Rev Andal Med Deporte. 2017;10(1):19–24

JUNTA DE ANDALUCIA
Centro Andaluz de Medicina del Deporte

Revista Andaluza de
Medicina del Deporte

www.elsevier.es/ramd

Original article

Physical activity and sleep of persons living with HIV/AIDS: A systematic review

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ARTICLE INFO

Article history:
Received 12 May 2016
Accepted 29 August 2016
Available online 3 November 2016

Keywords:
Physical activity
Exercise
Sleep
Quality of sleep
Human immunodeficiency virus
HIV/AIDS

ABSTRACT

The objective of this academic work is to present the evidences available in literature about the relation between physical activity and sleep in regards to individuals living with HIV/AIDS. The databases: Web of Science, PubMed/MEDLINE, Science direct, Bireme, Scopus and EBSCO, were used to identify four articles, published until September 2015 to be included in this systematic review. According to the analyzed studies, interventions with physical activity for persons living with HIV/AIDS were significantly associated with the quality of sleep, total sleep time, efficiency, decreased of number of awakenings during sleep and improvement of sleeping disorders (insomnia). Therefore, the results presented in this research paper makes evident that physical activity has a relation with the quality of sleep amongst this specific population group, causing benefits to the quality of life of the patients. Nonetheless, it has been noticed that there is a necessity for more research and investigation in regards to the topic presented.

La actividad física y el sueño de las personas que viven con el VIH/sida: una revisión sistemática

Palabras clave:
Actividad física
Ejercicio
Sueño
Calidad del sueño
Virus de la inmunodeficiencia humana
VIH/SIDA

RESUMEN

El objetivo de este trabajo es presentar las evidencias disponibles en la literatura sobre la relación entre la actividad física y el sueño en personas que viven con VIH/sida. Las bases de datos Web of Science, PubMed/MEDLINE, Science Direct, Bireme, Scopus y EBSCO, fueron utilizadas para identificar cuatro artículos publicados hasta septiembre de 2015, para su inclusión en esta revisión sistemática. Según los estudios analizados, las intervenciones basadas en actividad física, para personas que viven con el VIH/sida, se asocian significativamente con la calidad del sueño, el tiempo total del sueño, la eficiencia, la disminución de la fragmentación del sueño y mejoras en trastornos del sueño (insomnio). De esta manera, los resultados de este estudio evidencian que la actividad física está relacionada con la calidad del sueño de este grupo específico de población, generando beneficios en la calidad de vida de los pacientes. Aun así, se ha constatado la necesidad de realizar más investigaciones y estudios sobre el tema presentado.

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http://dx.doi.org/10.1016/j.ramd.2016.08.001

Atividade física e sono de pessoas que vivem com HIV/AIDS: Uma revisão sistemática

Palavras-chave:
Atividade física
Exercício
Sono
Qualidade do sono
Vírus da imunodeficiência humana
HIV/AIDS

R E S U M O

O objetivo deste trabalho é apresentar as evidências disponíveis na literatura sobre a relação entre atividade física e o sono de pessoas que vivem com HIV/AIDS. As bases de dados Web of Science, PubMed/MEDLINE, Science Direct, Bireme, Scopus e EBSCO, foram utilizadas para identificar quatro artigos, publicados até setembro de 2015, para a inclusão nesta revisão sistemática. De acordo com os estudos analisados, intervenções com atividade física para pessoas que vivem com HIV/AIDS associam-se significativamente com a qualidade do sono, tempo total do sono, eficiência, diminuição da fragmentação do sono e melhoras nos distúrbios do sono (insônia). Desta forma, os resultados do presente estudo evidenciam que a atividade física tem relação com o sono dessa população, gerando benefícios para a qualidade de vida dos pacientes. Ainda sim, percebe-se a necessidade de mais indagações e pesquisas acerca da temática apresentada.

