

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/336367473>

Application of the Transtheoretical Model (TTM) to exercise behaviour among Macedonian college students

Article in *Journal of Human Sport and Exercise* · September 2020

DOI: 10.14198/jhse.2020.153.19

CITATION

1

READS

79

3 authors, including:



Gresa Elezi

University of Prishtina

9 PUBLICATIONS 3 CITATIONS

[SEE PROFILE](#)



Seryozha Gontarev

Ss. Cyril and Methodius University

109 PUBLICATIONS 189 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



СТРУКТУРА И РАЗВОЈ НА АНТРОПОМЕТРИСКИТЕ, МОТОРИЧКИТЕ, ФУНКЦИОНАЛНИТЕ ДИМЕНЗИИ И СОСТОЈБАТА НА ПОСТУРАЛНИОТ СТАТУС КАЈ УЧЕНИЦИТЕ ОД ДВАТА ПОЛА НА ВОЗРАСТ ОД 6 ДО 14 ГОДИНИ ОД ОСНОВНИТЕ УЧИЛИШТА ВО ОПШТИНА КИСЕЛА ВОДА [View project](#)



Gender differences in loosing weight [View project](#)

Application of the Transtheoretical Model (TTM) to exercise behaviour among Macedonian college students

ABDULLA ELEZIM¹, GRESA ELEZI² , SERYOZHA GONTAREV³, GEORGI GEORGIEV³

¹Faculty of Physical Education and Sport, University of Pristina, Kosovo

²American Hospital, Pristina, Kosovo

³Faculty of Physical Education, Sport, and Health, Ss. Cyril and Methodius University, Skopje, Republic of North Macedonia

ABSTRACT

Background: This study examined the applicability of trans-theoretical model (TTM) to understand exercise behaviour among students in University "St. Cyril and Methodius" in Skopje. **Methods:** A cross-sectional descriptive study was conducted. The dependent variables analysed were exercise self-efficacy expectation, decisional balance (pros and cons), social support for physical activity and exercise enjoyment. The independent variable was stage of exercise behaviour change. 1066 students representing various disciplines on campus completed a valid and reliable questionnaire during regularly scheduled classes. More than 67 percent of sample were sedentary (pre contemplation, contemplation, or preparation) whereas 17,6% were in the action stage (regularly active < 6 months) and 14,9% were in the maintenance stage (regularly active > 6 months). **Results:** All of the TTM constructs differed significantly across exercise stages. Students who are in the action and maintenance stage show greater self-efficacy, social support from parents and peers, and they receive greater benefit from physical activity, compared to students who are in the pre-thinking and thinking stage. In addition, students who are in the action and maintenance stage, enjoy physical activity more than students who are in the pre-thinking stage. Students who are in the stage of preparedness show greater self-efficacy than students who are in the pre-thinking and thinking stage and they receive greater social support from parents and peers, compared to students who are in the pre-thinking stage. **Conclusion:** Results supported the use of the entire TTM in examining exercise behaviour among college students.

Keywords: Trans-theoretical model; Exercise behaviour; Student.

Cite this article as:

Elezi, A., Elezi, G., Gontarev, S., & Georgiev, G. (2020). Application of the Transtheoretical Model (TTM) to exercise behaviour among Macedonian college students. *Journal of Human Sport and Exercise*, 15(3), 706-717. doi:<https://doi.org/10.14198/jhse.2020.153.19>

 **Corresponding author.** American Hospital, Industrial Zone. 10000 Prishtinë, Kosovo.

E-mail: gresaelezi@hotmail.com

Submitted for publication July 2019

Accepted for publication September 2019

Published September 2020 (*in press* October 2019)

JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

© Faculty of Education. University of Alicante

doi:10.14198/jhse.2020.153.19

INTRODUCTION

The World Health Organization in all its acts indicates the importance of physical activity in the preservation of health, especially in the procedures for the prevention and treatment of chronic diseases (WHO, 2004). Numerous scientific-professional studies emphasize the casual relation between physical activity, physical fitness and the health of the individual (Mišigoj-Duraković, 2008). The indicated studies point out causes such as: insufficient physical activity, sedentary lifestyle, inadequate nutrition, increased body weight, cigarette smoking, alcohol and drug consumption, and the increasingly present eating disorder which is manifested through anorexia or bulimia. The studies so far emphasized the problem of insufficient physical activity and propensity to risky behaviours, especially among the student population (Mandac et al., 2001; Kuzman et al., 2004; Huddleston et al., 2002). Students are a part of the population of young people who are getting ready for an important role in social life. As academically educated people, with their knowledge and experience, they will influence the future generations of children and youth. The sharp decline in physical activity is particularly expressed in the period of adolescence (15-19 years) and in young age categories (20-25 years), which puts students in the risk group (Wallace et al., 2000; Han et al., 2017; Jahan et al., 2017; Liu et al., 2018).

