Physical exercise on Burnout Syndrome levels and Heart Rate Variability in university students: an intervention study

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ABSTRACT

Intervention programs to prevent or treat Burnout Syndrome are essential to improve the health of students. But most of the research that has been done is psychological and cognitive interventions.

Objective: To determine the effects of physical exercises on Burnout Syndrome levels and Heart Rate Variability in university students.

Methods: An experimental study was carried out with pre-test and post-test, with 2 intervention groups and a control group. The sample was probabilistic and stratified with proportional participation. Study variables and instruments were included: Maslach Burnout Inventory Students Survey (MBI-SS) and Heart Rate Variability (HRV): calculation of the average RR, SDNN and RMSSD. For physical exercise, aerobic and strength exercises were applied during 3 weekly sessions of one hour, on alternate days, for 16 weeks.

Results: The group of aerobics with MBI-SS exhaustion was higher, reducing its levels by 26.4% (d=0.532), in Cynicism (-21.06, d=0.252) and Efficiency (-13.11, 0.397). Force group in Cynicism (-27.38, d=0.315), in Efficiency (-21.69, d=0.704), Exhaustion (-19.55, d=0.299). The Exhaustion control group increased by 10.26% (d=0.128). In HVR, with the aerobic group, NDL had the greatest percentage change, increasing 24,82 %, over the average RR and RMSSD (14,40 % and 16,45 %). In the force group and in the control group (21.77%, 14.24%, 12.60%; and 12.59%, 4.97% and 4.99% respectively) there was a change in the mean RR in the aerobic and strength groups (d = 1.281 and 1.328).

Conclusions: Effect of reduction of burnout syndrome and opposite effect of increase of HRV values.

Keywords: Physical exercises, Burnout syndrome, Heart rate, Mental health.

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https://doi.org/10.11606/issn.2176-7262.rmrp.2021.171898

INTRODUCTION

Burnout Syndrome (BS) is a health problem of great social repercussion nowadays. Initially, BS was studied exclusively in health professionals, but these studies have been initiated in other professional populations and even university students [1].

The international classification of diseases includes this syndrome: Factors influencing health status and contact with health services. Within Z 73: Problems related to difficulties in coping with life. And specifically, in Z 73.0: Burnout syndrome [2]. Freudenberger [3] describes BS as a sense of failure and an exhausted or worn-out existence resulting from an overtaxing of the worker's energy, personal resources or spiritual strength. For his part, Cherniss [4] is one of the first authors to highlight the importance of work as a precursor to the onset of BS and defines it as "the negative personal changes that occur over time in workers with frustrating jobs or excessive demands."

Maslach and Jackson [5] understand BS as "a three-dimensional syndrome characterized by emotional exhaustion, depersonalization, and reduced self-actualization." This definition, which does not depart from the assumption that work variables are the ultimate determinants of burnout, has the importance of not being theoretical, but is an empirical consequence of the study that the authors developed.

Currently, most studies are framed within the three-dimensional approach that the syndrome is composed of emotional exhaustion, depersonalization and loss of self-actualization in the workplace [6-11]. In the case of students, the three dimensions are: emotional exhaustion, cynicism and academic efficacy [12-14]. Students in higher education, like professionals, face the pressures and overloads of academic work. To date, there have been very few studies of physical exercise intervention in college students with BS and what effects these would have on heart rate variability and the syndrome itself.

Intervention programs to prevent or treat BS are essential to improve the health of workers and students. Review studies [15,16] have shown that most of the research conducted and found are psychological and cognitive interventions. People who perceive higher levels of health are those with higher Heart Rate Variability (HRV). Higher vagal activation at rest is related to higher health-related quality of life. HRV analysis is a good marker of health status and can help quickly and efficiently diagnose states of stress, burnout, fatigue, overtraining, exhaustion or anxiety, in the general population [17]. HRV is an excellent cardiovascular biomarker for the prevention and early detection of BS [18].