Introduction

Acquired immunodeficiency syndrome (AIDS) is characterized as a clinical manifestation in which the agent is the human immunodeficiency virus (HIV), being thus acknowledged as a serious public health problem at a world level due to its profound suppression of the immunity, mediated by the T cells, in which makes individuals susceptible to opportunistic infections, neurological diseases and muscular hypotrophy.[1,2]

In this manner, the antiretroviral treatment (TARV) appears as an associated tool for the search of better quality of life and survival, reducing thus 33% of the number of deaths caused by HIV infection. On the other hand, this treatment often is associated with the use of protease inhibitors, which can cause side effects.[3,4]

Most of the side effects identified is associated to the metabolic processes, thus increasing the risk of metabolic syndromes, lipodystrophy, insulin resistance, hyperglycemia and redistribution of body fat as well as diarrhea, nauseas, vomit, agitation and insomnia.[5]

Since this is, an infection that facilitates the onset of various other opportunistic diseases, due to the deterioration of the individual's immune system, evidences shows the appearance of neurological problems. Such as, sleeping disorders, which could be related to the deficit of dopamine release (produced by the adrenal glands) for the regulation of sleep, and which could influence the worsening of the patient's health.[6–8] In this regard, the practice of physical activity appears as a non-pharmacological treatment, which aims to decrease the action of the treatment's side effects and the opportunistic diseases, thus providing numerous benefits for this population group.[9–11]

Studies shows that the effects of regular physical exercise, provides benefits for sleeping, regarding hypothesis such as thermos regulation (the increase in body temperature facilitates the sleep induction). In addition, energy conservation (the increase of calorie output promoted during sleep because physical exercise increase the necessity of sleep) in order to obtain a positive energetic balance, establishing a condition for the sleeping cycle.[12]

Although, there are evidences which indicates that physical exercise provides beneficial effects and consequently a possible relation with a good quality of sleep, there are still no systematic analysis that explores the relation between physical exercise and sleep in individuals living with HIV/AIDS.[13,14] And thus, aiding professionals that work with this population group with interventions and the targeting of actions.

Thus, the objective of this study is to verify the scientific evidences available on the relation of physical exercise and sleep in persons that living with HIV/AIDS.

Method

Selection criteria

The current systematic revision was ellaborated observing the methodological procedures of The Cochrane Collaboration.[15] The search of the descriptors and terms used were made through consultations on the *Descritores em Ciências da Saúde* (DeCS) through the portal of the *Biblioteca Virtual em Saúde* (BVS) and Medical Subject Headings (MeSH), through the portal of the U.S. National Library of Medicine (NLM).

The descriptors used were: "Physical activity", "Exercise", "sleep", "insonmia", "HIV" and "Acquired immunodeficiency syndrome", "actividad física", "ejercicio", "sueño", "insomnio", "VIH" and "Síndrome de inmunodeficiencia adquirida". For the variable physical activity were included the terms "Physical activity, Exercise, actividad física and ejercicio" and for the variable sleep, the terms used were "sleep, insomnia, sueño, insomnio".

The searches were made in the English and Spanish language, using the Boolean operators, "AND" and "OR" for the searches in English, and "Y" and "O" for the searches in Spanish. Additional researches were elaborated in the references of the selected articles; however, no relevant article was identified.

Inclusion and exclusion criteria

The studies identified through these methods were selected based on the following inclusion criteria: (1) studies with transversal, longitudinal and intervention delineation that examined the acute or chronic effect of physical activity in a biological measure or self-report of the total time of sleep, latency, efficiency, numbers of awakenings, phases 1, 2, 3, and 4 of sleep, slow waves of sleep, sleeping disorders and quality of sleep; (2) adults of both genders living with HIV/AIDS (in other words, average age $\geq$18); (3) making use or not of the antiretroviral therapy; (4) articles published in English or Spanish; and (5) be published until September, 2015.

The exclusion criteria were selected to assure that the studies included were well controlled. In this manner, the studies that presented the following criteria were excluded: (1) studies analyzing only physical activity without making a relation between physical

activity and sleep; (2) studies that examined other type of population group; (3) including exclusively children and adolescents (average age below 18); and (4) studies with animals.

Database and research strategies

The research was made during July and September 2015, in the bases of the electronic periodicals Web of Science, PubMed/MEDLINE, Science Direct, Bireme, Scopus and EBSCO. The strategy of the research was based in a combination of three parameters of research; independent variable (PE), dependent variable (sleep), population of interest (adults living with HIV/AIDS).