The theoretical conception that this research rests on is the trans-theoretical model. The point of departure in the trans-theoretical model is the fact that the change in behaviour progresses through five stages (levels of motivational readiness for change), as follows: pre-thinking stage (the individual does not intend to change his/her behaviour in the near future), thinking stage (the individual thinks there is some problem), readiness stage (the individual may have set a goal to change), action stage (the individual has changed his/her behaviour in the last 6 months) and maintenance stage (the new behaviour is automated, the individual feels good, and invests less conscious effort) (Prochaska and DiClemente, 1982, 1984). During this process, the individual often moves forward and backward through these stages, before reaching the last level, the maintenance stage (automation of the behaviour). Therefore, the stages of change would be better described as spiral or cyclic rather than linear. In this model, people use different processes of change as they move from one stage to another. According to this theory, the intervention is directed to correspond to the appropriate stage or to a particular individual (the intervention is specific to each stage or individual). Changes that take place step by step, progressing from one stage to another, will have a greater effect than direct encouragement of the person to engage in action.

The trans-theoretical has a multidimensional foundation because it also includes other components such as: movement through the separate stages, cognitive-affective and behavioural changes, decision-making process (for and against change), perceived self-efficacy (self-sufficiency) and successful change of the new behaviour. These constructs are conceptualized as factors that enable better understanding of the behaviour change across the five separate stages. The model is described as a trans-theoretical model because it involves several cognitive and motivational theories, such as the social learning theory, the socio cognitive theory and the theory of planned behaviour.

The aim of this study was to identify the relation between the level of physical activity and the structures of TTM. Therefore, we sought to identify the factors affecting the change in behaviour, in order to design interventions that would lead to the promotion of physical activity in a sample of Macedonian College Students.

METHODS

A sample of respondents

The survey was conducted on a sample of 1066 respondents randomly selected from several faculties within Ss. Cyril and Methodius University in Skopje. The sample consisted of 419 (39.31%) male respondents and 647 (60.69%) female respondents. The average age of the respondents of both genders was 19.3 years. The respondents were treated in accordance with the Helsinki Declaration.

A sample of variables

The data are collected using the structured questionnaire method of research. The dependent variables analysed were exercise self-efficacy expectation, decisional balance (pros and cons), social support for physical activity and exercise enjoyment.

Description of the measurement instruments

Physical Activity Stages of Change Questionnaire (PASCQ)

The PASCQ (Marcus & Simkin, 1993) scale consists of four items (questions) that determine the five stages of the student's current motivational readiness to change the physical activity habits. The answers of the questions are yes or no, and they are evaluated using the scoring algorithm. For example, a student is classified in the pre-thinking stage if he/she answered "no" to the first two questions. The student is classified in the maintenance stage if he/she answered "yes" to questions one, three, and four. The reliability of the instrument was checked with the test-retest method in the studies so far and ranges between .78 and .85, according to Marcus & Forsyth (2003). The validity of the instrument was determined by comparing direct measurements of physical activity with an accelerometer, also by comparing with other instruments for physical activity assessment, and on the basis of maximal oxygen consumption VO_{2max} , and it was satisfactory (Cardinal, 1995; Marcus & Simkin, 1993; Wyse 1995).

The Decisional Balance Scale (DBS)

The Decisional Balance scale (DBS) according to Marcus, Rakowski and Rossi (1992) is used for assessment of the perceived advantages and disadvantages (pros and cons) that can affect the behaviour change. The scale consists of 10 items and it is 5-point Likert-type scale, ranked from 1 (I completely disagree) to 5 (I completely agree). For example, the questions by which the perceived advantages were assessed: "Regular physical activity will help me get rid of stress" and a question for assessing perceived negativities: "If I am physically active regularly, I will have less time for my family and friends." The results are obtained by summarizing the items through which the perceived advantages are assessed and by summarizing the items through which the perceived negativities are assessed, and the difference between the two sums determines the balance index for and against the change.