This study addresses BS in university students and proposes physical exercise as an intervention. The issue addressed in the study is relevant and important, as university students experience pressure to complete activities, stress, exhaustive schedules, and activity overload, which subsequently contribute to the development of BS. Furthermore, the proposed intervention is consistent with previous studies in the literature. The practice of physical exercise contributes to the relief of anxiety, stress and improved quality of life [19-21]. If the intervention proves effective, this would suggest a simple, cost-effective and accessible strategy to reduce BS in this important and large academic population. The results of this could be used to provide better evidence-based policy and practice to university students from different majors and health policymakers regarding the effect of exercise on the well-being of university students.

Therefore, the main objective of this study was to determine the effects of physical exercise on the levels of Burnout Syndrome and Heart Rate Variability in college students.

MATERIAL AND METHODS

Study design

An experimental study was conducted with pretest and posttest, with two intervention groups (aerobic exercise group and strength exercise group) and a control group (no exercise). Participants in each group were randomly distributed, using simple random sampling.

Participants

The sample was drawn from the population of students diagnosed with burnout syndrome at the University of Ambato in Ecuador, where a wide variety of university careers were studied (in health sciences, engineering, education sciences, economics and business, agronomy, law, tourism and social sciences). The sample size was obtained from the standard error of the proportional sampling distribution and the critical value K, corresponding to the confidence level chosen (see Figure 1).

