongly agree). The indicator for measuring perceived barriers consists of 9 statements with a 4-point Likert scale (1=not at all true to 4=very true).

The 13-item questionnaire developed by Abasi et al (25) was used to assess self-efficacy, with a 5-point Likert scale (1=strongly disagree to 5=strongly agree). Items to measure self-regulation were taken from a questionnaire developed by Rovniak et al. (26). This questionnaire consists of statements with a 5-point Likert scale (1=not all true to 5=very true). Questions to measure parental support are adapted from a questionnaire developed by Robbins et al. (27). This questionnaire consists of 8 statements with a 4-point Likert scale (1=never to 4=often). Questions to measure peer support were adapted from a questionnaire developed by Sallis et al. (28) with a total of 8 statements and a 4-point Likert scale (1=never to 4=often).

Statistical Analysis

This study used Structural Equation Modelling (SEM) analysis. SEM is a second-generation multivariate statistical analysis technique to simultaneously analyse complex models and relationships between several independent and dependent variables and is used to confirm or develop a model or theory (29). The software used in data analysis is Smart-PLS3.0.

First, Measurement model was conducted to describe the relationship between latent variables and indicators through validity and reliability test. The validity test consists of convergent validity by looking at the loading factor value (recommended value >0.7) and Average Variance Extracted (AVE) value (recommended value >0.5) and discriminant validity by looking at the results of cross loading. It meets discriminant validity if the

value of the cross loading indicator on the variable is the largest compared to other variables (29). The reliability test is seen by looking at the value of Cronbach's alpha and composite reliability (recommended value > 0.7).

Second, the direct and indirect relationship of the variables were examined using structural model. The parameters in structural model were estimated using coefficient of determination or goodness of fit (R^2), cross-validated redundancy (Q^2) and path coefficient. The values of R^2 and Q^2 are used to measure the variance in the dependent variable and have a range of 0-1 with a higher value indicating a higher ability to explain the variable. To see the direct and indirect effects, the bootstrapping method was used. The effect is seen through the coefficient and is stated to be significant with t-statistic > 1.96 and P value < 0.005.

Ethical clearance

This study was approved by Medical and Health Research Ethics Committee (MHREC) Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada No. KE/FK/1021/EC/2021.

RESULTS

Descriptive Statistic

Three hundred and fifty-one high school students participated in the study. The characteristics of the respondents are shown in Table I. Most of the respondents are aged 16-17 years (69.23%) and male (64.67%). Respondents with a BMI less than normal 32.76%, overweight 11.11% and obesity 2.85%.

The descriptive statistics of social cognitive theory constructs and physical activity are presented in Table II. The results show that the mean score of self-efficacy for carrying out activities in adolescents has the highest value, namely 2.85, which is the same as the mean score of self-regulation. Respondents also recognized higher social support with the mean score 2.34 compared to the obstacles they felt in carrying out physical activity with the mean score 2.26.

The Measurement Model

We evaluated convergent validity from the loading factor on the latent variable with its indicators. All the loading factor of self-efficacy, outcome expectation, social support, perceived barriers, self-regulation and PA ranged from 0.70-0.90 ($P < 0.005$) as presented in Figure 1, which confirmed the convergent validity of the indicators (35). Convergent validity can also be assessed from AVE value. Self-efficacy with AVE value 0.623, outcome expectation 0.585, social support 0.553, perceived barriers 0.628, self-regulation 0.552 and PA 0.566. All variables had AVE value > 0.5 which indicates that all variables are valid because they can explain more than 50% of the indicator variance (30).