Physical Exercise Self-Efficacy Scale (PESES)

The Exercise Self-Efficacy Scale was constructed by Schwarzer and Renner, and the measurement characteristics were checked by Brown (2005). It is used for an estimation of the self-efficacy of the respondent to engage in physical activities even though he is faced with certain difficulties (for example, bad weather, bad mood, a lot of work, etc.). The scale consists of 5 items and it is Likert-type scale, with 5 points (levels), ranked from 1 (I am sure that I can not) to 5 (I am that sure I can). The result is obtained as the average value of the answers to all 5 items. Higher score suggests that the respondent has a higher level of perceived self-efficacy to practice physical activity. The reliability (internal consistency) of the scale is approximately .87 (Cronbach- α = .87). One variable is obtained from the scale. Brown (18) found that the intercorrelation between the items was relatively good ($r = .40$ to $.76$), while the internal consistency was

excellent (Cronbach- α =.88). The validity of the scale showed moderate correlation with the intent to practice ($r = .33$) and the motivational readiness of the respondent to change the physical activity habits ($r = .39$) observed within a period of 6 months.

Exercise Enjoyment Scale

The scale which is used to assess how much the respondent enjoys physical activities, is constructed by Kendzierski & DeCarlo (1991). It is a graphic scale, with 7 points (levels), and comprises of 18 items. The result is obtained as the average value of all particles.

Measuring Social Support for Physical Activity

The scale for assessing social support from parents and peers is constructed by Sallis et al. (1987). It is a Likert-type scale, with 5 points (levels), ranging from 1 (never) to 5 (very often) (for example: "in the last three months the members of my immediate family verbally encouraged me to participate in physical activities") and it comprises of 10 items. The respondent should answer each question both about the family and about the peers/friends (in a separate column for the family and friends). The result is obtained as the average value of the answers to all items, separately for parents and friends.

Data processing methods

For all quantitative variables, the basic descriptive statistical parameters are calculated, as follows: arithmetic mean (X), standard deviation (SD), curvature ($KURT$), distribution asymmetry ($SKEW$). The normal distribution of the variables was tested with the Kolmogorov-Smirnov test. For all qualitative variables, frequencies, relative frequencies, and percentages of individual responses were calculated and χ^2 -tests were applied. In order to determine which psychosocial factors are significant in the differentiation of the respondents who have a different level of motivational readiness to change the habits for physical activity, a multivariate and univariate analysis of covariance (MANCOVA and ANCOVA) was applied with partialization of gender and age (gender and age were treated as a covariance in order to neutralize the eventual impact), and post-hoc tests were also applied (Bonferroni test). The data is processed with the SPSS statistical package for Windows Version 22.0.

RESULTS

Table 1 shows the classification of the respondents in 5 (five) categories according to their motivational readiness to change their physical activity habits. From the overview of the table it can be seen that 11.8% of the respondents are in the pre-thinking stage (respondents who are not physically active and do not even think about the need of physical activity), 43.5% of the respondents are in the thinking stage (respondents who are not physically active, however they are considering the need of physical activity), 12.1% of the respondents are in the readiness stage (respondents who are occasionally physically active or are prepared to start regular physical activity), 17.6% of the respondents are in the action stage (respondents who have been physically active for less than 6 months), 14.9% of the respondents are in the maintenance stage (respondents who are physically active for more than 6 months). The values of the χ^2 -test ($\chi^2 = 92.311$; $p = .000$) indicate that there are statistically significant differences between male and female students. The values in Table 1 show that a significantly higher percentage of male students (47.0% males versus 23.2% females) are in the action and maintenance stages, while a significantly higher percentage of female students (66.2% females versus 38.6% males) are in the pre-thinking and thinking stages.

Table 1. Classification of the respondents in 5 (five) categories, according to their motivational readiness to change the physical activity habits.

	Boys		Girls		Total		χ^2 test
PC	40	9.50%	86	13.30%	126	11.80%	92.311
C	122	29.10%	342	52.90%	464	43.50%	.000
P	60	14.30%	69	10.70%	129	12.10%	
A	93	22.20%	95	14.70%	188	17.60%	
M	104	24.80%	55	8.50%	159	14.90%	

In order to determine what psychosocial factors are important for the differentiation of the respondents who have different motivational readiness to change the physical activity habits, a multivariate analysis of covariance (MANCOVA) was applied, with partialization of gender and age. The results of the multivariate and univariate analysis of covariance and the size of the partial effect of the determinants (partial n^2) are presented in Table 2.

