Int. J. School. Health. 2020; 7(1)
Published online 2020 January.

Research Article

The Effectiveness of an Autonomy-Based Exercise Training on Intrinsic Motivation, Physical Activity Intention, and Health-Related Fitness of Sedentary Students in Middle School

Behrouz Sfandyari[1], PhD Student; Saeed Ghorbani[1]*, PhD; Reza Rezaeeshirazi[1], PhD; Saharnaz Noohpisheh[1], MD

[1]Department of Physical Education and Sport Sciences, Aliabad Katoul Branch, Islamic Azad University, Aliabad Katoul, Iran

Corresponding author:* Saeed Ghorbani, PhD; Department of Physical Education and Sport Sciences, Aliabad Katoul Branch, Islamic Azad University, Daneshjoo Blv. Aliabad Katoul, Postal Code: 49417-93451, Golestan, Iran. **Tel: +98 17 34224500; **Fax:** +98 17 34225673; **Email:** s.ghorbani@aliabadiau.ac.ir

Received November 15, 2019; **Revised** November 25, 2019; **Accepted** December 4, 2019

Abstract

Background: Understanding how to enhance the motivation of inactive students to do physical activity is of great importance for school health. The purpose of the present study was to investigate the impact of an autonomous exercise training intervention on intrinsic motivation, physical activity intention, and health-related fitness of sedentary students in middle schools of Aliabad Katoul city, Golestan province, in 2019.
Methods: The present causal-comparative field study was conducted on 45 middle school boys (mean age: 15.08 years) who were sedentary according to Godin-Shephard Questionnaire. The subjects were randomly assigned into three groups: Choice (autonomy training), No-Choice (training without autonomy), and control (no training). Subjects in Choice and No-Choice groups practiced physical fitness items (including flexibility and endurance) for eight weeks, such that the Choice group was allowed to the chosen order of exercises while the No-Choice group was trained in a predetermined order. Intrinsic motivation and physical activity intention were measured by questionnaire and health-related physical fitness components including flexibility, upper-body endurance, and cardiovascular endurance were evaluated by standard tests. One-way and mixed analysis of variance (ANOVA) were used to analyze the data. Tukey test was also used as follow-up test.
Results: The participants in the Choice group reported higher intrinsic motivation (6.11±0.53) and physical activity intention (6.20±0.62) scores compared with other groups in post-test. Moreover, the results showed that autonomy training compared with training without autonomy and no training significantly increased intrinsic motivation ($F=36.03$, $P<0.001$) and physical activity intention ($F=36.68$, $P<0.001$). However, autonomy training did not improve physical fitness components such as flexibility ($P=0.847$), upper-body endurance ($P=0.572$), and cardiovascular endurance ($P=0.982$) more than non-autonomous training.
Conclusions: These results may indicate that the feeling of autonomy during exercise training has a greater effect on psychological components (including intrinsic motivation and physical activity intention) compared with physical components (including physical fitness).

Keywords: Autonomy, Motivation, Intention, Fitness, Sedentary students

How to Cite: Sfandyari B, Ghorbani S, Rezaeeshirazi R, Noohpisheh S. The Effectiveness of an Autonomy-Based Exercise Training on Intrinsic Motivation, Physical Activity Intention, and Health-Related Fitness of Sedentary Students in Middle School. Int. J. School. Health. 2020;7(1):40-47.

1. Introduction

The positive effects of regular physical activity on the physical and mental health of students have been well documented (1-4). Despite these positive effects, many school-age children and adolescents have a sedentary lifestyle. It has been shown that regular physical activity at school age can influence physical activity during adulthood and the public health in general (5-7). Moreover, physical inactivity is a major health challenge that can be associated with a lower quality of life (8-12). Therefore, regarding school health, it is highly important to understand how to enhance the motivation of inactive students to perform physical activities. To achieve this goal, exercise training methods for promoting the motivation of inactive individuals for participation in physical activity require further investigation.

Self-Determination Theory (SDT) is a popular theory that has long been the theoretical underpinning of research into promoting the motivation of individuals to increase their participation in physical activity and adopt an active lifestyle (13). This theory was first introduced by Deci and Ryan in the mid-1980s and developed gradually over the course of 45 years. SDT has been originated from the attention of its experts to the study of intrinsic motivation as a tool for performing different tasks and has been extensively expanded and refined by many researchers around the world (14-16). It is a theory based on experience and related to motivation, development and human health. It also focuses on the types of human motivation and distinguishes between different types

of motivation (16-18). According to SDT, there are certain distinct psychological, and social intentions that will facilitate one's growth, integration, and well-being if satisfied in interpersonal and cultural contexts associated with one's growth. Based on SDT, these essential satisfactions for personality development and cognition are referred to as basic psychological needs (13-19). There are three basic psychological needs, namely autonomy, competence, and relatedness. These basic psychological needs have three functions: 1) they indicate the movement direction of individuals; 2) they help understand how humans can thrive; and 3) understanding how these needs function helps parents, teachers, educators, administrators, and physicians determine which aspects of social context will significantly enhance one's participation and effectiveness in the environment (13-19). The focus of the present study was on autonomy.

