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Original Article

SEDENTARY BEHAVIOR IN YOUNG ADULTS USING ECOLOGICAL MOMENTARY ASSESSMENT: AN IMAGE OBSERVATION PROTOCOL

COMPORTAMENTO SEDENTÁRIO EM ADULTOS JOVENS POR AVALIAÇÃO MOMENTÂNEA ECOLÓGICA: PROTOCOLO DE OBSERVAÇÃO POR IMAGEM

Amanda Baroni Costa[1], Arthur Magro Pinheiro[1], Guilherme Batista de Sousa[1], Lucas Vinícius Ramos[1], Millena Aparecida Ladislau[1], and **Catiana Leila Possamai Romanzini[1]**

[1]State University of Londrina, Londrina-PR, Brazil.

RESUMO

Novas formas de se obter informações sobre o comportamento sedentário (CS) têm sido exploradas recentemente. O objetivo do presente estudo foi verificar a concordância da postura auto-relatada por meio da Avaliação Momentânea Ecológica (AME). As imagens foram enviadas por meio de um protocolo de observação criado em um formulário respondido pelo telefone celular de adultos jovens. Foi utilizado um banco de imagens fornecido por 41 universitários, obtidas por um projeto realizado em 2019 com base na taxonomia do comportamento sedentário. As seguintes posições foram analisadas: sentada, deitado/reclinado ou em pé, comparando a imagem fornecida com o CS auto-reportado por meio da AME, que foi coletada por telefone celular. A concordância foi realizada por dois pesquisadores de modo independente. A análise dos dados foi realizada pela estatística descritiva, t de Student, qui-quadrado e k de Cohen no SPSS 25 com P<0,05. A concordância entre os avaliadores foi forte/substancial de 87,6% (avaliador 1; k = 0,696) e de 88,6% (avaliador 2; k = 0,720). O protocolo de observação por imagem criado por formulário eletrônico conseguiu discriminar o comportamento adotado pelos participantes, bem como viável de ser utilizado de modo independente, somente para o registro da AME e/ou da imagem/fotografia.
Palavras-chave: Telefone celular, Estudantes, Fotografia.

ABSTRACT

New ways to obtain information on sedentary behavior (SB) have recently been explored. This study aimed at assessing the self-reported posture agreement by using the Ecological Momentary Assessment (EMA). The images were sent by an observation protocol created in a form that would be answered via the mobile phone of young adults. The bank of images was provided by 41 university students. Such images were obtained from a project carried out in 2019, which was based on the taxonomy of sedentary behavior. The following positions were assessed: sitting, lying/reclining and standing, comparing the images provided with the self-reported SB by using EMA, which was collected via cell phone. The agreement was assessed by two researchers independently. Data analysis was based on descriptive statistics, Student's t test, chi-squared test, and Cohen's k in SPSS 25 with P<0.05. The inter-rater reliability was strong/substantial, that is, 87.6% (rater 1; k = 0.696) and 88.6% (rater 2; k = 0.720). The image observation protocol created in an electronic form could discriminate the behavior adopted by the participants, as well as it could be used independently, only for recording EMA and/or the image/photograph.
Keywords: Cell phone, Students, Photograph.

Introduction

Sedentary behavior (SB), defined as having an energy expenditure of less than or equal to 1.5 metabolic equivalents (METs), assessed while awake and on a sitting, lying or reclining position[1], is a multifaceted phenomenon. It can be measured considering different behaviors, such as watching TV or driving; as well as the amount of time in a specific domain, such as leisure or work, besides total time and even the pattern of the time accumulated throughout the day[2,3]. Aiming at classifying these different types of sedentary behavior, a project named "Sedentary Behavior International Taxonomy" established nine facets of SB, which represent: the objective, environment, posture, social aspect, measure, associated behavior, status, time and type, in addition to their subdomains[4].

Understanding SB in different facets is particularly important, since limitations that permeate the collection of information still exist, given that objective measures, particularly inclinometers or accelerometers, have greater validity for measuring time in SB, but are not able to provide details, for example, about the type, the posture adopted and behavior context. On the other hand, the subjective measures, such as diaries and questionnaires, are effective for

capturing time spent in different environments, contexts and behaviors; however, they have low validity in comparison with objective methods for measuring SB total time[5].