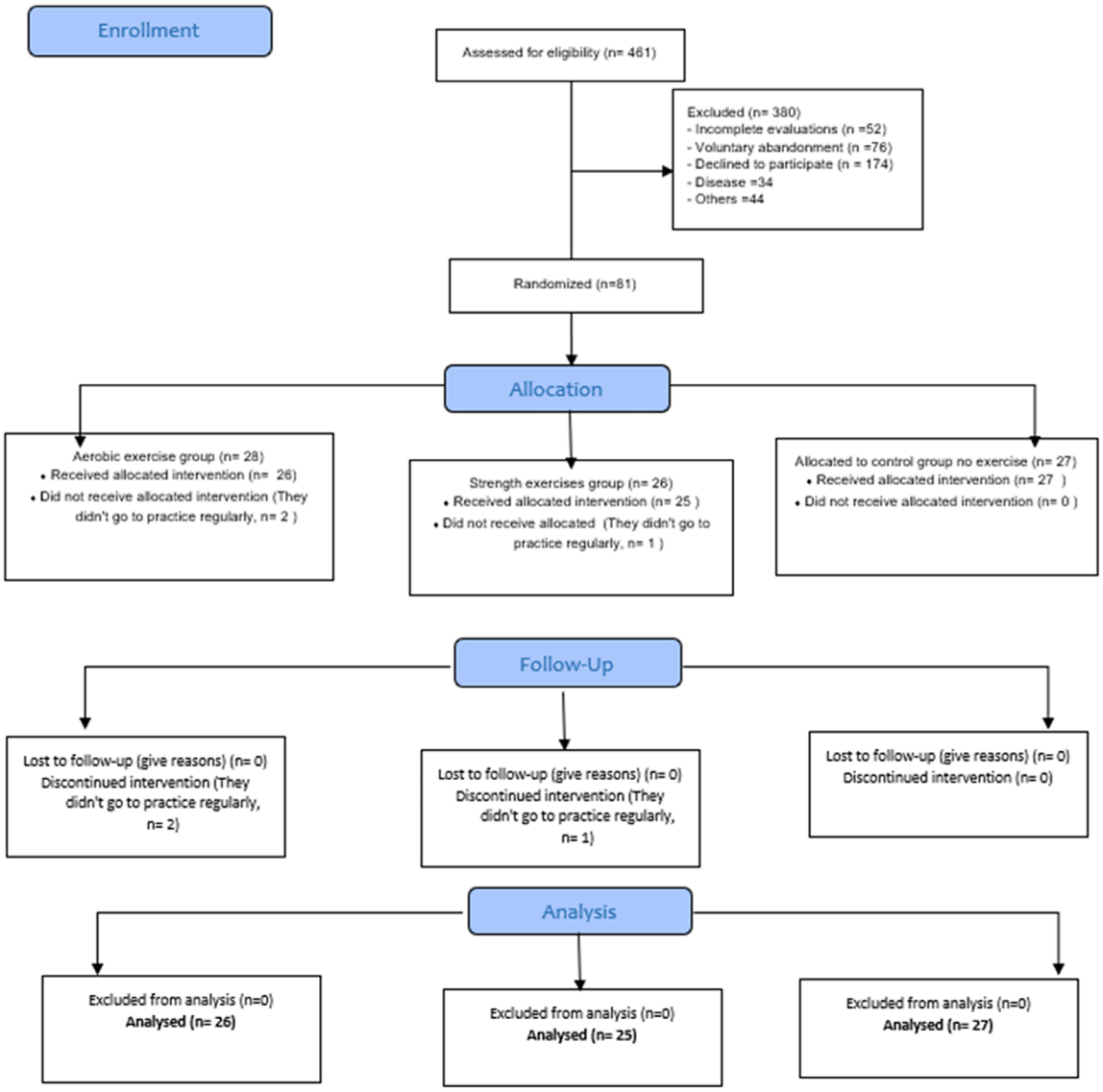


Figure 1. Flow chart of the study protocol.

The total sample was 81 participants who were randomly selected. There were no differences between conditions at the beginning of the study and they were divided into three groups of similar composition, using simple random sampling. The aerobic exercise group consisted of 28 students. All of them received the intervention, although only 26 were taken into account for the statistical analysis, since 2 did not perform a regular practice of at least 3 days per week. The strength exercise group consisted of 26 students. all of them also received the regular intervention, although only 25 were taken into account for the statistical analysis, since one did not practice regularly. The control group, which did not receive any intervention but was followed up, consisted of 27 students.

Instruments

- Burnout syndrome in students: the Maslach Burnout Inventory Students Survey (MBI-SS) 22 was used: Emotional Exhaustion, Cynicism and Academic Efficacy. The response scale is Likert-type and ranges from 0 ("never") to 6 ("always").

- Heart Rate Variability (HRV): Using a transmitter band and the Elite HVR android application and

calculating the mean RR (mean of RR intervals), SDNN (standard deviation of NN periods), and RMSSD (square root of the mean value of the sum of the squared differences of all successive RR intervals).

Procedures and intervention

After knowing the number of students diagnosed with burnout with MBI-SS, HRV was measured using a transmitter band and the Elite HVR android app. Prior to the training sessions, the initial MBI-SS and HRV test was applied. At week 17, the two measurement instruments were reapplied to the 3 groups and longitudinal and cross-sectional comparisons were made (see Figure 1).

They were divided into three groups of similar composition. A control group to which no activity was applied, an experimental group 1 to which aerobic exercise was applied and an experimental group 2 to which an anaerobic (strength) exercise was applied.

In both intervention groups, physical exercise was governed by the latest guidelines for prescribing exercise: Quantity and Quality of Exercise to Develop and Maintain Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Adults: in the American College of Sports Medicine (ACSM) Exercise Prescribing Guidelines 23 and 3 sessions per week for one hour, every other day, were applied for 16 weeks.

The physical exercises were applied in the sports areas of the University, by a single qualified and trained instructor with a Bachelor's degree in Physical Activity and Sports.

Aerobic exercises

They were applied with moderate and/or vigorous intensity for most of the students. In a time of 30 to 60 minutes per day (150 minutes x week) of intentional moderate exercise, involving the major muscle groups and continuous and rhythmic. Increasing the number of steps by 2000 steps per day to reach and maintain a daily step count of 7000 steps 23.

In our study, aerobic exercises were performed (jogging, walking and/or stationary bicycle riding for approximately 30 to 50 minutes, divided into an initial warm-up and stretching part, the main part with planned aerobic exercises and a final recovery part.

Strength exercises

These were applied with an intensity of 60%-70% of 1RM (moderate to hard intensity) for beginners to intermediate to improve strength. With exercises involving each of the major muscle groups and using a variety of exercise equipment and/or body weight to perform them. From 8 to 12 repetitions to improve strength and power. With 2-3 minute rest intervals between each set of repetitions. And a rest of 48 hours between sessions for each muscle group 23.

In our study, strength exercises were applied (hands-free exercises such as push-ups, sit-ups, crunches, sit-ups, crunches, fixed bar, leg squats, with 30-50 minute sessions divided into the warm-up and stretching parts, the main part with planned strength exercises and the final recovery part).