Autonomy refers to the integrated processing of capabilities and matching these capabilities to emotions, needs, and limitations. In fact, autonomy is the need to experience freedom to perform the behavior. An autonomous person makes his own choices instead of letting his surrounding determine his actions. In fact, the need for autonomy or self-respect refers to the need to have the freedom to make decisions and become independent in performing the activities and tasks. Autonomy occurs when individuals feel that they are the cause of their behavior. When individuals act autonomously, they become more deeply involved in activities and their performance becomes more productive (13-14, 19). Autonomy is the main and the most controversial concept among the basic psychological needs that initiates and regulates one's own behavior. Among basic psychological needs, autonomy holds a special place in the literature (16, 18).

Many studies have examined the relationship between satisfying basic psychological needs and the participation of school students in physical activity and exercise. For instance, Chang and colleagues (20) examined the effect of an autonomy-supportive intervention in physical education classes on the autonomous motivation of elementary students. Their findings showed that an autonomy-supportive intervention had positive and significant effects on perceived autonomy and intrinsic motivation to perform physical activity in elementary students. Meng and colleagues (21) examined the impact of a self-determination training intervention on the motivation and physical activity of adolescent students. The results of this study showed that an intervention with autonomy approach significantly affected the autonomous motivation and physical activity level of adolescent students. White and co-workers (22) reported that leisure time physical activity was significantly associated with positive emotions in adolescent students while motivation had no positive effects on this relationship. Moreno-Murcia and Sánchez-Latorre (23) found that an autonomy-based intervention significantly increased self-esteem, intrinsic motivation, the importance of physical education and exercise, and intention to perform physical activity among adolescent students. Finally, in a meta-analysis, Lochbaum and Jean-Noel (24) showed that perceived autonomy support was significantly associated with higher psychological needs, higher internalizing processes, and positive emotions of students.

Many studies have assessed the relationship between the satisfaction of basic psychological needs (the need for autonomy in particular) and the participation of students in physical activity and exercise; however, very few have examined the effects of autonomy-based exercise training interventions on motivational and health components, especially in sedentary students. Accordingly, the objective of the present study was to investigate the effectiveness of an autonomy-based exercise training intervention on intrinsic motivation, physical activity intention, and health-related fitness in sedentary middle school students.

2. Methods

The present causal-comparative (pre-test and post-test) field study was performed on the middle school male students of Aliabad Katoul city, Golestan province, in 2019. To determine the final sample, we used simple random sampling method. Using this method, 45 male students aged 14 to 16 years (mean age of 15.08 years) were selected from three schools as study sample. These students had very low physical activity (sedentary) according to the Godin-Shephard Leisure-Time Physical Activity Questionnaire (25), in which means less than 14 during the week indicate very low physical activity. This questionnaire has been employed in previous studies to measure leisure-time physical activity and has excellent validity and reliability (25-27). The specified sample size was 45 students (15 in each group) according to GPower statistical software with an effect size of 80%, a test power of 0.8, and a significant level of 0.05 (28). Via a simple random coin-throwing method, students were randomly assigned into three groups: Choice (autonomy training), No-Choice (training without autonomy), and control (no

training) groups. Each group consisted of 15 students.

The dependent variables in the present study were intrinsic motivation to perform physical activity, intention to be physically active, and health-related physical fitness. The Sport Motivation Scale Questionnaire-2 (29) was utilized to measure the intrinsic motivation for leisure time physical activity. This questionnaire has four questions based on a Likert scale from completely disagree (1) to completely agree (7). Physical Activity Intention Questionnaire (30) was used to measure the physical activity intention. This questionnaire involves two questions assessed according to a Likert scale from completely disagree (1) to completely agree (7). Two health-related physical fitness components, namely flexibility (sit and reach test) and endurance (sit-up test for upper body endurance and step test for cardiovascular endurance and lower trunk muscles) were measured to assess the physical fitness of the students. These tests were selected because they are field-based and compatible with the conditions of the present study. The sit and reach test was employed to measure the flexibility of the participants. In this test, the subject sits on the floor under a board and places their palms in a perfectly straight and upright position. Afterwards, with the fingers fully extended, the arms are stretched upwards as far as possible. The students' score was based on the point on the board (in centimeters) where they had been able to reach their middle fingers. The sit-up test was used to measure the endurance of the upper-body muscles. In this test, the subject lies back, retracts the legs, and begins to lie down while the examiner firmly holds their legs. The number of times the students were able to move correctly within 60 seconds was considered as their score. Step test was utilized to measure cardiovascular endurance. In this test, the subject stands next to a step board at a height of 30 centimeters. Then, with the "start" sign, they begin to step up and down the step board. The students' score in this test included the number of times they stepped up and down the step board in 60 seconds. Each up and down makes a single step.