In order to try to overcome the limitations of using one measure over another, some researchers have explored other methods for measuring SB, so as to aggregate information, such as the Momentary Ecological Assessment (EMA)[6,7] and the SenseCam's[8,9]. EMA is defined by the repeated collection of data in real time in natural environments. Its focus is to capture the ecological validity by assessing how the SB can vary according to the environment and the circumstances that involve a person's daily routine[10,11] . In addition, the possibility of using EMA via cell phones, besides being more viable, it also enables a faster collection of information, provided at the time of random signalings[12] and has already shown to be potentially important in identifying the prevalence of SB in young adults[13]. The SenseCam's are micro-cameras that are accommodated on the neck by a cord similar to that of a badge and can provide information about the context of the SB in an easy and viable way with photos obtained automatically throughout the day while it is in use[8,9].

More recently, in 2019, a mobile photo-sharing application called Be Real[14] was created, which brings together the characteristics of sending random notifications to the application user throughout the day (EMA characteristics). Thus, the person can provide two photos of himself/herself, one selfie style and another from his/her front view (SenseCam features), without any kind of filter (photography effects), to be shared in two minutes with his/her network of friends. It is worth mentioning that photographic records are considered the 'gold standard' for identifying SB context[5], as if the researchers were actually observing this behavior occurring at that moment[3,5].

Specifically, considering the reality of a developing country, as the case of Brazil, and thinking about strategies for using these tools in a public reality, such as the Brazilian Unified Healthcare System (SUS), the Physical Education professionals could create a simple questionnaire that requests records and images through Google Form to obtain information from the population assisted by the Basic Health Units (UBS) programs, regarding one or more facets of SB throughout the day. Knowing more details on SB context, such as discriminating the posture adopted, might greatly help in the dissemination of intervention strategies focused on reducing the total sedentary time in different populations.

Therefore, the present study aimed at assessing the agreement of the self-reported posture (sitting, lying/reclining and standing) by using the Ecological Momentary Evaluation with the images sent through an observation protocol created in a form that could be answered via the cell phone of young adults.

Methods

Participants

This is a descriptive study that used a bank of images provided by 41 university students attending the 1st and 4th years of the Bachelor's Physical Education Course at the State University of Londrina (UEL) in the morning and evening. These students sent photographic records while participating in the Health Mobile Project (Opinion number 3.362.166, May 31st, 2019). This study was approved by the Committee on Ethical Research with Humans of the State University of Londrina under opinion number 4.285.166 on September 18th, 2020, and followed all precepts for studies that involve human beings. It is worth mentioning that a new authorization in the Free Informed Consent Form (FICF) was not provided, since this authorization had already been granted at the time of data collection in 2019.

Procedures

In order to carry out the present study, the free Google Forms platform was used, which is very similar to the paid platforms, most widespread in studies with EMA via cell phone, such as Ilumivu®[15] or MovieSens®[16]. Initially, a simple questionnaire was created on the platform, following a strategy already used by other researchers, as shown in the study by Holube et al[17]. The form was divided into sections, and, always considering the exact moment immediately after receiving the link, the participants were asked which position they were in (Figure 1) and, optionally, to send of a photo of the activity they were performing according to their point of view, but not a selfie (Figure 2).

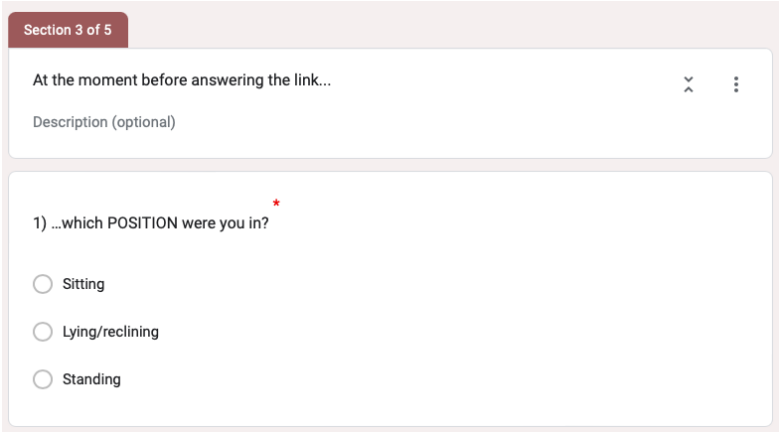

Figure 1. Request for information on the position adopted at the exact moment of the response
Source: the authors

