Effectiveness of individual counselling and activity monitors to promote physical activity among university students

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ABSTRACT

BACKGROUND: Physical activity promotion among university students is important to contribute to a lifelong healthy lifestyle. Nevertheless, research in the field is still limited in quantity, quality and generalizability. This study aimed at testing the effectiveness of two strategies for promoting physical activity among university students.

METHOD: Thirty-three students were recruited and randomly assigned to three groups. The first group attended individual counselling sessions via videoconferencing calls, the second used wearable physical activity monitors and the third served as control. Interventions lasted 12 weeks. Measures of physical activity (self-reported and recorded by ActiGraph-GT3X+ monitors) and the stages of change of participants were collected at baseline (t0), immediately after the 12-week intervention (t1), and after a 3-month follow-up (t2).

RESULTS: Analyses revealed that students in the individual counselling group increased self-reported energy expenditure between t0 and t1 and maintained this improvement at t2; progression through stages of changes was observed in the same group at t1, followed by some relapses at t2. No significant differences were found neither in the group of students who used the physical activity monitors nor in the control group.

CONCLUSIONS: Individual counselling program was effective for promoting physical activity among university students, whereas the autonomous use of physical activity monitors had no effects. However, the low participation rate in the study suggests to consider carefully the difficulties in motivating this population and in finding low time-consuming strategies to incentive participation.

Key words

Active lifestyle - Behavioural change - Health education - Young adults

Introduction

University students represent a large population in industrialized countries (nearly 44% of people aged 20 to 24[1]) at-risk of leading sedentary lifestyle[2-4], which should be specifically addressed with health-related physical activity programs. If, on the one hand, in the transition from secondary school to university there is a significant decline in physical activity (PA)[5-7], on the other hand university years can represent an ideal period for promoting active lifestyle behaviours. University students are at a stage in life when they can make autonomous decisions about their lifestyle and it is likely that these are maintained into the future, despite new life and work commitments[8].

Different studies evaluated the efficacy of interventions to promote PA in this population, most of which have been conducted in United States universities. Controlled trials reporting positive effect on students' PA levels often describes course-based interventions[9-13] or programs focused on group lectures, seminars or practical activities[14, 15]. Course-based interventions can incentive students' participation in PA promotion programs by granting academic credits and not adding additional time commitment to students, while group activities can address a large number of students simultaneously, reducing the intervention cost. Individual counselling and the adoption of pedometers/accelerometers are other strategies frequently used in interventions aimed at promoting PA[17]. The short-term effectiveness of peer-to-peer PA counselling, given by sport sciences students to students of different subjects, has been reported by Newton, Kim, and Newton[18] and by Boyle et al.[9], but both studies lacked randomization and follow-up data. Wearable PA monitors have become in recent years a popular and relatively inexpensive means of promoting PA[19], however little is still known about the effectiveness of the autonomous use of these devices[20, 21]. Controlled evidence on the effectiveness of PA monitors in promoting PA among university students is currently limited to programs combining also different strategies (e.g. health and PA

information and support from a fitness instructor) in studies with no-follow-up[22] or short-term observation[23].

In Italy, the country where the present study was conducted, a significant decrease of PA from high school to university has been observed, with a 12% reduction of young people regularly engaging in PA from the age group 15-17 to the group 20-24[16]. At today, there are not published studies regarding programs to promote PA among Italian university students, denoting a need for research in this field. Some characteristics of the Italian university system jeopardize the applicability of interventions developed in different university settings: in Italy students are not usually free to choose subjects which are not related to the main topic of their study curriculum, thus hampering the application of PA promotion through course-based interventions. Moreover, in the Italian context the widespread city-based university model is not ideal for proposing students to attend group lectures or practical activities because this could raise timing or logistical problems due to transfers across the city.

The aim of this randomized controlled trial was to test the effectiveness of two different strategies aimed at increasing PA levels in university students and to investigate the sustainability of the effects up to a three-month follow up. One strategy was based on individually tailored counselling, the other on the independent use of PA monitors. We hypothesized that a tailored counselling intervention could better foster behavioural change toward a more active lifestyle, compared to the autonomous use of a PA monitor.