During the experiment, all participants completed the pre-test related to the research variables. Next, the training groups, Choice and No-Choice groups, were trained for 8 weeks and 3 sessions per week under the supervision of a specialist instructor. The workout days included Saturday, Monday, and Wednesday from 10 am to 10:30 am. At the beginning and end of the workout, there was a 5-minute warm-up and cool-down, which included walking, jogging and stretching. The main exercise in each session consisted of the repetition of components related to flexibility and endurance. In one training session, the training of flexibility component comprised 3 sets of a 60-second exercise of flexibility to sit and reach the board. The upper endurance exercise was comprised of 3 one-minute long sit-ups. Finally, the cardiovascular endurance component training consisted of 3 sets of a 60-second step exercise. To create a sense of autonomy during training, the students were given the freedom to select the sequence of exercises during a training session (including the selection of both components and sets). For instance, they could exercise a step endurance set, a sit-up endurance set, a flexibility set, a step endurance training set, a flexibility training set, assuming that they complete the number of sets considered in each training session. However, the participants in the No-Choice group followed the sequence already selected by the trainer. This sequence was the same for all students in the No-Choice group and included exercising all sets of endurance and flexibility throughout the 8-week training period. During the exercise, after each set, the students rested for 60 seconds. The students in the control group did not perform any exercise during the 8-week training period. To control these students, their parents were asked to cooperate with the examiner as a control tool during this time. After 8 weeks of training, all participants took the post-test and their scores were recorded for statistical analysis. The present study was performed according to the ethical considerations set out in the Helsinki Declaration and the research protocol was reviewed and approved by the University' Human Research Ethics Committee. All the participants voluntarily participated in the present study and written informed consent was obtained from the subjects and their parents.

In the present study, descriptive statistics including means and standard deviations were used to describe the research variables and charts for each variable were reported in the results section. One-way analysis of variance (ANOVA) was used to compare the means of the groups in the pre-test. To compare the pre-test and post-test scores of all groups, we made use of a 3 (GROUP: including Choice, No-Choice, and control)×2 (TIME: including pre-test and post-test) ANOVA. Tukey test was used as the follow-up test. Significance level was set at $P<0.05$.

3. Results

Mean age of the participants was 15.08 years. According to the Godin-Shephard Leisure-Time Physical Activity Questionnaire, physical activity level

of all the students was 9.62, which is very low.

Pre-Test

The results of one-way ANOVA indicated no significant difference between the groups in the pre-test regarding all research variables (Table 1). Therefore, all study groups had similar conditions prior to training.

Intrinsic Motivation

Results of ANOVA indicated significant main effect of intrinsic motivation on GROUP (F=36.03, P<0.001, η2=0.63), TIME (F=212.40, P<0.001, η2=0.83) and the interaction between GROUP×TIME (F=33.64, P<0.001, η2=0.61). According to the means of the groups (Figure 1), it was observed that the scores of Choice and No-Choice groups were improved in the post-test. The results of Tukey test showed that the Choice group had significantly higher scores compared with the No-Choice and control groups (P=0.005, P<0.001, respectively). Furthermore, the No-Choice group reported significantly higher scores than the control group (P<0.001).

Physical Activity Intention

Results of ANOVA indicated significant main effect of physical activity intention on GROUP (F=36.68, P<0.001, η2=0.63), TIME (F=173.94, P<0.001, η2=0.80) and the interaction between GROUP×TIME (F=41.61, P<0.001, η2=0.66). Means of the groups (Figure 2) showed that the scores of Choice and No-Choice groups were improved in the post-test. Results of Tukey test revealed that the Choice group had significantly higher scores in comparison to the No-Choice and control groups (P=0.018, P<0.001, respectively). Moreover, the No-Choice group reported significantly higher scores than the control group (P<0.001).

Flexibility

Results of ANOVA showed that the main effect of flexibility on GROUP (F=2.43, P=0.10) was not significant, but significant on TIME (F=9.88, P=0.003, η2=0.19). Also, there was a significant interaction between GROUP×TIME (F=3.81, P=0.030, η2=0.15). Based on the means of the groups (Figure 3), the scores of Choice and No-Choice groups were improved in the post-test. However, there was no significant difference between the groups concerning flexibility (P=0.10).