In the first phase, 6.285 articles were located in the following databases: Web of Science $n = 28$ (0.4%), PubMed/MEDLINE $n = 36$ (0.5%), Science Direct $n = 6.058$ (97%), Bireme $n = 27$ (0.4%), Scopus $n = 60$ (0.9%), EBSCO $n = 76$ (1.0%), such as described in Fig. 1.

The searches were performed through two researchers (Name initials: IKS and MIK) that, in an independent manner, researched, extracted and assessed the quality of the studies. The discrepancies found were resolved through the meeting of a consensus or through a third evaluator (Name initials: KPMA).

Assessment of the methodological quality of the studies

To evaluate the methodological quality of the studies, it was used the Downs & Black scale[16] and as reference, the check-list Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[17]

Results

Using the strategy for searching as described previously, 6285 articles were identified, in which 5811 were excluded for being duplicated, leaving 474 articles for the reading of their titles. After the reading of the titles, 405 more articles were excluded for not comprising the criteria for selection as defined, remaining 69 articles for the reading of the abstracts.

The next stage included the reading of 69 abstracts, in which 58 articles were excluded, for containing in the sample the following: healthy adults, average age not in the range determined by the study, did not investigate the variables defined and literature revision studies. Concluding, 11 articles were selected to be read thoroughly, and after the reading of the manuscripts, seven articles that did not attend the inclusion criteria were excluded (three articles because were a literature revision and four others because did not include the main variable of interest), remaining four articles to be evaluated.

From the selection process of the articles, a synthesis of the characterization and sociodemographic data of the included studies was performed, in which it was identified, that in the four selected