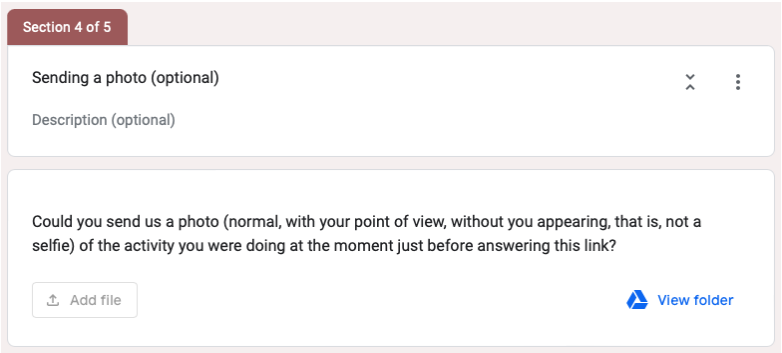

Figure 2. Request for a photo/image of the activity being carried out at the exact moment of the response
Source: the authors

The collections of the Health Mobile Project took place in September and October, 2019. The information on SB using EMA[7] was obtained via the participants' own cell phone. Six daily links have been sent for seven days, two per day period.

After having the form finished, the researchers involved in the Health Mobile Project added the cell phone (with WhatsApp) of each participant to a list, so that the form link could be sent manually for responses. Thus, a fixed schedule was established with two mailings in each of the day shifts. It is worth mentioning that paid mobile applications perform this function automatically, after being programmed in the system.

The spreadsheet generated by the form provided a direct link address to a Google Drive folder of the owner where the form was created for each response with an image (Figure 3).

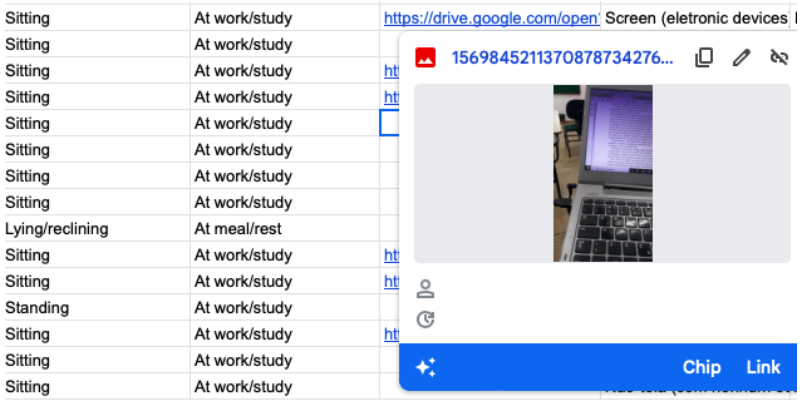

Figure 3. Registration of the form responses and observation of the image sent
Source: the authors

Therefore, the image analysis procedure consisted of observing whether the image provided by the participants corresponded to their self-report using EMA, in terms of only adopting one position out of the three possible ones: sitting, lying/reclining or standing.

In this sense, the adoption of a sitting or lying/reclining position was classified as sedentary behavior (SB), and the adoption of a standing position as non-sedentary behavior (non-SB). Depending on the context in which the participant reported being involved, different images were received. The focus was on assessing the agreement between the two methods (EMA and photography). Figure 4 shows some other domains, also with the 'sitting' position.

