

Exercise and Sleep Quality Among College Students

Schori Hadas
Seminar Hakibbutzim College

Gili Joseph
Seminar Hakibbutzim College

This study aims to examine sleep quality and well-being of college students according to their amount of exercise, field of study and academic school year.

367 college students from different academic disciplines submitted a questionnaire via Google Forms relating to the amount of exercise they engage in, sleep quality and well-being.

Physical-education students exercise more than other disciplines (4.8 compared to 2.7; $p < 0.001$). Their sleep quality is better compared to students from other disciplines (5.72 compared to 5.05, $p < 0.05$). Moreover, sleep quality of freshmen students who exercise more is better (5.33 compared to 4.85, $p = 0.002$).

To ensure adequate quality of life and a better well-being of College students, it is recommended to enhance the level of the students' weekly physical activity, as well as implement an educational program for physical activity in their curriculum, and as early as their first year of study.

Keywords: sleep quality, exercise, well-being, college students, freshman students

INTRODUCTION

Changes are an integral part of our life. We move through different stages of age, education; we change workplaces, experience shifts in our family composition and in our lifestyle. Life events are perceived as life changes that invariably require readjustment and formation of new habits (Cole, 1985). Even though many of these events are positive, they alter our lifestyle, change our routine, and are often accompanied by stress (Linville, 1985; Pine & Fletcher, 2016). Many of our habits are linked to our sleep (Kabrita et al., 2014), thus it is not surprising that there is a correlation between transitional phases and life changes, mental and physiological well-being as well as quality of sleep (Monk, et al., 2003; Suh et al., 1996).

Sleep is one of the most important physiological processes for the human body. Poor quality of sleep has serious health consequences (Agargün, 2003), such as decrease in physical and mental health as well as cognitive performance (Hirshkowitz et al., 2015). Researchers have shown that sleep functions adversely to stress, and sometimes sleep quality is the first indication of anxiety and depression (Morin et al., 2003; Norlander et al., 2005).

Sleep habits are one of the first practices to alter when a major change in life occurs, such as becoming a college student (Pilcher et al., 1997). Attending college for the first time may cause significant adjustments in many aspects of life, which can lead to stressful conditions. One of the first symptoms of the student's difficulty in adjusting to the new college lifestyle is a decline in sleep quality (Jensen, 2003), which is highly prevalent among students across the globe. Studies conducted with various college students have shown that 42-57.5% were classified as poor sleepers (Cheng et al., 2012; Lemma et al., 2012; Suen et al., 2008). This can be due to several factors, one of them may be short sleep duration, that characterizes student lifestyle (Hicks et al., 2001), and is an important risk factor for several physical problems as well as mood and anxiety disorders (Forquer et al., 2008; Lemma et al., 2012). There is a strong need to find ways to improve student's quality of sleep.

One way to improve sleep quality can be exercise. A number of studies have shown that acute and long-term exercise increases slow-wave sleep and total sleep time, as well as decreases the time period between initial attempts to fall asleep and the onset of sleep (Kubitz et al., 1996; O'Connor & Youngstedt, 1995; Youngstedt et al., 1997). Physical activity elicits feelings of health and vitality, reduces cardiovascular disease, improves blood lipid proteins, and has a beneficial effect on immune-related health. Researchers have shown that people who exercise more have suffered from fewer incidents of illness during time of stress (Dey, 1994; Morris et al., 1980; Sothorn et al., 1999). More evidence indicates that exercise prevents stress and stress-induced behavioral depression (Moraska & Fleshner, 2001).

Several studies have investigated the correlation between well-being, exercise, and sleep quality especially student related. Ma et al (Ma et al., 2020), has shown that little physical activity and increased screen time can exacerbate the risk of mental problems and poor sleep quality (Ma et al., 2020). Wunsch et al (Wunsch et al., 2017), has shown that students who are more physically active during stressful times in college feel better in general than those who are not active at all. Thus, exercising during stressful times in college may be able to buffer the negative effect of stress on health-related outcomes and prevent negative effects on sleep (Wunsch et al., 2017). Studies have been conducted on students who have already established student lifestyle and its related habits. It remains to be studied whether the transition to student life affects students' quality of sleep, their well-being and if exercise can ameliorate the symptoms that are accompanied with changing lifestyle and habits.