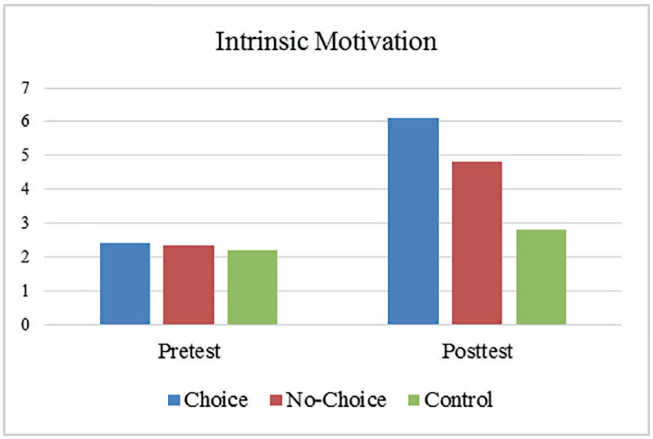

Figure 1: The figure shows the means of intrinsic motivation scores of the groups during the pre- and post-test.

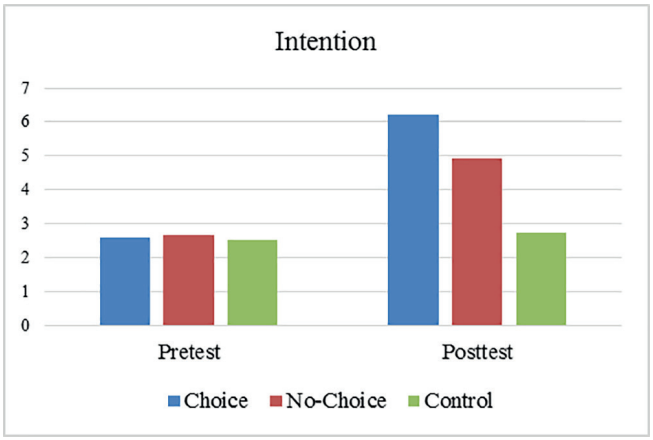

Figure 2: The figure shows the means of intention scores of the groups during the pre- and post-test.

Table 1: Comparing the mean scores of groups in the pretest

	Pretest			Statistics
	Choice	No-Choice	Control	
Intrinsic motivation	2.40±0.71	2.35±0.96	2.21±0.73	F=0.204 P=0.819
Intention	2.60±0.71	2.66±0.61	2.53±0.51	F=0.173 P=0.842
Flexibility	31.93±5.41	32.73±5.33	31.73±4.77	F=0.156 P=0.856
Sit-up	24.53±3.92	26.80±4.42	25.53±4.53	F=1.045 P=0.361
Step	51.33±10.14	50.66±8.72	47.46±8.91	F=0.743 P=0.482

Comparison of pre-test and post-test

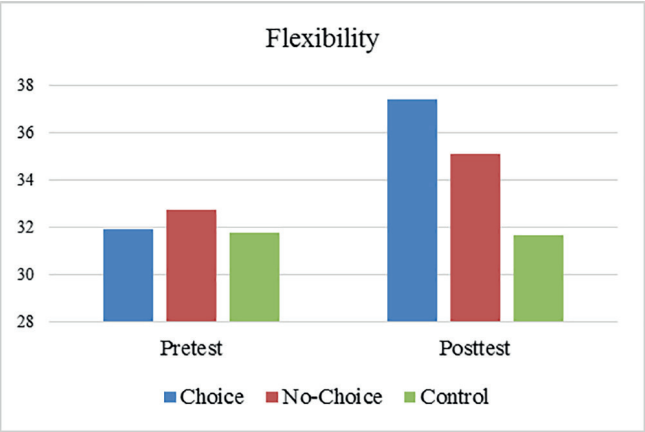

Figure 3: The figure shows the means of flexibility scores of the groups during the pre- and post-test.

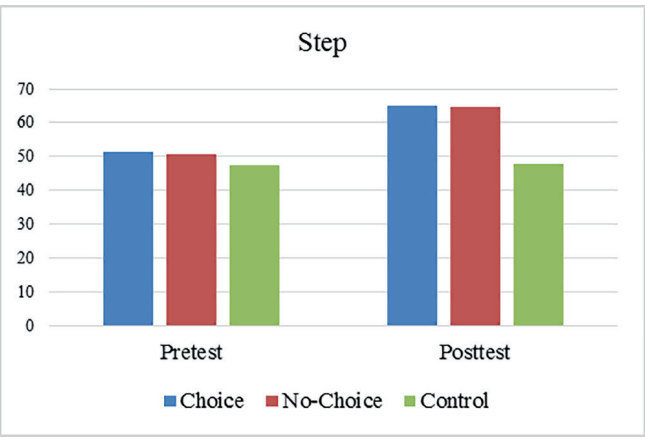

Figure 5: The figure shows the means of step scores of the groups during the pre- and post-test.