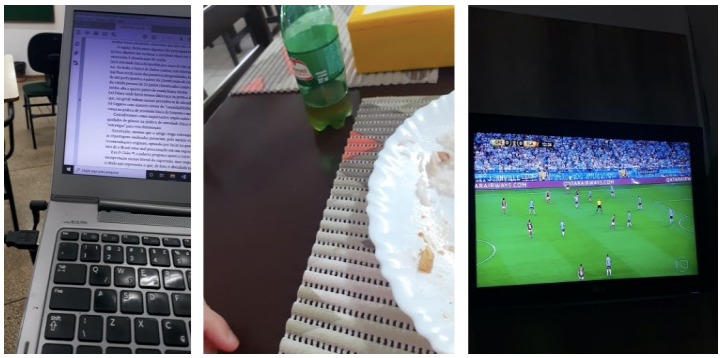

Figure 4. Different sitting position according to the domain (work/study, meal/rest and leisure/free time)
Source: the authors

The process of assessing the images provided by the participants was performed by two researchers independently; they were categorized according to the taxonomy of the specific SB for the position. In this sense, both researchers carried out the process of classifying the information and, then, they proceeded to confirm the records provided by the participants to see if there was agreement.

Statistical analysis

Descriptive statistics (mean and standard deviation) was used for data analysis. Student's t test for independent samples compared demographic variables per sex. The chi-square test was used to verify the association between the data collection methods (EMA with raters, and inter-raters). Cohen's k was calculated for the combination of EMA method with rater 1; EMA with rater 2, and inter-rater reliability, which was interpreted using Landis and Koch guidelines[18]. SPSS version 25 was used; the significance level for all analyzes was $P<0.05$.

The assessment of the images provided by the participants was performed by two researchers independently, and they were categorized according to the taxonomy of the specific SB for the position. In this sense, both researchers classified the information and, then, proceeded to confirm the records provided by the participants to see if there was agreement.

Results

The mean age of the participants was 24.35 ± 6.63 years for males and 21.06 ± 4.69 years for females. The data collection carried out for seven days with the 41 participants generated a total of 227 image records. For analysis purposes, 26 records were excluded because they could not be classified using the image/photograph method, since the position adopted by the participant was not identified.

Therefore, the final analysis was performed with 201 records, which represented 62.7% of male participants and 37.3% of females. Regarding the study grade, the 1st year of the Physical Education Bachelor course at UEL had a representation of 54.2% of the records, whereas the 4th year had 45.8%. Table 1 shows data on the prevalence of sedentary behavior (sitting and lying/reclining) according to the method, that is, EMA vs. photography; the latter was obtained by two raters independently.

Table 1. SB prevalence (sitting and lying/reclining) and non-SB according to the method (EMA vs photography) (n=201)

	EMA (n= 201)	**Photograhy Rater 1 (n= 201)**	**Photograhy Rater 2 (n=201)**
SB (sitting; lying/reclining)	71.1*	71.6*	71.6*
Non-SB	28.9*	28.4*	28.4*
Total	100.0	100.0	100.0

Note: SB = sedentary behavior; Non-SB = non-sedentary behavior; * there is association for P<0,001 according to the chi-squared test

Source: the authors

Table 1 shows that there was a prevalence of total SB measured by EMA of 71.1%, whereas for both raters it was of 71.6%. The kappa test showed a strong/substantial reliability between EMA and rater 1 (k = 0.696; P<0.001; agreement = 87.6). There was also strong/substantial reliability between EMA and rater 2 (k = 0.720; P<0.001; agreement = 88.6). Regarding the comparison inter-raters, when assessing only the images, a perfect reliability was seen (k = 0.976; P<0.001; agreement = 99.0%) as shown in Table 1 (photograph by rater 1 x photograph by rater 2).

Table 2 shows the SB classification of the participants according to the posture identified in the images by the raters.

Table 2. Sum of the inter-rater SB classification according to the posture image.

	Rater 1 (n= 201)	**Rater 2 (n=201)**	**Total**
SB (sitting)	131	135	**266**
SB (lying/reclining)	13	09	**22**
Non-SB	57	57	**114**
Total	**201**	**201**	**402**

Note: SB = sedentary behavior; Non-SB = non-sedentary behavior; chi-squared test: $\chi 2=0.787$

Source: the authors

According to Table 2, which refers to the photographic images, it is relatively easier to identify both, the sitting SB and the non-SB (standing) than the lying/reclining SB, which is often implied in the images and depends on the rater's interpretation. However, there was no

difference between the raters in discriminating these classifications (k = 0.976; $\chi 2$=0.787).