From the analysis of the results it is clearly observable that in the whole system of treated variables there are statistically significant differences at the multivariate level ($Q = .00$). Therefore, an analysis of the individual contribution of each variable in the definition of these differences was performed. From the overview of Table 2 one can see that statistically significant univariate intergroup differences were found in the following variables: perceived self-efficacy (self-sufficiency) ($F = 52.68$; $p = .000$), social support from the family ($F = 15.47$; $p = .000$), social support from friends ($F = 17.20$; $p = .000$), perceived advantages ($F = 14.91$; $p = .000$), the balance index ($F = 10.12$; $p = .000$) and the enjoyment in physical activity ($F = 14.91$; $p = .006$). The partial effect of the determinants partial - n^2 is ranked between .01 and .17. The greatest effect in determination of the differences is observed at the variable level (degree) of perceived self-efficacy (partial - $n^2 = .17$). The post-hoc tests have shown differences in all psychosocial factors between the pre-thinking stage and all other stages. There are also statistically significant differences in most psychosocial factors (TTM constructs) between the readiness stage and the action and maintenance stages. The differences in psychosocial factors between the maintenance and action stages are less pronounced.

Table 2. Multivariate and univariate differences in psychosocial factors among students with a different level of physical activity.

Wilks' Lambda	Rao's R	df 1	df 2	Q
0.44	10.87	40	1613	.00

Variables	PC		C		P		A		M		F	Sig.	n^2
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD			
PESES	2.94	0.94	3.29	0.84	3.58	0.88	3.92	0.80	4.15	0.93	52.68	.000	.17
SSF	2.69	0.61	2.99	0.64	2.96	0.59	3.23	0.71	3.22	0.67	15.47	.000	.06
SSP	2.65	0.58	3.04	0.71	3.06	0.70	3.26	0.71	3.28	0.72	17.20	.000	.06
PROS	13.67	3.77	15.08	3.44	14.55	3.92	16.49	2.91	16.20	3.65	14.91	.000	.06
CONS	11.89	2.85	11.90	3.30	12.37	4.07	11.58	3.50	11.31	3.51	1.81	.124	.01
DBS	1.77	4.83	3.18	5.19	2.18	6.22	4.91	5.04	4.89	5.58	10.12	.000	.04
PAE	4.12	1.23	4.43	1.39	4.56	1.40	4.70	1.57	4.70	1.47	3.63	.006	.01

Note: M = Mean; SD = standard deviation; F-ratio; Sig = statistical significant difference of F; n^2 = Partial eta-squared; PC = Stage Precontemplation; C = Stage Contemplation; P = Stage Preparation; A = Stage Action; M = Stage Maintenance.

DISCUSSION

The results of the research provide preliminary information regarding the influence and the relation of psychosocial factors with physical activity among the student population. Analyzing the obtained results and comparing them to similar intranational studies, one can come to a conclusion that 32.5% of the students are engaged in regular physical activity (respondents in the action and maintenance stage), 12.1% of the students exercise occasionally (respondents in the readiness stage) and 55.3% of the students do not exercise during their free time (respondents in the pre-thinking and thinking stage). From the data analysis, it is evident that a large percentage (76.9%) of female students do not have regular (recommended) physical activity. In a study by Keareny et al. (1999), which was conducted with respondents from 15 to 24 years of age in 15 EU member states, it was found that approximately 30% of the youth in EU member states are not engaged in any physical activity, 22% of the respondents have occasional physical activity and 46% of the respondents have a recommended level of physical activity. Zhang & Liu (2014) examined the physical activity among Chinese students and found that 57.4% of the respondents are not engaged in physical activity, 22.7% of the respondents have occasional physical activity, and 19.9% of the Chinese students are engaged in regular physical activity. Juniper et al. (2004) studied the physical activity of African-American students. The results of the research showed that 21.9% of the students are not engaged in physical activity, 32.2% of the students had occasional physical activity, and 45.9% of the students had regular physical activity. Cardinal et al. (2004) compared the physical activity among American and Finnish students and found that 38.0% of the Finnish students had no physical activity, 9.1% had occasional physical activity and 66.0% had regular physical activity. Furthermore, 12.0% of the American students had no physical activity, 12.6% had occasional physical activity, and 75.4% of American students had regular physical activity. Keating et al. (2005) studied the physical activity of 1843 Chinese students. The results of the study showed that 48.0% of the respondents were in the pre-thinking and thinking stage, 20.1% of the respondents were in the readiness stage, and 27.9% of the respondents were engaged in regular physical activity (respondents in the action and maintenance stage). Wakui et al. (2002) studied the physical activity of female students in Japan and found that 51.4% of the students had no physical activity, 39.3% had occasional physical activity, and 9.4% had regular physical activity.

The results of the research further suggest that students who are in the action and maintenance stages show greater self-efficacy (self-sufficiency), social support from parents and friends, they perceive greater benefit from physical activity, compared to students who are in the pre-thinking and thinking stage. In addition, students who are in the action and maintenance stage enjoy physical activity more than students who are in the pre-thinking stage. Students in the readiness stage show greater self-efficacy than students who are in the pre-thinking and thinking stage and they perceive greater social support from parents and friends than students who are in the pre-thinking stage.