Table I: Demographic Characteristic of Respondents

Characteristic Variable	N	Percentage
	351	%
Gender		
Female	124	35.33%
Male	227	64.67%
Age (year)		
14 – 15	78	22.22%
16 - 17	243	69.23%
18 - 19	30	8.55%
Height (cm)		
110 -130	3	0.85%
131 – 151	36	10.26%
152 – 172	42	11.97%
173 - 193	270	76.92%
Weight (kg)		
30 – 60	269	76.64%
61 – 91	81	23.08%
92 – 122	1	0.28%
BMI		
< 18.5	115	32.76%
18.5 – 24.9	187	53.28%
25.0-29.9	39	11.11%
≥ 30	10	2.85%

Table II: Descriptive Statistics of Social Cognitive Theory Constructs and Physical Activity Among Participants (N = 351)

Variable	IND	CR	Mean (SD)	Range
SE	13	0.955	2.85 (0.99)	1 - 5
OE	10	0.934	2.66 (0.81)	1 - 4
SC	16	0.952	2.34 (0.90)	1 - 4
BAR	9	0.938	2.26 (0.92)	1 - 4
SR	10	0.925	2.85 (0.89)	1 - 5
PA	6	0.886	1.35 (0.48)	1 - 2

Note: SE: self-efficacy; OE: outcome expectation; SC: social support, BAR: barriers; SR: self-regulation; PA: physical activity; IND: number of indicators; CR: composite reliability; SD: standard deviation

The reliability test showed that self-efficacy had Cronbach's Alpha (α) 0.949 and Composite Reliability (CR) 0.955, outcome expectation $\alpha = 0.921$, CR=0.934, perceived support $\alpha = 0.946$, CR=0.952, perceived barriers $\alpha = 0.926$, CR=0.938, self-regulation $\alpha = 0.910$, CR=0.925, and physical activity $\alpha = 0.846$, CR=0.886. All variables had Cronbach's alpha and composite reliability more than 0.7 which confirmed the internal consistency reliability.

The Structural Model

The structural model was tested with all the paths depicted in Figure 1. Coefficient of determination (R^2) indicated that the model's predictive accuracy is good ($R^2 > 0.75$). Outcome expectation had $R^2 = 0.774$, social support $R^2 = 0.828$, perceived barriers $R^2 = 0.845$, self-regulation $R^2 = 0.842$, and PA $R^2 = 0.825$.

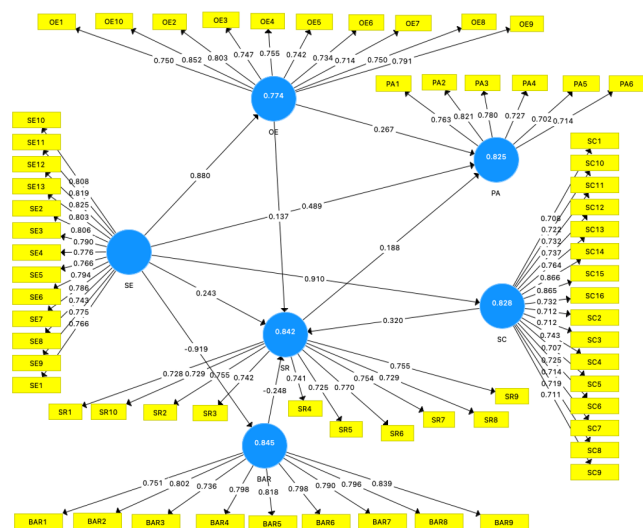


Figure 1: Outer Model The Analysis of the Measurement Model for Validity and Reliability Test of Latent Variables and Their Indicator

Cross-validated redundancy (Q^2) for outcome expectation, social support, perceived barriers, self-regulation and PA ranged 0.425-0.531. The value of Q^2 in all variables has a value > 0.35 indicates that the independent variable has relatively large predictive relevance for the dependent variables. The model was also a good fit to the data: NFI = 0.829, SRMR = 0.038. As presented in Figure I, all direct paths were significant. Self-efficacy had positive effect on outcome expectation ($\rho=0.880$, t-statistic= 79.346, P-value 0.000), self-regulation ($\rho= 0.243$, P-value 0.000, t-statistic 3.995), social support ($\rho=0.910$, P value 0.000, t-statistic 96.722) and PA ($\rho=0.489$, P value 0.000, t-statistic 5.390). Self-efficacy had negative effect on perceived barriers ($\rho=-0.919$, P value 0.000, t-statistics 92.095). Outcome expectations had positive effect on PA ($\rho=0.919$, P value 0.000, t-statistics 4.525) and self-regulation ($\rho=0.137$, P value 0.026, t-statistics 2.238). Self-regulation had positive effect on PA ($\rho=0.188$, P value 0.004, t-statistic 2.897). Social support had positive effect on self-regulation ($\rho=0.320$, P value 0.000, t-statistic 4.564). Perceived barriers had negative effect on self-regulation ($\rho=-0.248$, P value 0.003, t-statistic 2.985).