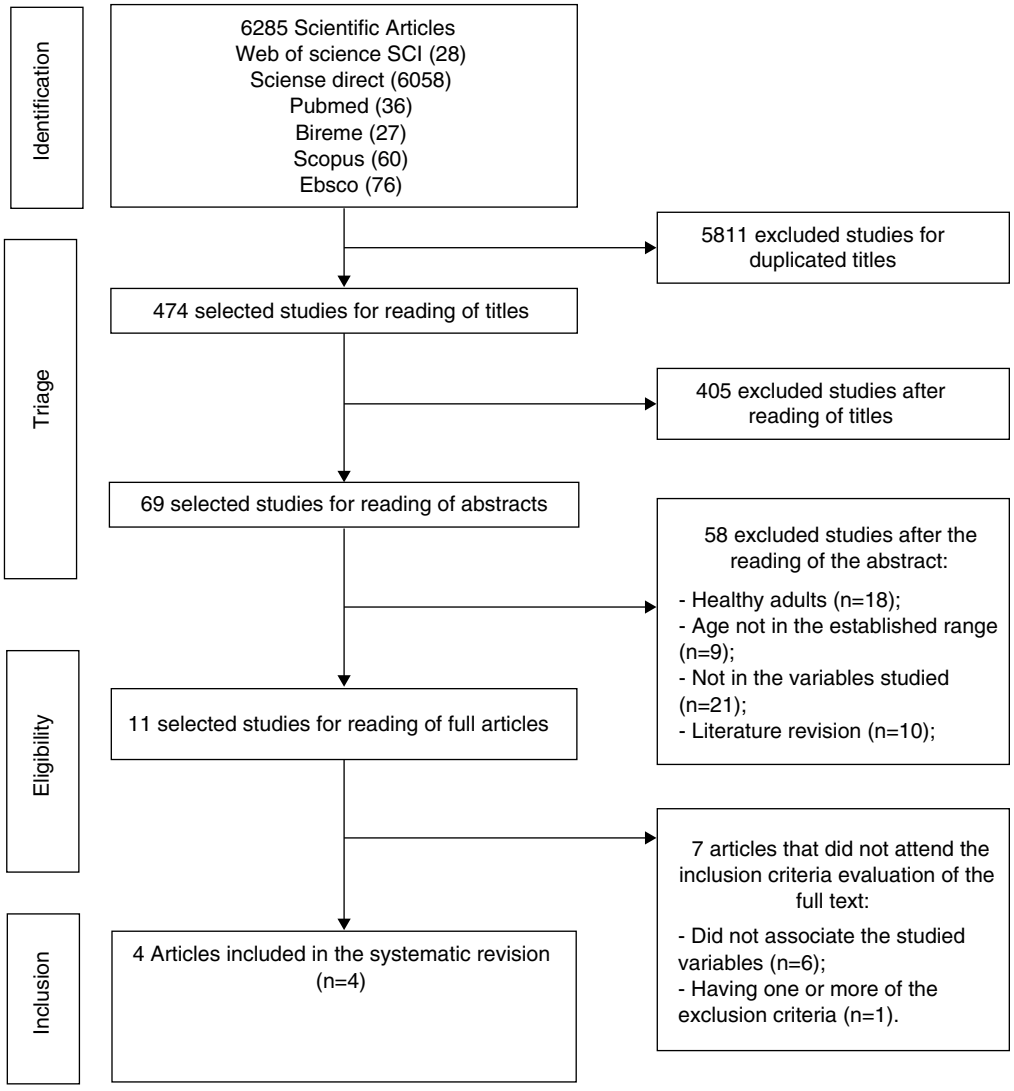

Fig. 1. Flowchart of the process for the selection of the studies.

Table 1
Sociodemographic and methodology characteristics of the evaluated studies ($n = 4$).

Author/year	Country	Sample (gender)	Age (years)	ART	Design	Instruments		P
						Physical activity	Sleep	
Sandoval, Gilkerson, 2015	USA	1 patient (male)	67	Y	Case study (intervention)	Accelerometer (Fit Bit Flex) TC6 Bruce Protocol	PSQI Fit bit Flex	17
Wirth et al., 2015	USA	45 patients (26 male; 19 female)	47.1 ± 9.4	Y	Transversal	Accelerometer (Sense Wear)	Sense Wear	17
Webel et al., 2013	USA	40 patients (both gender)	>18	Y	Pilot study (intervention)	Accelerometer (Actigraph)	Sleep Diary Actigraph	20
Hudson, Portillo, Lee, 2008	USA	30 patients (female)	31 and 54 (40.4 ± 6.3)	NR	Pilot study (intervention)	Accelerometer (Actigraph)	PSQI Actigraph GSDs	21

USA: United States of America; ART: antiretroviral treatment; Y: yes; N: no; NR: not reported; PSQI: Pittsburgh Sleep Quality Index Questionnaire; SMWT: Six-Minute Walk Test; GSDs: General Sleep Disturbance Scale; P: quality points.

academic papers, all of them were conducted in the United States, during 2008 and 2015. The samples of the studies varied from 1[18] to 45 adults living with HIV/AIDS,[19] making use of the antiretroviral therapy, ages ranging from 18 to 67 years old, however only study did not report if the sample was making use of the antiretroviral therapy[20] (Table 1).

Of the four studies evaluated, all of them used the accelerometer to assess the physical activity, howbeit, one study used the accelerometer model Fit bit Flex,[18] another the Sense Wear,[19] and two other studies used the Actigraph.[20,21]

To evaluate the sleep variable, the four studies used actimeters and questionnaires. In the studies of[18] and[20] the Questionnaire Index of Sleep Quality from Pittsburg was used, validated by Buysse et al.,[22] and the daily sleep was used.[21] In the study of the actimeter Sense Wear was used,[19] while that in the studies,[20,21] the actimeter Actigraph was used, the participants used them in the pulse or in the waist for at least seven days (one week) to ten days.

Table 2 presents the data of all the studies included in this revision, identifying the types of intervention performed, procedure for each intervention, the results and conclusions. In this respect, it demonstrates how the authors accomplished the procedures aiming to identify the association between physical activity and sleep, from simpler statistical technics to the comparisons of the averages (paired *t*-test), association test of the *Chi-Squared*, comparison test (*Anova*) until more sophisticated techniques as analysis of the variance and covariance (*ANCOVA*).

All of the studies presented a good methodological quality, referent to the Downs and Black scale, obtaining values above 17 points from the 27 items assessed. Out of the four studies analyzed, the studies pertaining a significant association was observed between the interventions with the practice of physical activity over the total time of sleep and the decrease of 64% in the number of awakenings during sleep.[18–21] However, while analyzing the time for the practice of physical activity by the participants, it was observed that as less time was dedicated for physical exercise, greater was the chances for the individuals to present a high value of C-reactive protein (CRP) and consequently a shorter time of sleep (<8 h/day).[19] In the other hand, identified significant association in the reduction of occurrences of insomnia episodes and improvement in remaining a sleep.[20]

Discussion

This systematic review examines the effect of the practice of physical activity on sleep of people living with HIV/AIDS. The results show that with regular practice of physical activity can realize significant improvements in total sleep time, sleep efficiency and reduction in episodes of sleep disorders, offering a better quality of life for the population studied.