Self-efficacy is not assessed as a personality trait, rather as a belief in one's own capabilities to coordinate knowledge and abilities to achieve the desired goal. Personal factors (cognitive, emotional and biological), factors of the environment and the behavior have an interactive influence in the model of mutual determinism (Bandura, 1997). The results of this research show that self-efficacy which is a construct of the socio-cognitive theory, is the most important determinant that physical activity among the students of both genders depends on. And the results of the other studies indicate that self-efficacy indirectly and directly affects the physical activity of young people (DiLorenzo, et al., 1998; Wu, 1999; Neumark-Sztainer et al., 2003; Chang et al., 2004; Petosa et al., 2005; Wu & Jwo, 2005; Pis, 2006; Dowda et al., 2007; Jago et al., 2007; Loucaides et al., 2007; Motl et al., 2007; Sherrick-Escamilla, 2007; Xiong et al., 2017; Rostami et al., 2017; Saeidi et al., 2018).

The social environment where physical activity takes place has a vital influence on young people. Family members, friends, teachers and coaches (trainers) can play a significant role in promoting physical activity among students. Social influence can function through various mechanisms, including encouragement, modeling of activity, joint activity and practical support. The results of our research showed that parents can affect physical activity among students of both genders. The studies conducted so far suggest that the role of parents in promoting physical activity can take various forms, such as transfer of positive attitudes and values (Iannotti et al., 2005), participation in joint activities (Stucky-Ropp & DiLorenzo 1993) organization of the activity (Stucky-Ropp & DiLorenzo 1993; Anderssen & Wold 1992), providing transportation, tangible assets, etc. (Sallis et al., 1992).

Social support from friends, and in particular the activity of the group (the number of friends who exercise), is also a very important determinant that can help increase physical activity among students. This has been confirmed in many previous studies carried out in children, pre-adolescents and adolescents (Anderssen & Wold 1992; Zakarian et al., 1994).

There are two cognitive variables that can determine the level of physical activity: perceived barriers and perceived benefits as well as their ratio. The perceived benefits have a positive influence, while the perceived barriers negatively affect the level of physical activity (Buckworth & Dishman 1999). The results of the study indicate that the level of perceived benefits is positively related to physical activity, while the perceived barriers did not have statistically significant influence in this sample of respondents.

Enjoying physical activity is also a strong predictor of physical activity among students of both genders. The concept of enjoyment is defined as a multidimensional construct that consists of factors associated with affect, competence, attitude and cognition (Crocker et al., 1995; Wankel 1997). According to Scanlan and Simons (Scanlan & Simons 1992), enjoyment is an important factor for engaging in physical and sports activity and it can contribute for an increased participation in the activity. Rowland and Freedson (1994) point out that providing a pleasant experience is a potential strategy to increase the level of physical activity in youth.

On the basis of the obtained results from this research, one can conclude that educational programs and strategies should be directed towards an increased self-efficacy (self-sufficiency, confidence in their own abilities to perform specific behaviors in certain situations), the level of perceived benefits of the physical activity, an increase of social support from the closest persons in the surrounding (parents and peers), as well as to offer students activities that they enjoy and choose themselves. According to this model, the goals, the educational programs and the strategies should be different depending on the stage of motivational readiness of the respondent for changes in physical activity habits, which can be seen from Table 3.

Although the trans-theoretical model has suffered some criticism, still it represents one of the few most important attempts to operationalize different strategies to change physical activity and other health behaviours. This leads to the conclusion that the trans-theoretical model is applicable to different types of behaviour and different populations, such as the student population, which suggests the possibility of a high level of generalization. This model, which unites many theories, is aimed at helping people to better understand, predict, and control their behaviour. The very integrative approach elevates this model beyond the limitations of individual theories and models, and in order to create a comprehensible approach to change of behaviour and habits.

Table 3. Physical activity promotion strategies in young people, depending on the phase of motivational readiness.