Materials and methods

Participants

One thousand two hundred fifty-four students from the University of Padua, a city-based university in North-East Italy, were contacted in university buildings or on the streets in their vicinity with a brief face-to-face interview. The purpose of the interview was to identify

students that were not regularly physically active (less than self-reported 150 min×week^{-1} of moderate PA), had no health conditions contraindicating PA and were not sport sciences student. Four hundred and twenty-six students (34%) reported to being engaged in PA on a regular basis, 828 (66%) met the inclusion criteria. Fifty-two from the second group accepted to participate in the study. Baseline assessment was completed by 35 students, 17 left the study before the baseline assessment without providing any explanation, 2 dropped-out after baseline assessment. The remaining 33 participants (13 men and 20 women, aged from 19 to 26 years, M = 22, SD = 2) were stratified according to their stage of change (see Measures section) and consequently randomized into three groups: individual counselling group (ICG), PA monitors group (PAMG) and control (CG) by means of a random number generator. Thirty-three completed the post-intervention measurement, 32 completed follow-up measurements, 1 was excluded because of concurring health problems, resulting in a 97% retention rate (see Figure 1).

Participants volunteered and did not receive any rewards. They provided written informed consent, received written explanations regarding aims and methods of the study and were informed they could withdraw at any time. The study was approved by the Biomedical Sciences ethical Committee of the University of Padua on July 18th 2015 (n. 0048) and was conducted in accordance with the ethics principles of the declaration of Helsinki.

###Insert Figure 1 approx. here###

Measures

Participants filled in the International Physical Activity Questionnaire short form (IPAQ-S) and the Physical Activity Stage of Change questionnaire (PASOC). The IPAQ-S is designed to measure PA performed in the last seven days[24]. It requires respondents to self-report how

many days and how many minutes per day they were engaged in moderate and vigorous PA and in walking. Data of IPAQ-S were processed by using a continuous scoring, adjusting the time spent in each intensity level for a standard MET value: 3.3 METs for walking, 4 METs for moderate PA, and 8 METs for vigorous PA[25]. The PASOC[26] assesses the stages of change according to the Transtheoretical Model of Behaviour Change, it asks respondents if they were regularly engaging in PA in the previous six months and what their intentions were in the near future (subsequent six months). “Engaging in regular PA” is intended as engaging in at least 150 minutes of moderate PA×week^{-1}. Respondents are classified at: precontemplation stage if they do not regularly engage in moderate PA and don’t intend to engage in moderate PA in the next six months; contemplation stage if they are not currently active but they intend to engage in moderate PA in the near future; preparation stage if they engage in moderate PA, but not regularly yet; action stage if they engage regularly in moderate PA, but they haven’t been regularly participating in moderate PA for the last six months; maintenance if they engage regularly in moderate PA, and have been regularly participating in moderate PA for the last six months.

Moreover, to objectively assess PA, all participants wore for seven consecutive days, at the different data collection sessions, an ActiGraph-GT3X+ activity monitor (this is a widely used and validated triaxial accelerometer)[27, 28]. In the present study measures from the Actigraph were expressed as minutes spent in moderate to vigorous PA (MVPA), since this is the range of PA which is believed to lead to health improvements[29]. We considered valid a daily wear time of at least eight hours. If participants forgot to wear the monitor or if they wore it for less than eight hours a day, another seven-day measurement was carried out. Participants were asked not to wear the monitors in water, to prevent damages to the device.

Procedures

The participants were involved in three evaluation sessions. Measures were taken at the baseline (t_0), at the end of the 12-week treatment period (t_1) and 3 months after the end of the treatment (t_2). At t_2, participants were asked for feedbacks on the study via an unstructured interview. Individuals in the ICG took part in an initial one-hour group meeting, where they were invited to discuss the importance of PA, moreover they attended every second week individual video-call meetings (via Skype) and received two informative emails a week. Participants in the PAMG received a wearable PA monitor (the MyWellness Key) and were instructed on how to use the device and the dedicated website, they were asked to wear the monitor for the entire 12-week experimental period. Participants in the CG did not receive any treatment.