Discussion

Based on the analysis of 201 electronic records provided by EMA, that is, an electronic form answered via the participants' cell phone and concomitant analysis by photographic image, which was sent by the participants through this same form, it was seen that the prevalence of records referred to the adoption of SB by young adults (71.1%). Although it was not the focus of the present study, several of these behaviors were recorded during study/work, meals and also rest/leisure (TV).

The agreement between the self-reported behavior by the participants using EMA and the image recording, assessed by two raters, independently, showed a strong/substantial agreement of 87.6% (rater 1; k = 0.696) and of 88.6 % (rater 2; k = 0.720). In addition, the inter-rater reliability, just when assessing the image/photograph for identifying or not what was characterized as SB, was considered perfect (k = 0.976). It is not possible to state that there was a difference between raters in the discrimination of these classifications ($\chi 2$ =0.787).

A recent study[13] had already shown the viability of using EMA via the participants' cell phone to obtain information about the occurrence of SB in young adults. In addition, research that includes university students and the use of cell phones has increasingly been performed, mainly because one of the principal reasons for their use is accessing the social networks, such as Facebook and Instagram. Additionally, more and more studies seek to find ways in the technology itself to combat this public sedentary behavior[19]. In the case of initiatives aimed at the population served by different Unified Healthcare Systems (SUS), it would not be different. Thus, it is necessary to be aware of the ease of using strategies, such as the one shown in the present study, so as to provide information on the different behaviors of the population.

Based on the evident lack of more robust and high-cost resources for data collection regarding SB, such as SeseCam's[8,9], the strategy of using EMA, distributed through a simple electronic form on Google Forms of free access to any user with a Gmail account, it is possible to obtain valuable and extremely relevant information for further research. In addition, a recent opinion article addressed the issue of developing and adapting SB measurement instruments, mainly due to its dynamic nature, and that this requires innovative solutions[20].

As any other research, the present study also has limitations, which are mainly related to the fact that the analysis was restricted to a population more involved with technology and with a certain level of education, that is, the university students, in addition to being restricted only to the registration of the participants who sent the photos. However, the creativity and facility of using the free platform to motivate the collection of information on such behavior should be emphasized, since most research carried out in Brazil, for example, obtain such information by using high-cost and difficult-to-access equipment.

Based on this idea, new possibilities might emerge with regard to the use of other more intuitive ways of collecting information, such as the development of applications by including the use of audio and accessibility instructions in order to serve an increasingly diverse population which is assisted by SUS programs.

Conclusion

It is concluded that the image observation protocol created by electronic form did not generate costs. In addition, its practicality for obtaining information on the SB of young adults is evident. It is noteworthy the perfect agreement between the self-reported behavior using EMA and the analysis of the images provided by two raters independently, as well inter-rater

assessment. Thus, the applicability of the instrument used in the present study is highlighted, since it enabled to discriminate the behavior adopted by the participants, besides being feasible to be used independently only by registering EMA and/or the image/photograph.

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ORCID:
Amanda Baroni Costa: https://orcid.org/0000-0001-9013-0287
Arthur Magro Pinheiro: https://orcid.org/0009-0009-9579-5523
Guilherme Batista de Sousa: https://orcid.org/0009-0007-4103-9736
Millena Aparecida Ladislau: https://orcid.org/0009-0004-1704-3346
Lucas Vinícius Ramos: https://orcid.org/0009-0003-8635-3674
Catiana Leila Possamai Romanzini: https://orcid.org/0000-0001-6677-3290

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Correspondence address: Catiana Leila Possamai Romanzini. Centro de Educação Física e Esporte da Universidade Estadual de Londrina - Rodovia Celso Garcia Cid | PR 445 Km 380 | Campus Universitário Cx. Postal 10.011 CEP 86.057-970 | Londrina – PR. E-mail: clpossamai@uel.br