It is recommended to enhance the level of the students' weekly physical activity, as well as implement an educational program for physical activity in their curriculum, and as early as their first year of study.

This study was conducted at an Israeli college of education at a point in time in which the students had just begun the academic year. The purpose of this study was to compare sleep quality and well-being of students from different academic disciplines, in different years of study, depending on the amount of exercise they engaged in, in order to find out whether these variables relate to improvement of the students' social and educational sustainability, for ensuring adequate quality of life and a better well-being.

METHODS

Subjects

367 students from a college of education in the center of Israel participated. The average age was 4.5 ± 25.3 years, the age range was 18-40 years, while 57% of the students were between 18-25 years old. 82% of the students were females, and 85% were unmarried. 44% of the students were in their first year of studies, 34.5% in their second year and 21.5% in their third year. 35.5% of the students studied in the physical education department, the rest studied in other education disciplines such as science, elementary school, preschool, and special education.

Research Tools

A questionnaire was submitted by the students via Google Forms. The questionnaire included four different parts: sociodemographic questions, questions about the amount and intensity of their weekly exercise, a well-being questionnaire and a questionnaire about their quality of sleep. The sociodemographic and exercise questionnaire was taken from the HBSC health questionnaire (Hareel-Fish et al., 2016). The

students were asked to note how many times and hours per week do they exercise, and how many times and hours a week do they exercise in a way that it makes them sweat and pant heavily. The questions were on a Likert scale of 1-7 when 1 represents never and 7 represents always. The four exercise questions were grouped into one variable and then, a dichotomous variable was rebuilt, and the population was divided to two groups by the median of 3.5. Students with a score of 0-3.49 in exercise were considered to be engaging a lesser amount of exercise. Students with a score of 3.5-7 in exercise were considered to engage in a greater amount of exercise. The well-being questionnaire included ten questions. The questionnaire was developed by Veit & Ware (1983) (Veit & Ware, 1983) and validated by Florian & Drori (1990) (Florian & Drori, 1990), alpha Cronbach= 0.96. Sleep quality was measured using the Mini Sleep Questionnaire (MSQ-Mini Sleep Questionnaire), which also includes ten questions that relate to quality of sleep on a Likert scale of 1-7 (Zomer et al., 1985).

Research process: During the second and third week of the first semester, the researchers entered the classrooms and explained the objectives of the study. Immediately following, the questionnaire was sent out and the students submitted them via Google Forms. The questionnaire was anonymous. The study was approved by Seminar Hakibutzim college's Ethics Committee.

Statistical Analysis

The amount of exercise the different students engaged in, compared by their type of education studies was measured using one-way ANOVA. A Scheffe Post-Hoc analysis for multiple variables was used to measure the difference between the amount of exercise the physical-education students engaged in and each of all the other students from the different disciplines. An independent T-test was conducted to find the difference in exercise, well-being and quality of sleep, between physical education students and other students, between first year students and second- and third-year students, between students who engage in lesser or greater amounts of exercise and between female and male students.