Counselling intervention

The counselling intervention was developed using the Social-cognitive theory and the Transtheoretical model of behaviour change. According to Social-cognitive theory, a behaviour can be promoted by increasing the behaviour-related self-efficacy and outcome expectations[30, 31]. Self-efficacy has been proved a consistent predictor of PA[32, 33], and associated with changes in PA behaviour in interventions to promote PA[34].

The Transtheoretical model conceptualizes the process of intentional behaviour change as a progression through different stages[35], and indicates cognitive and behavioural processes that people use to progress throughout the stages[26]. Both the Social-cognitive theory and the Transtheoretical model have been widely used to design interventions to promote PA in university students (e.g.[9, 12, 13, 18]).

The counselling intervention aimed to increase PA-related self-efficacy (enabling mastery experience, providing vicarious experience and verbal persuasion, and reflecting on emotional arousal), and outcome expectations of the participants, and to foster progression through

stages of change using cognitive and behavioural strategies suggested by the Transtheoretical model (see Table I). We tailored the intervention according to the stage of change of each participant and by taking into consideration individual characteristics, personal needs, previous experience and expectations. Online videoconferencing and emails were used to deliver the counselling intervention, so to help participants to save time and adhere to the program, since lack of time is often the main barrier towards practising PA reported by university students[36-38].

###Insert Table I approx. here###

Physical activity monitor intervention

The MyWellness Key (Technogym SpA, Cesena, Italy), used by participants in the PAMG, is a PA monitor specifically designed to monitor and promote PA[39]. Activity is measured by a uniaxial accelerometer worn at the waist by means of a belt clip and is expressed as "moves", a unit that takes into account both quantity and intensity of PA. The device automatically sets a goal of moves to achieve every day, based on the measurement of the previous seven days. It also provides a direct feedback to the user showing the amount of moves accumulated during the day on a white bar displayed on the device. Data can be downloaded and the user can look at his/her results on a personal web page, where it is possible to plan exercise and keep track of current and past PA.

Statistical Analysis

Independent sample t tests and one-way ANOVAs were used to test the differences at the baseline respectively between men and women and between groups. Pearson's correlations between IPAQ-S and Actigraph MVPA measures were calculated. Three (time) x 3 (group)

RM-ANOVAs were conducted for each measure (except for PASOC scores) to examine differences over time and among groups. Significant time x group interactions have been further investigated using a simple main effects test as post-hoc. Effect size (Hedges' g) for significant effect of intervention was estimated using the measure proposed by Morris[40]. The Friedman test was used to detect changes in PASOC scores at the three times of research; significant differences were further investigated using the Wilcoxon signed-rank test.

Results

No significant differences between men and women and between the three groups were found at the baseline in any of the variables.

Pearson's correlation among IPAQ-S and Actigraph MVPA measures revealed a moderate statistically significant correlation only at the baseline ($r_{30} = 0.37$, $p = 0.037$).

Repeated measures ANOVA showed significant time x group interaction ($F_{2.61,\ 37.8} = 5.99$, $p = 0.003$) in self-reported PA levels as measured by the IPAQ-S. Post-hoc test revealed that students in the ICG showed a significant increase in self-reported PA (mean increase = 2063.3 min×MET×week^{-1}, $p < 0.001$) from t_0 to t_1, whereas participants in the PAMG and in the CG did not show any significant difference (descriptive statistics and changes over time for each group are reported in Table II). The post-hoc test did not show any significant difference for any of the groups from t_1 to t_2. The effect size for the counselling intervention (IPAQ measures) was $g = 0.409$.

###Insert Table II approx. here###

No significant time x group interactions were found in PA levels measured by the Actigraph.