Statistical treatment of the data

Descriptive statistics are presented using the mean (X) and standard deviation (SD). Normal distribution was tested using the Shapiro-Wilk test. Baseline comparisons between groups were made using Kruskal-Wallis tests. Within-group comparisons between pre and post-time points were made using the Wilcoxon signed rank test. Percent change was calculated and presented for each variable. To report the magnitude of changes, the effect size of the biserial point correlation (rpb) was calculated and converted to the standardized Cohen's d. The benchmarks used were: trivial ($d < 0.2$), small ($d = 0.2$ to 0.5), moderate ($d = 0.5$ to 0.8), large ($d = 0.8$ to 1.2), very large ($d > 1.2$) (Cohen, 1988). The level of statistical significance was assumed for $p < 0.05$. The Statistical Program for Social Sciences (SPSS), version 25.0 for Windows, was used.

Research ethics

The planning of this research was carried out taking into account the guidelines of the 1973 Declaration of Helsinki, revised in 1986 and amended in October 2013, and was also governed by the standard rules in force in the Republic of Ecuador for the conduct of biological studies. It was explained to the students what the research consisted of to obtain informed consent to participate in the research and a document will be signed by both the patients and the author of the research for the record. The study was approved by the corresponding ethics committee.

RESULTS

The flow diagram of the participants is shown in Figure 1. The aerobic exercise group had an average age of 22.74 years (± 3.05). In the strength exercise group it was 22.97 years (± 3.31). In the control group, the average age was 23.13 years (± 3.77).

Initial and final measurements verified the effects of the exercise intervention on BS levels and HRV in the participants of the three groups using mainly two specific tests for this purpose: the MBI-SS (in its three dimensions; burnout, cynicism and academic efficacy) of psychological cut-off, and the measurement of HRV (measuring the mean of the RR intervals, the standard deviation of the NN or RR periods and the square root of the mean value of the sum of the squared differences of all successive RR intervals) of physiological cut-off. In this case, the means of both measurements, their percentage change and the change in effect size were compared using Cohen's d (see Table 1).

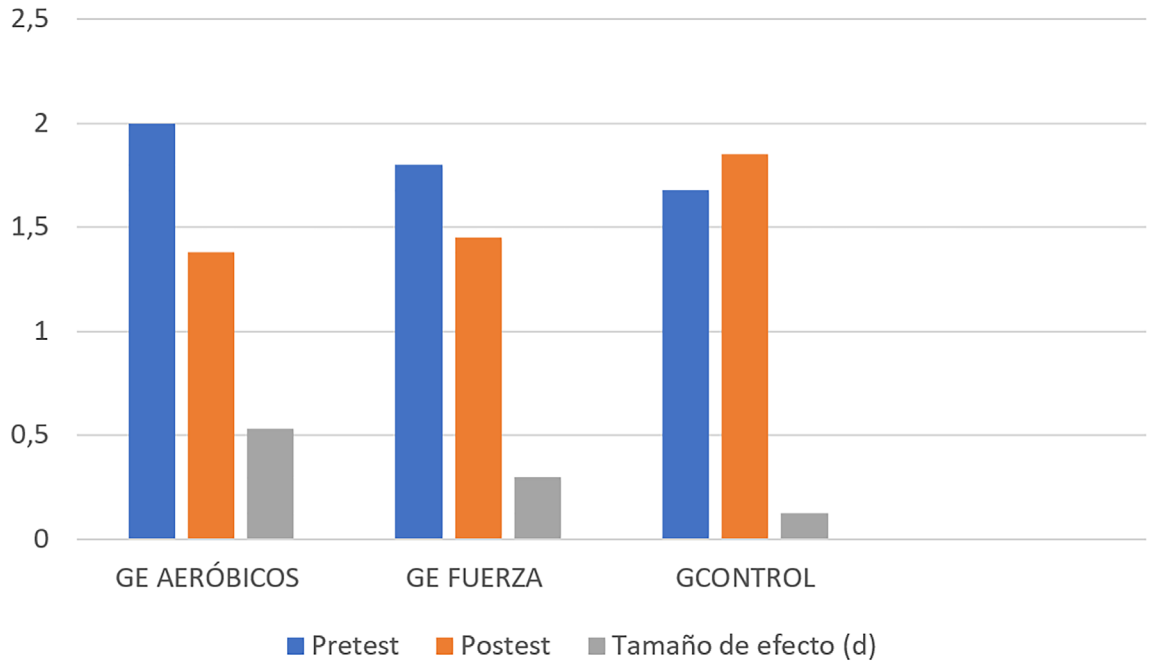
As can be seen in Table 1, in the results of these comparisons of the percentage change of the aerobic exercise experimental group with respect to the MBI-SS on the dimension exhaustion there was a higher percentage, reducing its levels by 26.4%, on cynicism (-21.06), and academic efficacy (-13.11). Unlike the experimental group of strength exercises in which there was a higher percentage change in the cynicism dimension (-27.38), in efficacy (-21.69), burnout was the smallest change (-19.55). In the control group mean levels of burnout increased unfavorably by 10.26%, efficacy also increased, although not significantly (4.26), while levels of cynicism decreased by 7.26%. In the aerobic exercise intervention group, the dimension that improved was exhaustion (d = 0.532) with moderate effect size, but not cynicism and efficacy, which had small change effects (d = 0.252 and 0.397 respectively). In the strength exercise intervention group, on the other hand, the dimension that improved the most according to effect size was efficiency, considered moderately high (d = 0.704). Here the change in exhaustion levels was considered trivial and in cynicism was small (d = 0.299 and 0.315 respectively). In the control group, the effect size on burnout, cynicism and efficacy was considered trivial (d = 0.128, 0.062 and 0.129 respectively) (see Table 1 and Figures 1 and 2).