RESULTS

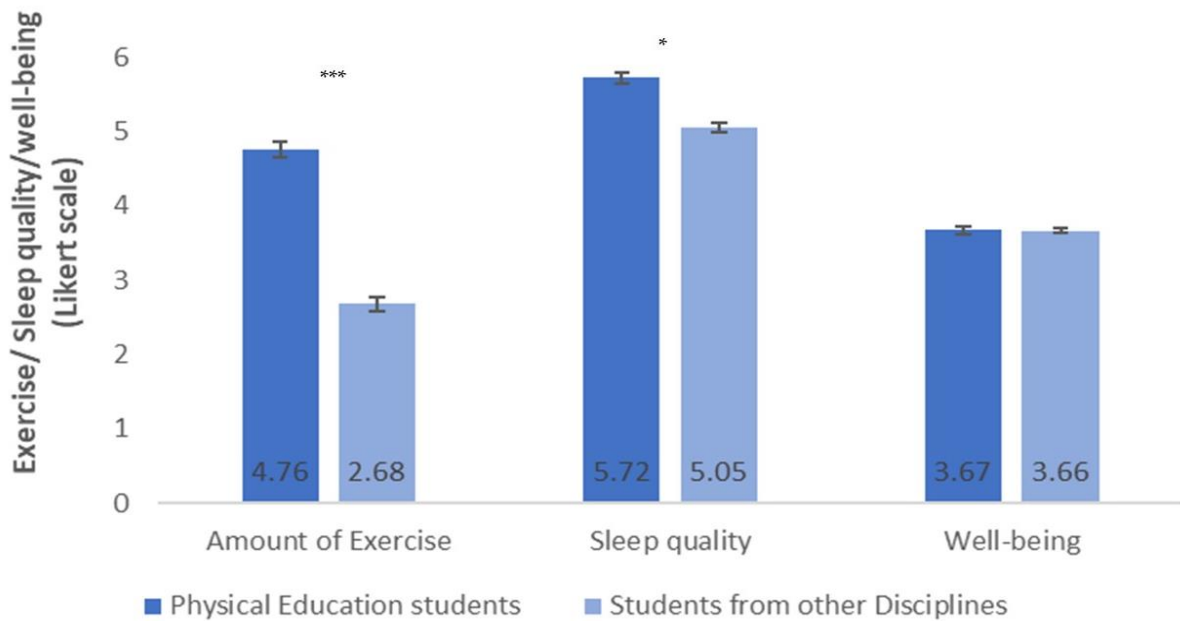
The purpose of this study was to examine the relationship between exercise, quality of sleep and well-being among College of Education students. As explained in the Methods section, the amount of exercise was measured by the mean of four questions asked regarding the amount and intensity of exercise engaged in every week measured in a 1 to 7 Likert scale. The continuous physical activity variable was changed to a dichotomous variable and the population was divided into two groups by the median of 3.5. Students engaged in a lesser amount of exercise 53.7% (N=197) with a score of 0-3.49 in exercise, while 46.3% (N=170) of the students engaged in a greater amount of exercise (3.5- 7). The first research question asked was if there was a difference in the amount of exercise the different students engaged in. When comparing the amount of exercise, the different students engaged in, by their field of education (using one-way ANOVA analysis and exhibited in table 1), it was apparent as expected, that the students of Physical Education engaged in more exercise per week than all the other students from other disciplines ($f(5, 361) = 40.44$ $p < 0.0001$). The Scheffe Post-Hoc analysis for multiple variables showed a significant difference between the amount of exercise the physical-education students engaged in and each of all the other students from the various disciplines ($p < 0.0001$). No difference was found between first year students and second- and third-year students, (first year students: 3.28 ± 1.7 (N=204), second- and third-year students: 3.5 ± 1.7 (N=204); $p = 0.214$). When comparing the amount of exercise, the first-year physical-education students engaged in, to their second- and third-year students, no difference was found as well.

TABLE 1
THE AMOUNT OF EXERCISE PER WEEK AMONG COLLEGE STUDENTS ACCORDING TO THEIR DISCIPLINE

Discipline	N	Amount of Exercise (Mean)	Std. Deviation	Sig.
Physical Education	130	4.76	1.33	P=0.000
High School Science	25	2.82	1.33	P=0.001
Elementary School Science	13	2.88	1.78	P=0.000
Special Education	30	2.89	1.33	P=0.000
Preschool Education	157	2.69	1.43	P=0.000
Education	12	1.46	0.69	P=0.000

Figure 1 presents a dependent T-test analysis exhibiting the difference between physical education students and all the other students from the other disciplines in the amount of exercise, well-being and quality of sleep. All variables were measured in a 1-7 Likert scale. As can be seen, physical education students engage in more exercise than the other students ($\pm 4.760.11$ compared to $\pm 2.680.09$; $p < 0.001$). Though no difference was found in well-being, the sleep quality of the physical education students was better than the others (5.72 ± 0.07 versus 5.05 ± 0.06 ; $p < 0.05$)

FIGURE 1
THE AMOUNT OF EXERCISE, WELL-BEING AND SLEEP QUALITY OF PHYSICAL EDUCATION STUDENTS AND OTHER STUDENT FROM DIFFERENT DISCIPLINES



An independent T-test analysis was conducted to measure the difference between physical education students and other students from different disciplines in the amount of exercise, well-being, and sleep quality (**p < 0.001, * p < 0.05).