The indirect effects from self-efficacy, social support and outcome expectation were also presented in Table III. Self-efficacy has an indirect effect on physical activity through outcome expectations ($\rho=0.235$, P value <0.05), self-regulation ($\rho= 0.046$, P value <0.05), social support and self-regulation ($\rho=0.055$, P value <0.05). The indirect effect between other variables was not significant.

DISCUSSION

This study investigated the direct and indirect effects of SCT construct (self-efficacy, outcome expectation, social support, perceived barriers and self-regulation) on

Table III: The Indirect Effects of Social Cognitive Theory Construct on Physical Activity Among Adolescents in Depok City

Indirect Effects			Coefficients
Self-Efficacy	→ Outcome Expectation	→ PA	0.235**
Social Support	→ Self-Regulation	→ PA	0.060*
Self-efficacy	→ Social Support → Self-Regulation	→ PA	0.055*
Social Support	→ Self-Regulation	→ PA	-0.047
Self-efficacy	→ Barriers → Self-Regulation	→ PA	0.043
Outcome Expectation	→ Self-Regulation	→ PA	0.026
Self-efficacy	→ Outcome Expectation → Self-Regulation	→ PA	0.023
Self-efficacy	→ Self-Regulation	→ PA	0.046*

Note. PA = PA
* $p < 0.05$, ** $p < 0.01$

physical activity among adolescents in Depok City using structural equation modelling. The results identified that the proposed structural model fits the data and all paths presented in Figure I were significant.

Self-efficacy had positive effect on outcome expectations, self-regulation and social support and PA. Adolescents with high self-efficacy are more likely to have greater outcome expectations so that their attractiveness becomes a strong motivation resulting in higher levels of PA engagement. Outcome expectations had positive effect on adolescent PA improvement even though the effect is relatively small 26.7%. Previous studies that examined the effect of social cognitive theory constructs on adolescents PA reported similar results (31,32). Outcome expectations reported by adolescents from PA behaviour can be in the form of physical health or perceived social benefits such as improving appearance and having fun with friends (33). Adolescents will imagine the results or benefits of PA if they believe they have the ability (self- efficacy) to perform the behaviour. On the other hand, if they do not believe that they have the ability to perform physical activity, then they will not imagine the positive results of that behaviour.

Self-efficacy had positive effect on self-regulation in adolescents. This shows that with the increasing self-efficacy of adolescents, their ability to have self-regulation is also higher. The results obtained in this study are in line with several other studies. In their study, Liu J et al. (32) found that self-efficacy has a significant effect on self-regulation in adolescents in China by 20%. Research conducted by Lee et al. (34) also shows the results that self-efficacy had positive effect on self- regulation of adolescents in Korea although the effect is greater 58%. The intervention carried out by Matthews et al. (35) on adolescent PA at school through improving self-regulation techniques (self-observation, self-judgment and self-evaluation) has been shown to increase moderate-to-vigorous PA. Adolescents who have high self-efficacy will be motivated to set goals and decide to do physical activity. The result also concluded

that self-efficacy had positive effect on social support. This is in line with research conducted by Lee et al. (34) on adolescents in Korea. Different things were obtained by Liu J et al. (32) who found that self-efficacy not only affects the perception of adolescent social support but also vice versa that the perception of social support has a positive effect on self-efficacy in China.

The interaction between self-efficacy and social support is called a compensatory interaction where these two components will complement each other's shortcomings (36,37). Adolescents who have low self-efficacy need the support of friends to improve their PA behaviour. However, the lack of peer support does not negatively affect adolescents who already have high self-efficacy. This means that high self-efficacy can compensate for low peer support but high peer support can only partially help against low self-efficacy. The combination of increasing self-efficacy and peer support will produce a better effect on adolescents with low self-efficacy (38).