Based on the analyzed literature in this systematic revision, it is noticed a concern about the quality of sleep in regards to people living with HIV/AIDS, since that around 70% of the population reported having problems related to sleeping disorders.[23]

In light of this, the results of the assessed studies in this revision presents evidences that there is a consesus in literature about the association between the practices of physical activity and sleep, nevertheless, other behavioral, sociodemographic and health factors could mediate this complex relation.

Thus, it can be highlighted that the principal findings of the studies in this revision, were:

(a) Patients living with HIV/HCV submitted to intervention based on a program for physical activity, were significantly associated with improving the quality of sleep.[18]
(b) Patients that engage themselves in at least 70 min of moderate to vigorous physical activity (MVPA) are more predisposed to have sufficient sleep, better efficiency and demonstrated lower values of Cardiorespiratory Arrest and Interleukin 6, reducing the risk of inflammation.[19]
(c) Participants of behavioral intervention that includes the practice of physical exercises, presented an increase in the duration of sleep, efficiency and a decrease in the fragmentation of the night of sleep, and consequently a reduction in sleeping disorders, and health improvement and life expectancy of this population group.[21]
(d) The participation in physical activity is associated with an improvement in the frequency of insomnia episodes.[20]

Furthermore, the methods used the most to evaluate the association between MVPA and sleep were through the interventions based in the practices of physical activity, and behavioral changes. In this manner, the practice of physical activity in all of the studies were evaluated by accelerometer, of different models, due to its validation and objectivity in the application of the study with small and large samples.[18–21] For the evaluation of sleep, the studies used the actimeter (a watch that provides continuous data of the movements).

Based on these issues practicing less hours of physical activities is correlated with a less time of sleep, less efficiency and consequently with the development of the inflammation process, causing more problems to aggravate the disease.[19] On the other side, was identified an increase directly proportioned to the quality of sleep and consequently a significant improvement in the number of awakenings during sleep.[18] Correlated positively with the practice of physical activity proposed in the intervention with

Table 2
Methodology indicators, statistics, results and conclusions of the included studies ($n = 4$).

Author, year	Type	Intervention time	Types of intervention	Statistics analysis	Main results	Conclusions	P
Sandoval and Gilkerson, 2015	EC	6 weeks	Training A (Cardiovascular Training) – 3 sessions per week; 2 weeks of manual and cardiovascular stretching, walk or accelerated cycling for 30–60 min, 3–4 days per week, 40–60% of intensity. Training B (Resistance Training) – 3 sessions per week; 2 weeks of resistance training, making tests of 1 RM, rate of 3 sets of 4 repetitions for each exercise. Training AB (Training Circuit) – 3 sessions per week, 2 weeks of training in circuit with the cardiovascular and resistance training.	ANOVA Post Hoc Dunnet *t*	There was a significant improvement in the quality of sleep, having a final score in the questionnaire of 4/21, with a decrease of 64% in the number of awakenings during the night.	Exercise programs can improve the quality of sleep of individuals that live with HIV/HCV.	17
Wirth et al., 2015	T	7–10 days	The Sense Wear was used in the left arm per 10 days.	Qui Quadrado	The participants that did more than 70 min of moderate to vigorous physical activity per day showed a greater total time of sleep.	Participation in physical activity helped maintain the quality of sleep.	17
Webel et al., 2013	PS	10 weekly sessions	The Actigraph was used 7 days continuously, and then there was a participation of the System Alterar-HIV, which is based on the intervention and established in a socio-ecologic model.	ANCOVA	Increase in the total time of sleep; increase in the efficiency of sleep; decrease in the fragmentation and reduction of sleeping disorders. Increase of life satisfaction.	Interventions with physical activity are reasonable to improve the quality of sleep of this population group.	20
Hudson, Portillo, and Lee, 2008	PS	1 week with sessions of 30–45 min	B.E.T.T.E.R intervention, using the six principles: Bedroom – The noise, light and temperature of the room should be considered. Exercise – Maintain the practice of physical activity for a good night of sleep. Tension – Reduce the tension with relaxing activities. Time of sleep – Not everybody needs 8 hours of sleep. Eating, drinking and drugs – Sleep is affected by what is eaten, drunk and the medications that are taken. Rhythm – Keep a day and night program.	Teste t paired with the Cosinor Analysis	Improvement in maintaining a sleep, sleeps latency, and decrease in insomnia occurrence.	Intervention with physical activity helps decrease episodes of insomnia in this community group.	21