Regarding the most evident results of the HVR tests, in the experimental aerobic exercise group the SDNN had the largest percentage change, with an increase of 24.82 %, over the mean RR and RMSSD (14.40 % and 16.45%, respectively). Similarly occurred in the strength group and control group in the above three variables with only slightly lower levels of increase in both groups (21.77%, 14.24%, 12.60%; and 12.59%, 4.97% and 4.99%, respectively).

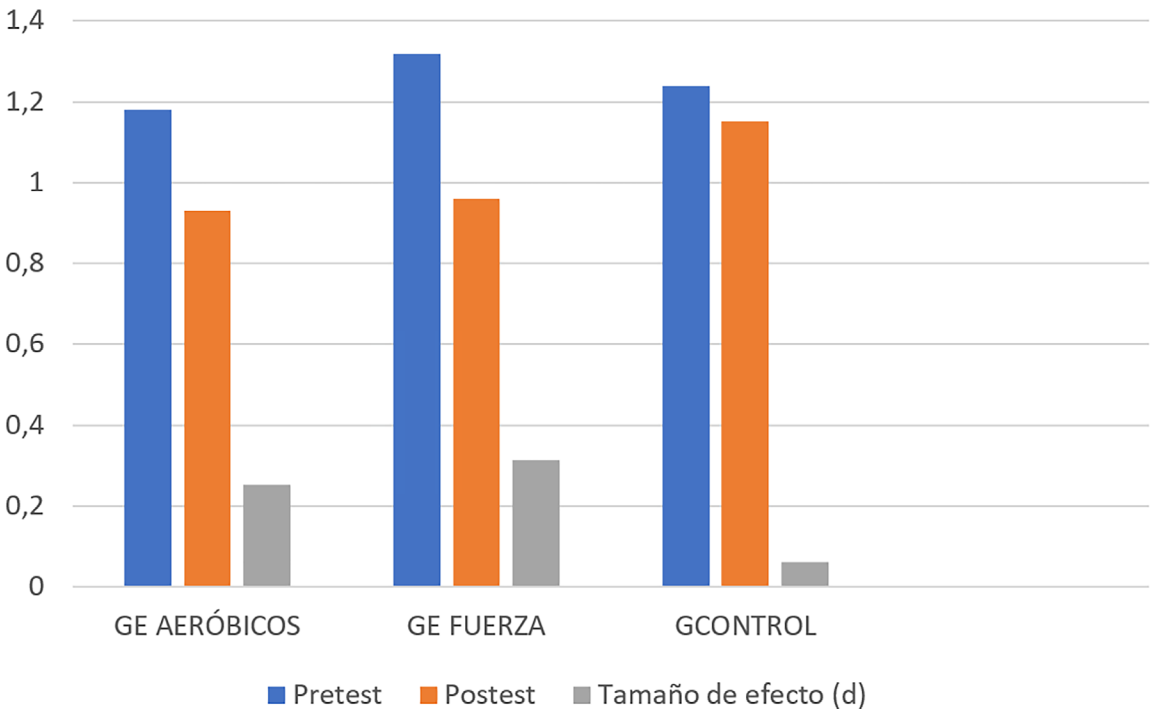
Results on effect size showed a very large change in mean RR in the aerobic and strength groups (d = 1.281 and 1.328 respectively), unlike the SDNN, which was large, and the RMSSD, which was small in both groups (d = 0.943 and 0.833; and 0.425 and 0.318 respectively). In contrast, in the control group they were small and trivial (0.449, 0.457 and 0.120 respectively).