Phase of motivational readiness	Objective	Specific Strategy
Precontemplation	To get your client thinking about physical activity	<ul style="list-style-type: none"> - Instigating the subject to learn more about the benefit of physical activity; - Reading journals, watching videos and talking with teachers about physical activity; - Making a list of potential benefits that might prevent the examinee from commencing a physical activity, and next determining in what way are these benefits important for him/her;
Contemplation	To encourage your client to start being physical activity	<ul style="list-style-type: none"> - Instigating the subject to visit a fitness or sports club and watch other people exercise, in order to boost self-confidence, self-efficiency and intimacy; - Identifying barriers that prevent the subject from starting a physical activity (e.g. lack of time) and finding a strategy for overcome them (managing spare time etc.); - Working out a program and plan for starting with physical activity (when, where, what activity and who with); - Setting the initial goal (e.g. 5 min running) and carrying out the goal;
Preparation	To encourage your client to be regularly physical activity	<ul style="list-style-type: none"> - prompting the subject to use a log by marking the progress and the assigned goal - prompting the subject to award him/herself when the goal has been reached and the level of physical activity increased; - Placing reminders in several places, that will remind the subject to exercise (e.g. sneakers in front of the door, etc.)
Action	To help your client maintain this physical activity habit over time	<ul style="list-style-type: none"> - Identifying possible factors that may prevent the subject from doing physical activity in the future and creating a plan to overcome these factors; - Helping the subject to carry out the assigned goal;
Maintenance	To help your client prepare for only future setbacks and increase enjoyment of physical activity	<ul style="list-style-type: none"> - Consulting the subject on how to get back on track, after taking a break from physical activity; - Physical activity should always be interesting, new activities should be tried, listening to music or watching TV while exercising, exercising with someone; - Prompting the subject to promote physical activity among peers (motivating them to be physically active).

CONCLUSION

The following conclusions can be drawn on the basis of the obtained results:

- Most of the psychosocial factors (variables) more or less affect the level of motivational readiness to change the physical activity habits among students. Students who have a greater level of self-efficacy

enjoy physical activity more, who perceive greater benefit from physical activity and perceive greater social support from friends and parents, also have a higher level of physical activity.

- The results of the research suggest that the trans-theoretical model that unites many theories is applicable and it can be used in the prediction, control and change of behaviour (change in physical activity) among the student population.

DECLARATION OF CONFLICTING INTERESTS

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

- Anderssen N, Wold B (1992). Parental and peer influences on leisure-time physical activity in young adolescents. *Res Q Exercise Sport*. 63(4):341-8. <https://doi.org/10.1080/02701367.1992.10608754>
- Bandura, A (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Brown SA (2005). Measuring perceived benefits and perceived barriers for physical activity. *Am J Health Behav*. 29(2):107-16. <https://doi.org/10.5993/ajhb.29.2.2>
- Buckworth J, Dishman RK (1999). Determinants of physical activity: research to application. *Life Med*, 1016-1027.
- Cardinal BJ (1995). Behavioral and biometric comparisons of the preparation, action, and maintenance stages for exercise. *Resr Theor Pract*. (11):36-43.
- Cardinal BJ, Tuominen KJ, Rintala P (2004). Cross-cultural comparison of American and Finnish college students' exercise behavior using transtheoretical model constructs. *Res Q Exercise Sport*. 75(1):92-101. <https://doi.org/10.1080/02701367.2004.10609137>
- Chang MC (2004). Behavioral and sociocultural influences on PA among Asian-American youth. Unpublished doctoral dissertation, University of Michigan, Ann Arbor, Michigan, USA.
- Crocker PR, Bouffard M, Gessaroli ME (1995). Measuring enjoyment in youth sport settings: A confirmatory factor analysis of the physical activity enjoyment scale. *J Sport Exercise Psy*. 17(2):200-5. <https://doi.org/10.1123/jsep.17.2.200>
- DiLorenzo TM, Stucky-Ropp RC, Vander Wal JS, Gotham HJ (1998). Determinants of exercise among children. II. A longitudinal analysis. *Prev Med*. 27(3):470-7. <https://doi.org/10.1006/pmed.1998.0307>
- Dowda M, Dishman RK, Pfeiffer KA, Pate RR (2007). Family support for physical activity in girls from 8th to 12th grade in South Carolina. *Prev Med*. 44(2):153-9. <https://doi.org/10.1016/j.ypmed.2006.10.001>
- Han H, Gabriel KP, Kohl III HW (2017). Application of the transtheoretical model to sedentary behaviors and its association with physical activity status. *PLoS one*. 12(4):e0176330. <https://doi.org/10.1371/journal.pone.0176330>
- Huddleston S, Mertesdorf J, Araki K (2002). Physical activity behavior and attitudes toward involvement among physical education, health, and leisure services pre-professionals. *Colle Stu J*. 1;36(4):555-73.
- Iannotti RJ, Sallis JF, Chen R, Broyles SL, Elder JP, Nader PR (2005). Prospective analyses of relationships between mothers' and children's physical activity. *J Phys Act Health*. 2(1):16-34. <https://doi.org/10.1123/jpah.2.1.16>
- Jago R, Baranowski T, Baranowski JC, Cullen KW, Thompson DI (2006). Social desirability is associated with some physical activity, psychosocial variables and sedentary behavior but not self-reported physical activity among adolescent males. *Health Educ Res*. 22(3):438-49. <https://doi.org/10.1093/her/cyl107>