To answer the second research question, in an attempt to find out if students who engage in more exercise have better quality of sleep and better well-being, an independent T-test analysis was conducted (Table 2). While no difference was found in the status of the student's well-being, sleep quality of those who engage in a greater amount of exercise was better ($t(365) = 3.073, p=0.002$).

TABLE 2
QUALITY OF SLEEP AND WELL-BEING DEPENDING ON THE AMOUNT OF WEEKLY EXERCISE ALL THE STUDENTS ENGAGED IN (INDEPENDENT T-TEST ANALYSIS)

	Exercise	N	Mean	Std. Deviation	Sig
Sleep quality	Lesser amount of exercise	197	4.98	0.99	P<0.005*
	Greater amount of exercise	170	5.28	0.88	
Well-being	Lesser amount of exercise	197	3.62	0.58	P>0.05
	Greater amount of exercise	170	3.72	0.59	

To find if there is a difference in sleep quality and well-being depending on the type of the student's discipline and according to the amount of exercise they engaged in, an independent T-test analysis was conducted, and the results are shown in Table 3. There was no difference in sleep quality and well-being among the Physical-Education students between students who do lesser amount of exercise and those who do greater amount of exercise. A difference was found among students from the other disciplines showing that students who engage in a greater amount of exercise have better quality of sleep compared to those who do a lesser amount of exercise ($t(235) = -2.12; p=0.035$).

TABLE 3
SLEEP QUALITY AND WELL-BEING IN STUDENTS ENGAGING IN LESSER OR GREATER AMOUNT OF EXERCISE ACCORDING TO THEIR DISCIPLINE OF STUDIES (INDEPENDENT T-TEST ANALYSIS)

		Amount of Exercise	N	Mean	Std. Deviation	Sig
Physical-Education Students	Sleep quality	Lesser amount of exercise	19	5.21	0.78	P=0.692
		Greater amount of exercise	111	5.29	0.88	
	Well-being	Lesser amount of exercise	19	3.44	0.51	P=0.073
		Greater amount of exercise	111	3.71	0.61	
Students from Other Disciplines	Sleep quality	Lesser amount of exercise	178	4.96	1.02	P=0.035*
		Greater amount of exercise	59	5.27	0.89	
	Well-being	Lesser amount of exercise	178	3.64	0.59	P=0.354
		Greater amount of exercise	59	3.72	0.57	

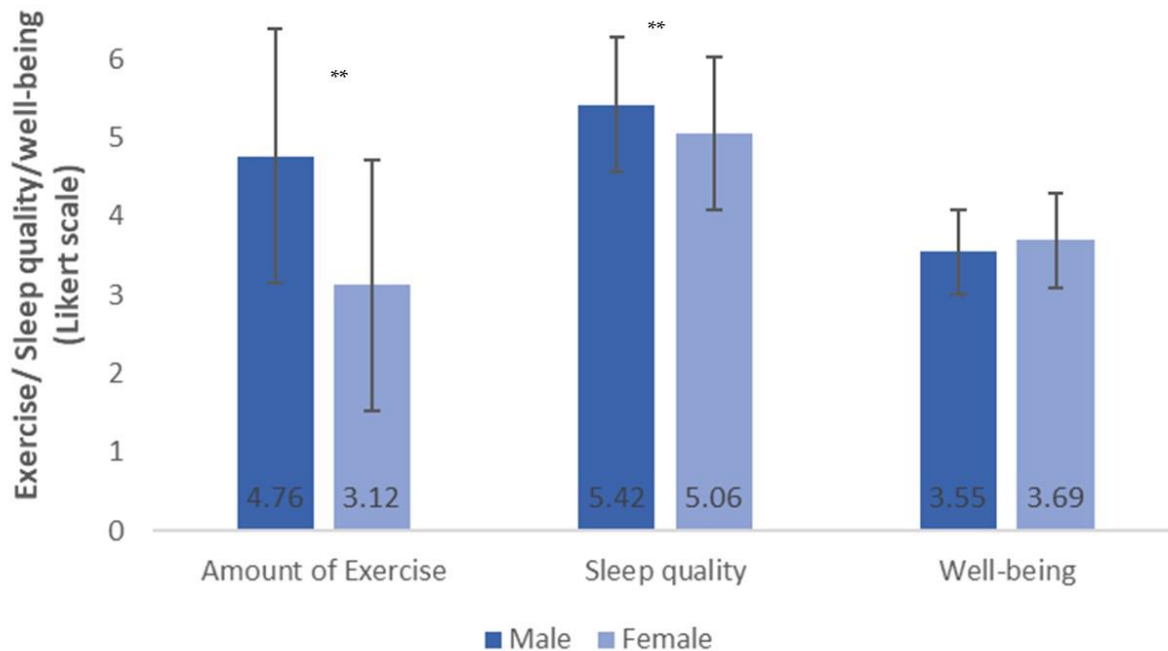
Table 4 presents the results of an independent T-test comparing well-being and quality of sleep among students who engage in a lesser amount of exercise compared to students who engage in a greater amount of exercise according to their year of study (first year versus second- and third year together). Sleep quality was found to be higher among first-year students who engage in a greater amount of exercise ($t(159) = -3.1; p=0.002$). No difference was found in well-being or sleep quality in the second- and third-year students according to the amount of exercise they are engaged in.