Sit-Up

Results of ANOVA showed that main effect if sit-up on GROUP (F=18.21, P<0.001, η2=0.46), TIME (F=106.98, P<0.001, η2=0.71) and the interaction between GROUP×TIME (F=29.62, P<0.001, η2=0.58) were significant. According to the means of the groups (Figure 4), it was found that the scores of Choice and No-Choice groups were improved in the post-test. Tukey test showed that the Choice and No-Choice groups performed significantly better than the control group (P<0.001), but there was no significant difference between the Choice and No-Choice groups (P=0.572).

Step

Results of ANOVA showed that main effect of step on GROUP (F=5.97, P=0.005, η2=0.22), TIME (F=60.59, P<0.001, η2=0.59) and the interaction between GROUP×TIME (F=14.29, P<0.001, η2=0.40) were significant. The means of the groups (Figure 5) showed that the scores of Choice and No-Choice groups were improved in the post-test. The results of

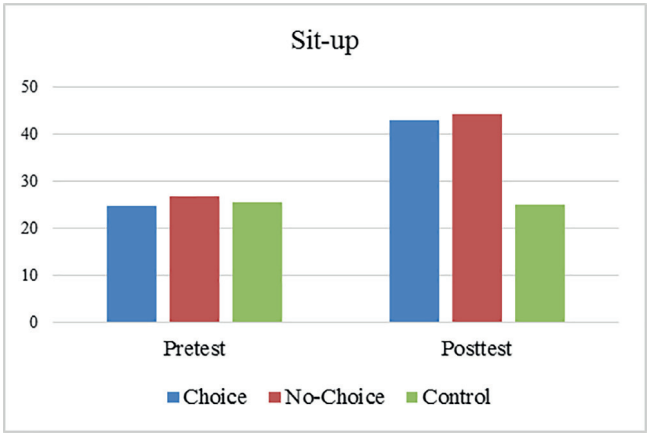

Figure 4: The figure shows the means of sit-up scores of the groups during the pre- and post-test.

Tukey test showed that the Choice and No-Choice groups performed significantly better than the control group (P<0.05), but there was no significant difference between the Choice and No-Choice groups (P=0.98).

4. Discussion

Exercise training methods are important in promoting intrinsic motivation in sedentary students to participate in physical activity and also in increasing their intention to be physically active. Therefore, the present study attempted to investigate the effects of an autonomy-based exercise training intervention on promoting intrinsic motivation and physical activity intention in sedentary adolescent students. We further investigated the effects of an autonomy-based exercise training intervention on health-related fitness in sedentary adolescent students. This research was based on the theoretical foundations of SDT (13-14) based on which, people with a higher sense of autonomy are more likely to have a greater intrinsic motivation and intention to perform different tasks. In the present study, it was assumed that the students in the Choice (autonomy training) group had a higher intrinsic motivation, physical activity intention, and post-exercise health-related physical fitness compared with the No-Choice (training with no autonomy) and control groups.

Regarding intrinsic motivation, the results revealed no significant difference between the groups in the pre-test, indicating the same pre-training conditions for all participants. However, the comparison of pre-test and post-test showed that the Choice group had significantly higher scores of intrinsic motivation compared with No-Choice and control groups. Moreover, the participants in the No-Choice group reported higher scores of intrinsic motivation in

comparison with the control group. These results are important in two ways. First, the exposure of sedentary adolescent students to an exercise training increased their intrinsic motivation for physical activity and exercise. Second, freedom of choice (with the sense of autonomy) regarding the sequence of exercises during intervention resulted in a higher intrinsic motivation compared to No-Choice exercise group, which is consistent with the assumptions of SDT (13-14). These results confirm the first part of the hypothesis in this study and are consistent with the results of previous research (21, 31-35). Our findings indicated that the sense of autonomy in sedentary adolescent students during exercise training might have led to an increase in their intrinsic motivation to participate in physical activity and exercise. In other words, reducing stress and control created by the trainer during training and giving students more power induce greater intrinsic motivation towards physical activity and exercise. This result can be very useful for physical educators at school as they can increase the intrinsic motivation of their sedentary students to participate in physical activity through providing them with more freedom of choice during exercise or in gym class.