Tabla 1. Comparación entre las mediciones iniciales y finales de los grupos de intervención (ejercicios aeróbicos y de fuerza) y el grupo control (sin ejercicios).

	GE AERÓBICOS (27 participantes)				GE FUERZA (26 participantes)				GC (27 participantes)			
	PRE MEDIA (SD)	POST MEDIA (SD)	PORCIENTO CAMBIO	TAMAÑO EFECTO (d)	PRE MEDIA (SD)	POST MEDIA (SD)	PORCIENTO CAMBIO	TAMAÑO EFECTO (d)	PRE MEDIA (SD)	POST MEDIA (SD)	PORCIENTO CAMBIO	TAMAÑO EFECTO (d)
Media Agotamiento	2.00 ± 1.24	1.38 ± .99	-26.4	.532	1.80 ± 1.19	1.45 ± 1.11	-19.55	.299	1.68 ± 1.27	1.85 ± 1.31	10.26	.128
Media Cinismo	1.18 ± 1.03	.93 ± .97	- 21.06	.252	1.32 ± 1.12	.96 ± 1.22	-27.38	.315	1.24 ± 1.22	1.15 ± 1.69	-7.26	.062
Media Eficacia	4.27 ± 1.38	3.71 ± 1.49	-13.11	.397	4.24 ± 1.37	3.32 ± 1.29	-21.69	.704	4.27 ± 1.34	4.46 ± 1.65	4.26	.129
RR media (ms):	865.69 ± 102.08	1011.37 ± 128.32	14.40	1.281	859.92 ± 100.76	1002.77 ± 117.92	14.24	1.328	862.53 ± 101.24	907.72 ± 104.05	4.97	.449
SDNN	71.32 ± 20.11	94.87 ± 29.86	24.82	.943	70.34 (20.18)	89.92 ± 27.24	21.77	.833	70.91 ± 21.24	81.13 ± 24.27	12.59	.457
RMSSD	68.71 ± 31.10	82.24 ± 33.78	16.45	.425	69.75 (31.76)	79.81 ± 32.73	12.60	.318	70.01 ± 30.97	73.69 ± 31.39	4.99	.120



Graph 1. Comparison between groups according to the levels of the Exhaustion dimension.
GE AERÓBICOS: Aerobic exercise experimental group (27 participants). GE FUERZA: Experimental group of strength exercises (26 participants). GCONTROL: Control group without intervention (27 participants).
Comparison using Wilcoxon rank test for $p < .05$.



Graph 2. Comparison between groups according to the levels of the Cynicism dimension.
GE AERÓBICOS: Experimental aerobic exercise group. GE FUERZA: Experimental group of strength exercises. GCONTROL: Control group without intervention.
Comparison using Wilcoxon rank test for $p < .05$.

DISCUSSION

The main objective of this study was to determine the effects of physical exercise on the levels of BS and HRV in university students. The results show that, through intervention with physical exercise, these could have a reduction effect on the levels of burnout syndrome in its three dimensions. However, sometimes, this reduction may not be considerable. And in the case of HRV, physical exercise has the opposite effect of increasing its values, specifically in the three measurements performed in our study: the mean of the RR intervals, the standard deviation of the NN periods and the square root of the mean value of the sum of the squared differences of all the successive RR intervals. Overall, this study was intended to provide a broader view of this crucial element in the knowledge of the mental health levels of this important population of students.