TABLE 4
SLEEP QUALITY AND WELL-BEING IN STUDENTS ENGAGING IN LESSER OR GREATER
AMOUNT OF EXERCISE ACCORDING TO THEIR COLLEGE YEAR
(INDEPENDENT T-TEST ANALYSIS)

		Exercise	N	Mean	Std. Deviation	Sig.
First-year students	Well-being	Lesser amount of exercise	94	3.63	0.62	p>0.05
		Greater amount of exercise	68	3.77	0.61	
	Sleep quality	Lesser amount of exercise	94	4.85	1.09	*p=0.002
		Greater amount of exercise	68	5.33	0.87	
Second- & third-year students	Well-being	Lesser amount of exercise	103	3.61	0.55	p>0.05
		Greater amount of exercise	101	3.68	0.59	
	Sleep quality	Lesser amount of exercise	103	5.1	0.89	p>0.05
		Greater amount of exercise	101	5.26	0.89	

When trying to find other variables that might show relationship to quality of sleep and well-being, gender, age, and marital status was examined. An independent T-test analysis was conducted, showing no difference in sleep quality, well-being, and amount of exercise between the different age groups and marital status (results not shown). However, it was found that male students show better sleep quality than female students ($t(365) = -2.78; p=0.006$) and engage in a greater amount of exercise compared to female students ($t(365) = -7.5; p=0.000$) (figure 2).

FIGURE 2
THE DIFFERENCE IN THE AMOUNT OF EXERCISE PER WEEK, SLEEP QUALITY AND WELL-BEING IN MALE AND FEMALE COLLEGE STUDENTS



Independent T-test was conducted to measure the difference between male (N= 65) and female (N=302) College students in amount of exercise, sleep quality and well-being ($p = 0.006$, $p=0.000$).

DISCUSSION

The first objective of this study was to examine the amount of physical activity students of education engaged in and compare the amount of exercise physical-education students engaged in vs. students from other disciplines. The results confirm as predicted, that the amount of exercise physical-education students engage in is significantly greater compared to the rest of the students of education (Table 1). Most of the physical-education students chose physical-education studies because of their natural penchant for sports, which may lead them to exercise more (Al-Rawahi & Al-Yarabi, 2013; Z.Howard, M.Hipscher, 2011). Moreover, their study program includes many mandatory sports lessons, thus it would be expected that they would exercise more than other students. When comparing the sleep quality of physical-education students and other disciplines, it was found that the physical-education students have better sleep quality (fig 1), while no difference was found when comparing both groups' well-being. Physical activity is known to be one of the factors that helps reduce many health-related consequences such as physical disabilities, mental problems, and poor sleep quality (Sherrill et al., 1998; World Health Organization, 2010; Youngstedt, 2005). Unfortunately, it has been shown that 40-50% of college students are physically inactive (Keating et al., 2005), and they are a population with poorer well-being compared to people of the same age that do not attend college. Moreover, it was shown that one of the first symptoms of student's stress is a reduction in their sleep quality (Jensen, 2003). The results here, are in line with previous studies showing that physical activity can improve sleep quality and that students that do more exercise will benefit from better sleep quality (Reid et al., 2010; Wang & Boros, 2019; Youngstedt, 2005). The fact that all the tested students achieved the same score of well-being, reinforces the positive effect of physical activity on sleep quality.