The Friedman test showed significant differences in PASOC in the ICG between different measurement time points ($\chi^2_2 = 15.24$, $p < 0.001$). The Wilcoxon signed-rank test revealed that all participants in the ICG reported a significant progress through behaviour change stages from t_0 to t_1 (Z = -2.85, $p = 0.004$). From t_1 to t_2, seven participants in the ICG regressed to a previous stage (Z = -2.4, $p = 0.016$). Within the overall time frame, from t_0 to t_2, six participants in ICG showed a progression through stages of change, approached approaching statistical significance (Z = -1.93, $p = 0.053$). No significant differences over time were found in PASOC for participants in the PAMG and in the CG. Table III displays the stages of the participants at t_0 and the progressions/relapses over time.

###Insert Table III approx. here###

Discussion

The aim of the present study was to analyse the effectiveness of two different strategies designed to increase PA among Italian university students of a city-based university. Of the 828 students eligible for the study, only 52 (6.3%) accepted to participate. The main reason that students gave when declining to participate was a lack of time, and a minority declared they were not interested. The low participation rate highlights the difficulties in motivating this population to engage in PA and suggests the importance of identifying effective and low time-consuming strategies to incentive participation.

Effects on PA levels

At t_0, according to Actigraph data, 21 participants spent more than 150 min×week^{-1} in MVPA, even if all participants declared not having been regularly physically active. The mismatch between participant's declaration at recruitment and the objectively measured PA could be due to the misevaluation of one's PA during the recruiting interview. In our

recruiting interview, participants were not guided step-by-step in the recall of PA, so it is plausible that they did not correctly perceive which types of PA fall into the range of MVPA, or were unable to accurately recall the time spent engaging in PA.

Results of MVPA objectively and subjectively measured did not correlate (only at t_0 a significant moderate positive correlation was found), and this is a well-known problem in research[41]. Moreover, data collected with the Actigraph monitors did not show any significant improvement over time in the three groups, while self-reported PA, as measured by the IPAQ-S, increased significantly in the ICG after the 12-week intervention and remained constant at the 12-week follow-up, differently from individuals in the PAMG and in the CG that did not report significant changes, either at t_1 and t_2. Different reasons could explain this result: a) the subjective evaluation of PA levels depends on the individual's recall of quantity and intensity; b) people can either over-report or under-report their performances[42, 43]; c) when an accelerometer is worn at the waist, as it was in our study, only activities involving the centre of mass swinging (e.g. walking and running) can be detected, while others (e.g. resistance exercise, biking, swimming, housework) are not properly recorded[44, 45]. Furthermore, it is possible that the improvement in MVPA for ICG shown by IPAQ-S measures, but not by Actigraph, is due to the fact the some ICG participants started engaging in types of PA that the monitors could not properly record. Regarding the ICG, eight participants started during the intervention a home-based resistance training (this was one of the topic discussed during the individual counselling), two started to attend aqua gym classes (participants were asked not to wear the Actigraph in water), and five initiated commuting by bike.

Results of the IPAQ-S support the effectiveness of an individual-based counselling intervention, compared to an intervention based on the independent use of accelerometers and to a no-intervention condition, in promoting PA among university students. Improvements in MVPA levels in ICG group lasted up to the 12-week follow-up period. This type of

intervention seems to hold good promises for future studies on larger samples, which should also test intervention effects for a longer term. Regarding unstructured interview, participants reported to appreciate using online videoconferencing for counselling. This approach is less time-consuming than in-person counselling, and has been widely used for psychological counselling[46]. This method seems to be useful in helping students to spare time and to avoid logistic and timing problems, which could occur when trying to arrange in-person meetings with the counsellor. Lack of time can lead students to the decision to not adhere to the program (as observed in the recruiting phase) or can cause participants to quit the counselling program, as observed in past studies[9, 18].

The present study is one of the first to evaluating the effectiveness of online videoconferencing to deliver a PA promotion program. A similar approach has been used in a recently published trial[47], but it did not find significant greater effectiveness in adding web-based video-coaching to a website-based intervention.