Concerning the second part of the research hypothesis, the results showed that the study groups did not significantly differ in the pre-test; nonetheless participation in exercise training with the autonomous approach resulted in higher scores of physical activity intention in the Choice group compared with the No-Choice and control groups. The No-Choice group also reported a higher physical activity intention than the control group. These results are consistent with previous research (30, 32, 36-39) and confirm the second part of the research hypothesis. Our findings further indicated that giving the students the freedom to select the sequence of exercises could significantly increase their willingness to engage in physical activity compared to traditional exercise methods (with no autonomy).

Concerning the third part of the research hypothesis, the results showed that participation in an exercise training period increased students' endurance in comparison to no exercise (control condition); however, autonomy over training did not have a significant effect on improving health-related physical fitness components. These results do not corroborate the third hypothesis of the study but indicate the effects of exercise itself on health-related physical fitness components. The findings of the present research are in line with the previous studies in which physical activity improved health-related physical fitness components (3, 40-42).

5. Conclusions

To conclude, the present study showed that compared with traditional training methods, the autonomy-based exercise training intervention was more capable to increase intrinsic motivation and intention to engage in physical activity in sedentary students. However, the sense of autonomy did not significantly improve health-related physical fitness components compared to no sense of autonomy. These results may indicate that the feeling of autonomy during exercise training has a greater effect on psychological components (including intrinsic motivation and physical activity intention) compared with physical components (including physical fitness). Our findings can have many practical implications for physical educators at school. Based on the results of the present study, it is recommended that physical educators use autonomy-based exercise trainings to increase the motivation and intention of sedentary students for physical activity. Finally, future research should examine the impact of other basic psychological needs, including competence and relatedness on intrinsic motivation and other psychological components in students with low physical activity and across different age periods (including elementary and high school).

Ethical Approval

This study was approved by Ethics Committee of Islamic Azad University of Aliabad Katoul (IR.IAU.AK.REC.1398.001). The participants voluntarily participated in the present study and written informed consent was obtained from the subjects and their parents.

Funding Support

The study received no grant from any institution, company or university.

Acknowledgments

We are grateful to all teachers, administrators, students and their parents who helped us in this research.

Conflicts of Interest

The authors declared no conflict of interest.