In our study, it was possible to define what, physical exercises could be effective, at least according to our results, in reducing the levels of BS in its three-dimensional approach. There could be a moderately small improvement overall among the members of the aerobic and strength exercise intervention groups over those of the control group. This could mean, generally speaking, that there were differences between the initial and final tests in all three groups, but in the two aerobic and strength exercise intervention groups the difference was greater than in the control group in the MBI-SS and HRV application scores. This study could have an important practical significance since, based on its results, more personalized physical exercise programs could be elaborated, proposed and validated according to the general levels of the BS and HRV, in university students.

Regarding the latter indicator, we agree with Pérez and Almirall [24] that mental effort is one of the stressors of academic life and HRV is a highly sensitive and specific indicator of its presence, since it allows us to objectively evaluate the health outcomes provided by the integration of biological, psychological and social aspects. It is an easy and non-invasive method that allows predicting the overall health status of the individual. Decreased HRV has been associated with negative emotions and poorer physical and psychological health. Specifically, in this study, there are coincidences with some results from other similar situations and others that were not very coincidental, but quite the opposite. As can be seen by Bonet, Parrado and Capdevila [25] indicating the beneficial effects of physical exercise on mood and general mental health in students, interventions with physical exercise showed its acute effect on the modulation of the autonomic nervous system through the analysis of HRV. HRV values are always lower in active participants. This difference is due to their physical training; since they are used to physical exercise, their metabolism is faster. The influence of long-term aerobic physical activity and capacity on HRV has been repeatedly reported in young and older adults [26]. Acute physical exercise improves mood in active and non-active individuals, although more significantly in active individuals [27, 28].

Such as the study conducted by Han et al. [29] explored the effectiveness of an exercise program for bank and insurance workers with BS. In the process of the study, a practical exercise program was developed in the workplace within the banking and insurance companies for three months. After the exercise program, BS levels showed significant improvement in the intervention groups, according to the pre-posttest difference. Meanwhile, in the research done by de De Vries et al.[30], the extent to which an exercise intervention is effective in reducing BS indicators in students was analyzed. The participating patients were students with high levels of BS. Participants in the intervention group showed a greater decrease in BS levels overall. These results highlight the value of low-intensity exercise for college students with high levels of study-related BS. Participants in the intervention group showed a greater decrease in BS ($t(48) = 6.82$, $p = <.001$, Cohen's $d = .90$) than those in the control group ($t(47) = 3.08$, $p = .003$, Cohen's $d = .46$). Slightly higher than our case, the intervention group with aerobic exercises through the main dimension exhaustion effect size was slightly lower ($d=0.532$), and even lower the group with strength exercises. ($d=0.299$) and the control group ($d=0.128$).

On the other hand, Eskilsson et al.[31], applied an aerobic training program in a randomized controlled study in patients with BS. The final results showed a reduction of BS in patients who performed physical exercise. Since the averages of these results are higher than those found in our study. However, overall the three results are similar in reducing BS levels through exercise, they are also very similar to ours. Another study by Gerber et al.[32], concluded that patients in the trained exercise group increased their

exercise duration more than patients in the general instruction group. This study has shown that a substantial increase in exercise levels can reduce BS levels in patients by regular comprehensive general treatment. Very similar to our results.

In contrast, Stenlund et al.[33], evaluated the efficacy of Qigong in the rehabilitation of patients with BS. And they were able to find that there was no significant difference in treatment efficacy between the intervention and control groups, unlike our study. Both groups improved significantly over time, with a reduction in BS levels and increased dynamic balance and physical capacity. Finally, a subsequent study by De Vries et al.[34] evaluated the efficacy of an exercise intervention to reduce BS in patients with multiple occupations. The analysis of covariance revealed that the intervention group reported a lower level of BS than the control group. This study demonstrates that exercise can be considered a powerful therapeutic tool for those undergoing treatment.