To understand whether better sleep quality is restricted to the physical-education students, or it correlates with any student who engages in a great deal of exercise, the students from all the disciplines were divided into two groups: one group included students who do a great deal of exercise, and the other

group comprised students who engage in a lesser amount of exercise. It was found that students from all the disciplines that are more active have better sleep quality (Table 2), but no difference was found in the well-being in either group (much or and little exercise). There are studies that imply a correlation between well-being and sleep quality and indicate that people with a poor sense of their well-being also suffer from poor sleep quality (Kenney et al., 2013; Pilcher & Walters, 1997; Steptoe et al., 2008). The result was that there was no difference in well-being yet there is a difference in sleep quality, reinforces the effect of physical activity on student sleep quality regardless of the well-being status. The fact that physical activity does not have a direct effect on the students' well-being can be correlated to the students' lifestyle that comprises many stressful parameters such as grade competition, a heavy workload, lack of social support, fear from facing parents after failing in the exams, new financial responsibilities and more (Acharya, 2003; Murphy et al., 2009; Stewart-Brown et al., 2000; Stewart et al., 1999).

With an attempt to shed more light on the positive effect of physical activity on student sleep quality, a correlation between lesser and greater amounts of exercise and the discipline was examined (Table 3). The students that attained better sleep quality were those who do not study physical education as their major and engaged in a greater amount of exercise. Those results support other studies showing a positive effect of physical activity on sleep quality among non-athletic students (Kianian et al., 2017). In the physical-education group of students, almost 90% of them engaged in a great deal of exercise, apparently due to their obligatory physical activity lessons in their studies; therefore, no difference could be found between greater and lesser amount of exercise among them. The results indicate that precisely a population that is not accustomed to physical activity should adopt an active lifestyle in order to gain better sleep quality.

It is also important to understand whether the positive effect of greater amount of exercise on sleep quality correlates with the year of study. To achieve this goal, both well-being and sleep quality of student engaging in greater or lesser amount of exercise was compared, dependent on their year of study. The distinction between first-year students and second- and third-year students is very important since the transition to college life incurs a major change of familiar habits and lifestyle which influences mostly the new students (Crombie et al., 2009; Vadeboncoeur et al., 2015). It was shown that college students become sedentary since they spend most of the day studying, sitting and talking, watching television, doing online activities and hanging out, all of which are defined as sedentary activities (Rouse & Biddle, 2010). A sedentary lifestyle, which is adopted in the transition to the college and is lacking in exercise, may lead to multiple chronic diseases (Booth et al., 2002). Our results show that freshman students that engage in a greater amount of exercise enjoy better quality of sleep compared to those who engaged in a lesser amount of exercise (Table 4). Moreover, the second- and third-year students who have become accustomed to college life, have not exhibited better sleep quality, regardless of the amount of exercise they engage in. These results reinforce the important role of exercise in times of changes in lifestyle, especially among populations that are not used to being physically active.

The last goal was to examine background variables such as marital status, age and student gender. No difference was found between sleep quality, well-being and physical activity in the different age groups and marital status, but it is important to note that the students examined were mostly unmarried (85%), and 57% of them were between the age of 18-25. However, when we examined the same parameters with respect to the student gender, we found that male students engage in more exercise and have better sleep quality compared to female students but had no differences in their well-being (Figure 2). These results match previous results showing that women aged 17-30 have more night awakenings, are more likely to have nightmares and in general, have poorer sleep quality compared to men (Coren, 1994; Doi et al., 2001). In addition, it was shown that these differences also characterize college students, among whom females were found to have poorer sleep quality (Tsai & Li, 2004). Nonetheless they are less physically active compared to men and exhibit lower motivation towards physical activity (González-Cutre et al., 2011; Lauderdale et al., 2015).

As in every study, there are some limitations in this study that can be noted: There is a relatively small sample, from one college only, thus it might not project on to college students in general. In addition, it should be considered that there could be other mitigating factors that might influence sleep quality and well-being, which were not examined in this study.

In conclusion, it is shown for the first time that exercise on its own has a positive effect on sleep quality of first-year students, especially those who do not take part in routine physical activity classes in their curriculum. Therefore, it is highly recommended for students to engage in physical activity during their transition into college-student life.

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