References

1. Lahart I, Darcy P, Gidlow C, Calogiuri G. The Effects of Green Exercise on Physical and Mental Wellbeing: A Systematic Review. *Int J Environ Res Public Health*. 2019;**16**(8). doi: 10.3390/ijerph16081352. [PubMed: 30991724]. [PubMed Central: PMC6518264].
2. Schwartz J, Rhodes R, Bredin SSD, Oh P, Warburton DER. Effectiveness of Approaches to Increase Physical Activity Behavior to Prevent Chronic Disease in Adults: A Brief Commentary. *J Clin Med*. 2019;**8**(3). doi: 10.3390/jcm8030295. [PubMed: 30832260]. [PubMed Central: PMC6462966].
3. Malm C, Jakobsson J, Isaksson A. Physical Activity and Sports-Real Health Benefits: A Review with Insight into the Public Health of Sweden. *Sports*. 2019;**7**(5). doi: 10.3390/sports7050127. [PubMed: 31126126]. [PubMed Central: PMC6572041].
4. Miles L. Physical activity and health. *Nutrition Bulletin*. 2007;**32**(4):314-363. doi: 10.1111/j.1467-3010.2007.00668.x.
5. Huotari P, Nupponen H, Mikkelsson L, Laakso L, Kujala U. Adolescent physical fitness and activity as predictors of adulthood activity. *J Sports Sci*. 2011;**29**(11):1135-41. doi: 10.1080/02640414.2011.585166. [PubMed: 21777154].
6. Telama R, Yang X, Viikari J, Välimäki I, Wanne O, Raitakari O. Physical activity from childhood to adulthood: A 21-year tracking study. *Am J Prev Med*. 2005;**28**(3):267-73. doi: 10.1016/j.amepre.2004.12.003. [PubMed: 15766614].
7. Tyson P, Wilson K, Crone D, Brailsford R, Laws K. Physical activity and mental health in a student population. *J Ment Health*. 2010;**19**(6):492-9. doi: 10.3109/09638230902968308. [PubMed: 20812852].
8. Pengpid S, Peltzer K. High Sedentary Behaviour and Low Physical Activity are Associated with Anxiety and Depression in Myanmar and Vietnam. *Int J Environ Res Public Health*. 2019;**16**(7). doi: 10.3390/ijerph16071251. [PubMed: 30965618]. [PubMed Central: PMC6479691].
9. Giné-Garriga M, Sandlund M, Dall PM, Chastin SFM, Pérez S, Skelton DA. A Novel Approach to Reduce Sedentary Behaviour in Care Home Residents: The GET READY Study Utilising Service-Learning and Co-Creation. *Int J Environ Res Public Health*. 2019;**16**(3). doi: 10.3390/ijerph16030418. [PubMed: 30717105]. [PubMed Central: PMC6388363].
10. Kivimäki M, Singh-Manoux A, Pentti J, Sabia S, Nyberg ST, Alfredsson L, et al. Physical inactivity, cardiometabolic disease, and risk of dementia: an individual-participant meta-analysis. *BMJ*. 2019;**365**:l1495. doi: 10.1136/bmj.l1495. [PubMed: 30995986]. [PubMed Central: PMC6468884].
11. Lavie CJ, Ozemek C, Carbone S, Katzmarzyk PT, Blair SN. Sedentary Behavior, Exercise, and Cardiovascular Health. *Circ Res*. 2019;**124**(5):799-815. doi: 10.1161/CIRCRESAHA.118.312669. [PubMed: 30817262].
12. Damian M, Oltean A, Damian C. The impact of sedentary behavior on health and the need for physical activity in children and adolescents. *Revista Românească pentru Educație Multidimensională*. 2018;**10**(1):71-83. doi: 10.18662/rrem/19.
13. Deci EL, Ryan RM. Intrinsic motivation and self-determination in human behavior. New York: Plenum Press; 1985.
14. Deci EL, Ryan RM. (2000). The "What" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*. 2000;**11**(4):227-268. doi: 10.1207/S15327965PLI1104-01.
15. Ryan RM, Deci EL. Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*. 2000;**25**(1):54-67. doi: 10.1006/ceps.1999.1020.
16. Ryan RM, Deci EL. Brick by brick: The origins, development, and future of self-determination theory. In: Elliot AJ, editors. Advances in motivation science. Cambridge: Elsevier Inc; 2019. p. 111-156.
17. Ryan RM, Deci EL. Overview of self-determination theory: An organismic dialectical perspective. In: Deci EL, Ryan RM, editors. Handbook of self-determination research. Rochester, NY: The University of Rochester Press; 2002. p. 3-33.
18. Ryan RM, Bradshaw EL, Deci EL. A history of human motivation theories in psychology. In: Sternberg RJ, Pickren WE. Cambridge, UK: Cambridge University Press; 2019. p. 391-411.
19. Ryan RM, Deci EL. Self-determination theory: Basic psychological needs in motivation, development, and wellness. New York: Guilford Publishing; 2017.
20. Chang YK, Chen S, Tu KW, Chi LK. Effect of autonomy support on self-determined motivation in elementary physical education. *Journal of sports science and medicine*. 2016;**15**(3):460-466.
21. Meng HW, Whipp PR, Dimmock JA, Jackson B. The effects of choice on autonomous motivation, perceived autonomy support, and physical activity levels in high school physical education. *Journal of Teaching in Physical Education*. 2013;**32**(2):131-148. doi: 10.1123/jtpe.32.2.131.
22. White RL, Parker PD, Lubans DR, MacMillan F, Olson R, Astell-Burt T, et al. Domain-specific physical activity and affective wellbeing among adolescents: an observational study of the moderating roles of autonomous and controlled motivation. *Int J Behav Nutr Phys Act*. 2018;**15**(1):87. doi: 10.1186/s12966-018-0722-0. [PubMed: 30200980]. [PubMed Central: PMC6131748].