- Juniper KC, Oman RF, Hamm RM, Kerby DS (2004). The relationships among constructs in the health belief model and the transtheoretical model among African-American college women for physical activity. *Am J Health Promot.* 18(5):354-7. <https://doi.org/10.4278/0890-1171-18.5.354>
- Kang S, Kim Y (2017). Application of the transtheoretical model to identify predictors of physical activity transition in university students. *Rev Psicol Deporte.* 26(3): 6-11.
- Kearney JM, de Graaf C, Damkjaer S, Engstrom LM (1999). Stages of change towards physical activity in a nationally representative sample in the European Union. *Public Health Nutr.* 2(1a):115-24. <https://doi.org/10.1017/s1368980099000166>
- Keating XD, Guan J, Huang Y, Deng M, Wu Y, Qu S (2005). Cross-cultural validation of stages of exercise change scale among Chinese college students. *Eur Phys Educ Rev.* 11(1):71-83. <https://doi.org/10.1177/1356336x05049825>
- Kendzierski D, DeCarlo KJ (1991). Physical activity enjoyment scale: Two validation studies. *J Sport Exercise Psy.* 13(1):50-64. <https://doi.org/10.1123/jsep.13.1.50>
- Kuzman M et al. (2004). Bolesti srca i krvnih zila – rizicne navike u djece i mladih. *Medix* 56/57, 73-7.
- Liu KT, Kueh YC, Arifin WN, Kim Y, Kuan G (2018). Application of Transtheoretical Model on Behavioral Changes, and Amount of Physical Activity among University's Students. *Front Psychol.* 9:2402. <https://doi.org/10.3389/fpsyg.2018.02402>
- Loucaides CA, Plotnikoff RC, Bercovitz K (2007). Differences in the correlates of physical activity between urban and rural Canadian youth. *J School Health.* 77(4):164-70. <https://doi.org/10.1111/j.1746-1561.2007.00187.x>
- Mandac V et al (2001). The influence of physical activity and knowledge nutrition on nutritional status of the twelve years old. In: International Conference EUSHM, Programme and Abstracts Book: P12, Budapest.
- Marcus BH, Forsyth LH (2003). Physical activity intervention series: motivating people to be physically active. Champaign, IL: Human Kinetics. 16-7.
- Marcus BH, Rakowski W, Rossi JS (1992). Assessing motivational readiness and decision making for exercise. *Health Psycho.* 11(4):257. <https://doi.org/10.1037//0278-6133.11.4.257>
- Marcus BH, Simkin LR (1993). The stages of exercise behavior. *J Phys Fit Sports Med.* 33(1):83-8.
- Marcus BH, Simkin LR (1994). The transtheoretical model: Applications to exercise behavior. *Med Sci Sport Exer.* (26):1400-1404.
- Misigoj Durakovic M (2008). Kinantropologija; Bioloski aspekti tjelesnog vježbanja. Kinezioloski fakultet Sveucilista u Zagrebu.
- Motl RW, Dishman RK, Saunders RP, Dowda M, Pate RR (2006). Perceptions of physical and social environment variables and self-efficacy as correlates of self-reported physical activity among adolescent girls. *J Pediatr Psychol.* 32(1):6-12. <https://doi.org/10.1093/jpepsy/jsl001>
- Neumark-Sztainer D, Story M, Hannan PJ, Tharp T, Rex J (2003). Factors associated with changes in physical activity: a cohort study of inactive adolescent girls. *Arch Pediat Adol Med.* 157(8):803-10. <https://doi.org/10.1001/archpedi.157.8.803>
- Petosa RL, Hertz BV, Cardina CE, Suminski RR (2005). Social cognitive theory variables associated with physical activity among high school students. *Int J Sports Med.* 26(02):158-63. <https://doi.org/10.1055/s-2004-821135>
- Pis MB (2006). Physical activity social support, self-efficacy, and self-definition in adolescents: A correlational cross-sectional comparative study (Doctoral dissertation).
- Prochaska JO (1984). Self change processes, self efficacy and decisional balance across five stages of smoking cessation. *Prog Clin Biol Res.* 156:131-40.
- Prochaska JO, DiClemente CC (1982). Transtheoretical therapy: toward a more integrative model of change. *Psychol Psychother-T.* 19(3):276-288. <https://doi.org/10.1037/h0088437>