Changes in Stage of Change

Significant changes in the stage of change, as measured by the PASOC questionnaire, were found in ICG members over the time, whereas no significant differences were found in the other two groups. All ICG participants progressed through stages from t_0 to t_1, but subsequently seven of them regressed to a previous stage from t_1 to t_2. Considering the differences between t_0 and t_2, there was an almost statistically significant progression through stages. At t_2, six participants of the ICG were at a further stage compared to t_0, with a decrease in individuals in the precontemplation and contemplation stages, and an increase in preparation and action stages. It seems that the individual counselling intervention was effective in promoting progress through stages, helping some participants to engage more

289 regularly in PA, and helping others to start thinking about changing from a sedentary to a
290 more active lifestyle.
291 *Results in the PA monitor (PAMG) and in the control groups (CG)*
292 Results suggest that the independent use of PA monitors did not succeed in increasing PA.
293 Students in the PAMG claimed that wearing MWK was uncomfortable and that, after a period
294 of time, it proved to be stressful for them to try to achieves the daily amount of PA set by the
295 device to reach the daily goal. As suggested in the review by Tudor-Locke and Lutes[48], PA-
296 promotion programs based on the use of pedometers/accelerometers should allow participants
297 to set their own daily PA goals. The device used in our study does not allow a customization
298 of daily PA goals when used autonomously; this could have been a factor leading to the
299 ineffectiveness of this approach. According to participants' feedback, future studies should
300 consider the impact of the PA monitors wearability on perceived comfort and the possibility
301 to customizes one's PA goals. PA monitors have been successfully used in PA promotion
302 programs[21, 48, 49] when linked with other forms of support (e.g. the intervention of a coach or a
303 counsellor in combination with the monitor). The individual use of PA monitors is a less
304 expensive strategy, since it minimizes the need for human resources, but, in our study, it was
305 insufficient to increase PA levels.
306 Finally, as expected, participants in the CG did not change their PA habits. No significant
307 differences in both IPAQ-S and Actigraph measures, as well as no significant progression
308 through stages of changes were observed in this group.
309

310 **Conclusions**

311 This paper presents the results of a study aimed at exploring the effectiveness of two different
312 strategies in promoting PA among university students in an Italian city-based university.

Measures of self-reported PA and of stages of change supported the notion that an individual counselling program can be a successful strategy in promoting PA among university students, while accelerometer measures did not support the effectiveness of the intervention. We can assume that the increase of self-reported MVPA was not detected by accelerometers because participants increased the time spent in certain types of PA that the Actigraph cannot properly record.

Counselling sessions delivered via online videoconferencing were appreciated by participants and helped to avoid possible logistic and timing problems that could rise when delivering a face-to-face intervention. The independent use of PA monitors did not succeed in improving PA levels. Further studies are needed to assess if these devices can be useful in promoting PA when used autonomously by individuals.

Limits and directions for future studies

The present study presents some limitations. The sample size was small and this could hinder the generalizability of the results. An inconsistency between participants' declaration of being not regularly physically active and baseline data was found; imprecise recall/evaluation of one's PA could be implied.

As reported in the literature, a mismatch between PA measured by questionnaires and PA recorded by the Actigraph in free-living condition was observed. Both instruments present some limitations, previously discussed, and future studies should try to integrate different measurement methods, to increase both objectivity and comprehensiveness of the measures.

Finally, based on observations conducted during the study and participants' feedback, we would suggest considering for future studies the great variability of PA behaviours that may occur during the academic year. University students, in contrast to other populations, have often no stable routine habits throughout the year. They tend to spend more time in sedentary

activities close to and during examination sessions, reducing the amount of time devoted to other activities, including exercise and PA.

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467

TITLE OF TABLES

Table I. Strategies used in individual counselling sessions.

Table II. Descriptive statistics, and change scores for physical activity measures over the three measurement points.

Table III. - Participants' stage of change at $t_{0,}$ and changes over time.

TITLE OF THE FIGURE

Fig. 1. - Participants' flowchart.