23. Moreno-Murcia JA, Sánchez-Latorre F. The effects of autonomy support in physical education classes. *RICYDE: Revista Internacional de Ciencias del Deporte*. 2016;**43**(12):79-89. doi: 10.5232/ricyde2016.04305.
24. Lochbaum M, Jean-Noel J. Perceived autonomy-support instruction and student outcomes in physical education and leisure-time: A meta-analytic review of correlates. *RICYDE: Revista Internacional de Ciencias del Deporte*. 2016;**43**(12):29-47. doi: 10.5232/ricyde2016.04302.
25. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. *Can J Appl Sport Sci.* 1985;10(3):141-6. [PubMed: 4053261].
26. van Poppel MN, Chinapaw MJ, Mokkink LB, van Mechelen W, Terwee CB. Physical activity questionnaire for adults: a systematic review of measurement properties. *Sports Med*. 2010;**40**(7):565-600. doi: 10.2165/11531930-000000000-00000. [PubMed: 20545381].
27. Godin G, Shephard RJ. Godin Leisure-Time Exercise Questionnaire. *Med Sci Sports Exerc*. 1997; 26 Suppl: S36-8.
28. Mohammad Gholinezhad P, Hojjati H, Ghorbani S. The effect of aerobic exercise on body composition and muscle strength of female students at elementary schools of Ali Abad Katoul in 2018. *Int. J. School. Health*. 2019;**6**(4):27-33. doi: 10.30476/intjsh.2019.45892.
29. Pelletier LG, Rocchi MA, Vallerand RJ, Deci EL, Ryan RM. Validation of the revised sport motivation scale (SMS-II). *Psychology of Sport and Exercise*. 2013;**14**(3):329-341. doi: 10.1016/j.psychsport.2012.12.002.
30. Hagger MS, Chatzisarantis NLD, Culverhouse T, Biddle SJH. The process by which perceived autonomy support in physical education promote leisure-time physical activity intentions and behavior: A trans-contextual model. *Journal of Educational Psychology*. 2003;**95**(4):784-795. doi: 10.1037/0022-0663.95.4.784.
31. Abula K, Beckmann J, He Z, Cheong C, Lu F, Gröpel P. Autonomy support in physical education promotes autonomous motivation towards leisure-time physical activity: evidence from a sample of Chinese college students. *Health Promotion International*. 2020;**35**(1):e1-e10. doi: 10.1093/heapro/day102.
32. Mavropoulou A, Barkoukis V, Douka S, Alexandris K, Hatzimanouil D. The role of autonomy supportive activities on students' motivation and beliefs toward out-of-school activities. *The Journal of Educational Research*. 2019;**112**(2):223-233. doi: 10.1080/00220671.2018.1503580.
33. Sebire SJ, Jago R, Fox KR, Edwards MJ, Thompson JL. Testing a self-determination theory model of children's physical activity motivation: a cross-sectional study. *Int J Behav Nutr Phys Act*. 2013;**10**:111. doi: 10.1186/1479-5868-10-111. [PubMed: 24067078]. [PubMed Central: PMC3852537].
34. Moustaka FC, Vlachopoulos SP, Kabitsis C, Theodorakis Y. Effects of an autonomy-supportive exercise instructing style on exercise motivation, psychological well-being, and exercise attendance in middle-age women. *J Phys Act Health*. 2012;**9**(1):138-50. doi: 10.1123/jpah.9.1.138. [PubMed: 22232500].
35. Behzadnia B, Adachi PJC, Deci EL, Mohammadzadeh H. Associations between students' perceptions of physical education teachers' interpersonal styles and students' wellness, knowledge, performance, and intentions to persist at physical activity: A self-determination theory approach. *Psychology of Sport and Exercise*. 2018;**39**:10-19. doi: 10.1016/j.psychsport.2018.07.003.
36. Hagger MS, Chatzisarantis NL. The Trans-Contextual Model of Autonomous Motivation in Education: Conceptual and Empirical Issues and Meta-Analysis. *Rev Educ Res*. 2016;**86**(2):360-407. doi: 10.3102/0034654315585005. [PubMed: 27274585]. [PubMed Central: PMC4873731].
37. Hagger MS, Chatzisarantis NLD, Barkoukis V, Wang CKJ, Baranowski J. Perceived Autonomy Support in Physical Education and Leisure-Time Physical Activity: A Cross-Cultural Evaluation of the Trans-Contextual Model. *Journal of Educational Psychology*. 2005;**97**(3):376-390. doi: 10.1037/0022-0663.97.3.376.
38. Halvari H, Skjesol K, Bagoien TE. Motivational climates, achievement goals, and physical education outcomes: A longitudinal test of achievement goal theory. *Scandinavian Journal of Educational Research*. 2011;**55**(1):79-104. doi: 10.1080/00313831.2011.539855.
39. Vierling KK, Standage M, Treasure DC. Predicting attitudes and physical activity in an "at-risk" minority youth sample: A test of self-determination theory. *Psychology of Sport and Exercise*. 2007;**8**(5):795-817. doi: 10.1016/j.psychsport.2006.12.006.
40. Wassenaar TM, Wheatley CM, Beale N, Salvan P, Meaney A, Possee JB, et al. Effects of a programme of vigorous physical activity during secondary school physical education on academic performance, fitness, cognition, mental health and the brain of adolescents (Fit to Study): study protocol for a cluster-randomised trial. *Trials*. 2019;**20**(1):189. doi: 10.1186/s13063-019-3279-6. [PubMed: 30940164]. [PubMed Central: PMC6444886].
41. Eigenschenk B, Thomann A, McClure M, Davies L, Gregory M, Dettweiler U, et al. Benefits of Outdoor Sports for Society. A Systematic Literature Review and Reflections on Evidence. *Int J Environ Res Public Health*. 2019;**16**(6). doi: 10.3390/ijerph16060937. [PubMed:30875938]. [PubMed Central: PMC6466442].
42. Mason RC, Horvat M, Nocera J. The Effects of Exercise on the Physical Fitness of High and Moderate-Low Functioning Older Adult Women. *J Aging Res*. 2016;**2016**:8309284. doi: 10.1155/2016/8309284. [PubMed: 27478640]. [PubMed Central: PMC4960339].