- Rashidi Jahan H, Amin Shokravi F, Sanaeinasab H. Relationship Between Regular Physical Activity and Transtheoretical Model Components Among Members of Municipality Councils in Selected Districts of Tehran, *Asian J Sports Med.* 2017 ; 8(2):e13736. <https://doi.org/10.5812/asjasm.13736>
- Rostami S, Fallahi A, Pashaei T, Roshani D (2017). Association of Trans-Theoretical Model (TTM) based exercise behavior change with body image evaluation among female Iranian students. *Int J Pediatr.* 5(3):4613-23.
- Rowland TW, Freedson PS (1994). Physical activity, fitness, and health in children: a close look. *Pediatrics.* 93(4):669-72.
- Saeidi A, Mirzaei A, Mahaki B, Jalali A, Jalilian M (2018). Physical activity stage of change and its related factors in secondary school students of sarableh city: A perspective from iran. *Open access Maced J Med Sci.* 6(8):1517. <https://doi.org/10.3889/oamjms.2018.298>
- Sallis JF, Alcaraz JE, McKenzie TL, Hovell MF, Kolody B, Nader PR (1992). Parental behavior in relation to physical activity and fitness in 9-year-old children. *Am J Dis Chil.* 146(11):1383-8. <https://doi.org/10.1001/archpedi.1992.02160230141035>
- Sallis JF, Grossman RM, Pinski RB, Patterson TL, Nader PR (1987). The development of scales to measure social support for diet and exercise behaviors. *Prev Med.* 16(6):825-36. [https://doi.org/10.1016/0091-7435\(87\)90022-3](https://doi.org/10.1016/0091-7435(87)90022-3)
- Scanlan TK, Simons JP (1992). The construct of sport enjoyment. *Motiv Sport Exer,* 199-215.
- Sherrick-Escamilla S (2007). Factors affecting self-reported physical activity in children aged 10–12. Unpublished doctoral dissertation, Wayne State University, Detroit, Michigan, USA.
- Stucky-Ropp RC, DiLorenzo TM (1993). Determinants of exercise in children. *Prev Med.* 22:880–889.
- Wakui S, Shimomitsu T, Odagiri Y, Inoue S (2002). Relation of the stages of change for exercise behaviors, self-efficacy, decisional-balance, and diet-related psycho-behavioral factors in young Japanese women. *J Sport Med Phys Fit.* 42(2):224.
- Wallace LS, Buckworth J, Kirby TE, Sherman WM (2000). Characteristics of exercise behavior among college students: application of social cognitive theory to predicting stage of change. *Prev Med.* 1;31(5):494-505. <https://doi.org/10.1006/pmed.2000.0736>
- Wankel LM (1997). “Strawpersons,” Selective Reporting, and Inconsistent Logic: A Response to Kimiecik and Harris’s Analysis of Enjoyment. *J Sport Exercise Psy.* 19(1):98-109. <https://doi.org/10.1123/jsep.19.1.98>
- World Health Organization, 2004. Global strategy on diet, physical activity and health.
- Wu TY, Jwo JL (2005). A prospective study on changes of cognitions, interpersonal influences, and physical activity in Taiwanese youth. *Res Q Exercise Sport.* 76(1):1-0. <https://doi.org/10.1080/02701367.2005.10599256>
- Wu TY, Pender N (2002). Determinants of physical activity among Taiwanese adolescents: an application of the health promotion model. *Res Nurs Health.* 25(1):25-36. <https://doi.org/10.1002/nur.10021>
- Wyse J, Mercer T, Ashford B, Buxton K, Gleeson N (1995). Evidence for the validity and utility of the Stages of Exercise Behaviour Change scale in young adults. *Health Educ Res.* 10(3):365-77. <https://doi.org/10.1093/her/10.3.365>
- Xiong S, Li X, Tao K, Zeng N, Ayyub M, Peng Q, Yan X, Wang J, Wu Y, Lei M (2017). Chinese College Students' Physical Activity Correlates and Behavior: A Transtheoretical Model Perspective. *JTRM in Kinesiology.* 5: 1-11.
- Zakarian JM, Hovell MF, Hofstetter CR, Sallis JF, Keating KJ (1994). Correlates of vigorous exercise in a predominantly low SES and minority high school population. *Prev Med.* 23(3):314-21. <https://doi.org/10.1006/pmed.1994.1044>
- Zhang H, Liu P (2014). An empirical study on college students physical exercise behavior change based on the transtheoretical model. *BioTechnology: An Indian J.* 10(13): 7597-.7601.



This work is licensed under a [Attribution-NonCommercial-NoDerivatives 4.0 International](https://creativecommons.org/licenses/by-nc-nd/4.0/) (CC BY-NC-ND 4.0).