T: transversal; EC: case study; PS: pilot study; P: quality points; CRP: C-reactive protein; TTS: total time of sleep; MVPA: moderate to vigorous physical activity.

different types of training and with the intensity of activity recommended by the American College of Sports Medicine.[24]

In this same manner, was indicates that the results of the patients living with HIV/SIDA, which participated in interventions with the objective to change the behaviors that may cause complications pertaining to their clinical condition, are of great relevance.[20] Demonstrating that, the participation in ten sessions involving daily changes and the stimulus for the practice of physical exercises, demonstrated the existence of beneficial effects in the quality of sleep and consequently in the quality of life. Presenting an increase of ten minutes of sleep time and an increase of 2.3% in efficiency and a decrease of 2% in fragmentation during sleep, becoming thus an intervention that is reasonable for the intended population group. Notwithstanding, these results were divergent to the ones identified that, although it reported significant improvements in insomnia episodes with the realization of an intervention through the practice of physical activity, it did not identify significant improvements in the number of awakenings and there was no alteration with the total time of sleep of the participants.[20]

Knowing that the quality and the quantity of sleep time are determined and influenced by the designated habits, that is, by the occurrence or not of the factors and situations occurred between the time to lay down to sleep and wake up. The studies analyzed in this revision besides associating the relation between physical activity and sleep, reported some aspects that influences sleep. Among those, it can be highlighted the immune system (TCD4/CD8), the antiretroviral treatment (ART), body mass index (BMI), perception of stress, pain symptoms, eating habits and the environment used by the patients to sleep.[25]

According to the evaluation of the quality of the four studies, all of them presented high quality, with a level of score obtained equal or above 80%, reinforcing thus the evidences of association between the physical activity with the quality of sleep and its particularities.[18–21]

Taking in consideration the results presented, it is noteworthy to highlight the relation and association between the physical activity and sleep in persons living with HIV/AIDS, submitted to interventions in different contexts and specifications, since the physical activity was present in all the interventions even though in different forms, providing answers to the treatment of this population group.

The current revision is not free from limitations, among those is highlighted the characteristics of the selected studies, that made it difficult to identify more clear the panorama about the interventions and behaviors approached, making it necessary to standardize the methods of practices. Among these characteristics, it was verified the fragility of the studies in which regards the methodological aspects related to the selection and sample calculation, since that it was not specified in other studies. In the same manner, it is suggested that subsequent studies be made in different places, making it possible to detect samples of different regions and countries, above all, in different contexts. This evaluation demonstrates that there are scarce studies concerning adults, especially living with HIV/AIDS and recommends directions for new studies. The present study adopted, during the searching process, all the methodological procedures to assure its quality.

According to the results presented in the revision, it is concluded that there is a relation between the practice of physical activity and sleep, although there is also a necessity for more studies, so that more information may be disclosed in regards to the topic in discussion. Even so, individuals that living with HIV/AIDS needs to adopt healthy habits for the enhancement of the quality of sleep and consequently the quality of life.

Ethical responsibilities

Protection of people and animals. The authors state that for this research has been no experience in humans and/or animals.

Confidentiality of data. The authors declare that they appear patient data in this article.

Right to privacy and written consent. The authors declare that they appear patient data in this article.

Funding

This study was funded with three postgraduate scholarships by Higher Education Personnel Improvement Coordination (CAPES/CNPQ) (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior-CAPPES/CNPQ.

Conflicts of interest

The authors declare no conflict of interest.

Acknowledgements

To the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES/CNPQ) – (Higher Education Personnel Improvement Coordination) for the granted master's scholarship and to the Professors José Carlos Leitão and Teresa Bento for their collaboration in all the stages of the article, as well as for the final revision of the article

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