In this study, it was also found that self-efficacy had a negative effect on perceived barriers. This means that the higher self-efficacy of adolescents, the lower their perceived barriers in carrying out PA. Individuals with low self-efficacy often perceive difficulties as greater than they actually are, which can cause stress and anxiety. While individuals with high self-efficacy are more likely to see difficult activities as challenges and have a calm feeling in doing these tasks (39). The results of this study are in line with those obtained by Dishman et al. (40) that a decrease in adolescent self-efficacy has an effect on increasing perceived barriers to physical activity. Research conducted by Lee et al. & Ishak et al. (33,41) shows that adolescents have lack of physical activity because they feel that a lot of energy and time is spent on doing assignments after coming home from school or taking additional courses. In addition, the use of digital media such as the internet, television and video games are one of the causes of lack of motivation in engaging in physical activities (41–43).

The next result obtained in this study is that outcome expectation had positive effect on self-regulation and physical activity. This means that the higher the adolescent's outcome expectation, the higher the self-regulation ability in performing physical activity. It was also found that self-regulation had positive effect on adolescent physical activity behaviour. In another study, it was also found that adolescents were more motivated in setting targets for physical activity if their outcome expectations were greater than the perceived barriers to physical activity (34). A similar study was also conducted by Liu J et al. (32) who found that adolescents in China who have high outcome expectations tend to have high self-regulation in setting targets. Self-regulation has been shown to be an important factor in initiating and sustaining physical activity behaviour (44). The same results were also obtained by Matthews et al. (35),

interventions carried out on self-regulation can increase adolescent participation in physical activity. Researchers provide training in self-regulation techniques in target setting and self-monitoring. In this study, it was seen that adolescents who received training reported doing more physical activity than adolescents who did not receive training.

The next result obtained in this study is that social support had positive effect on self-regulation and conversely the perception of obstacles had negative effect on self-regulation of adolescents in carrying out physical activities. The same result was obtained by Oyibo et al. (45) in their research on the effect of cognitive social determinants on adolescent physical activity in North America. Social support has been shown to have a significant effect on adolescent self-regulation in carrying out physical activities. Similarly, the results of research conducted by Liu J et al. (32) predicting the behaviour of physical activity of adolescents in China in the SCT framework. From the results of data analysis, it was found that the support of parents and friends affects self-regulation of adolescents in carrying out physical activities. SCT explains that social support can be a determining factor in adolescent physical activity (46). The decision-making process in adolescents to increase physical activity such as starting, continuing and stopping is influenced by social support (47). Adolescents who get support from parents and friends to do physical activity have a higher likelihood of doing moderate physical activity 5 or more days per week and doing vigorous physical activity 3 or more days per week (9). This parental support can help adolescents to develop the right attitudes and values and motivate them to be more involved in physical activity (48). Peer support also has a strong influence on adolescent behaviour to initiate, maintain or neglect physical activity (49).

Based on research conducted by Boraita et al. (50) in Spain, it was found that the obstacles experienced by adolescents in carrying out physical activities were the absence of an adequate environment, not being involved in extracurricular sports activities and not being confident with body image. In addition, teenagers also mentioned that they did not have time to do physical activity because of the many assignments from school that had to be done.

This study has several limitations. Data collection on the amount of physical activity in this study used the self-reported method or measured subjectively. The number of questions that need to be answered by respondents is quite a lot. This can lead to the possibility of recall bias or response bias. However, Researchers used Three Day Physical Activity Recall (3DPAR). This instrument divides 1 day (24 hours) into 34 time blocks per 30 minutes from 07.00 to 24.00 to minimize memory bias and ensure the accuracy of recording of physical activity. Researchers also used compendium adapted from

Western country literature because researchers have not found compendium literature in Asian countries. There are activities that are not listed such as “prayer” so the researcher uses conversions from other literature.

CONCLUSION

There is a significant direct effect between the variables contained in the framework of social cognitive theory on physical activity. Self-efficacy has a significant direct effect on the behaviour of adolescent physical activity, but does not have an indirect effect through perceived barriers and outcome expectations of physical activity. The SCT framework can be an effective model framework to understand the behavioural determinants of adolescent physical activity. In future research, it is hoped that this framework can also be used in predicting other health behaviour.

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