Among the strengths of the research is the adequate use of its methodology, when performed in three groups, one of them a control group, randomized with a very similar structure with initial and final tests. In addition, the recommendations of the ACSM [23] were taken into account to apply the exercises. On the other hand, in terms of limitations, it can be stated that it was not possible to use other tests related to the hypothalamic-pituitary-adrenal and sympathetic-medullary-adrenal axes, associated with the immune system and those related to inflammation.[35] To determine the effectiveness of the application of the physical exercises, the psychological and physiological cut-off tests were used instead. Although the latter are validated nationally and internationally and have a well-demonstrated efficacy, it would have been interesting to also apply the former for a better evaluation and robustness of the results.

For future studies, more specific exercise programs for the reduction of BS levels in university students could be developed, proposed and validated based on these and similar results. As the main conclusion, it can be stated that, through intervention with physical exercise, at least in the sample studied, there was a reduction effect on the levels of burnout syndrome in its three dimensions. In the case of HRV, physical exercises had the opposite effect of increasing its values.

REFERENCES

1.Segura O. Professional Exhaustion: Concepts and Implications for Public Health Biomedical. 2014; 34(4): 535-545.

2.World Health Organization. ICD-10 International Classification of Diseases. Geneva: American Psychiatric Publishing, Inc. 1994; p. 1244.

3.Freudenberger HJ. Staff burnout. J Social Issues. 1974; 30(1):159-166.

4.Cherniss C. Staff Burnout. London: Sage Publications; 1980.

5.Maslach C, Jackson SE. The Maslach Burnout Inventory. Research Edition, Palo Alto, C.A.: Consulting Psychologist Press; 1981.

6.Li H, Cheng B, Zhu XP. Quantification of burnout in emergency nurses: A systematic review and meta-analysis. Int Emerg Nurs. 2018;17. pii: S1755-599X (17)30173-8.

7.Mikalauskas A, Benetis R, Širvinskas E, Andrejaitienė J, Kinduris Š, Macas A, Padaiga Ž. Burnout Among Anesthetists and Intensive Care Physicians. Open Med (Wars). 2018; 5(13):105-112.

8.Armenta-Hernández OD, Maldonado-Macías A, García-Alcaraz J, Avelar-Sosa L, Realyvasquez-Vargas A, Serrano-Rosa MA. Relationship between Burnout and Body Mass Index in Senior and Middle Managers from the Mexican Manufacturing Industry. Int J Environ Res Public Health. 2018; 15(3).

9.Kavanagh KR, Spiro J. Faculty Wellness: Educator Burnout among Otolaryngology Graduate Medical Educators. Otolaryngol Head Neck Surg. 2018; 158(4):1-19.

10. Bruschini M, Carli A, Burla F. Burnout and work-related stress in Italian rehabilitation professionals: A comparison of ysiotherapists, speech therapists and occupational therapists. Work. 2018; 59(1):121-129.

11. Kawamura Y, Takayashiki A, Ito M, Maeno T, Seo E, Maeno T. Stress Factors Associated With Burnout Among Attending Physicians: A Cross-Sectional Study. J Clin Med Res. 2018;10(3):226-232.

12. Boni RAdS, Paiva CE, de Oliveira MA, Lucchetti G, Fregnani JHTG, Paiva BSR. Burnout among medical students during the first years of undergraduate school: Prevalence and associated factors. PLoS ONE. 2018; 13(3): e0191746

13. Erschens R, Keifenheim KE, Herrmann-Werner A, Loda T, Schwille-Kiuntke J, Bugaj TJ, Nikendei C, Huhn D, Zipfel S, Junne F. Professional burnout among medical students: Systematic literature review and meta-analysis. Med Teach. 2018; 14:1-12.

14.Liu H, Yansane AI, Zhang Y, Fu H, Hong N, Kalenderian E. Burnout and study engagement among medical students at Sun Yat-sen University, China: A cross-sectional study. Medicine (Baltimore). 2018;97(15): e0326.

15. Rammant E, Decaestecker K, Bultijnck R, Sundahl N, Ost P, Pauwels NS, et al. A systematic review of exercise and psychosocial rehabilitation interventions to improve health-related outcomes in patients with bladder cancer undergoing radical cystectomy. Clinical rehabilitation. 2018; 32(5): 594-606.

16. Colin PW, Liselotte ND, Patricia JE, Tait DS. Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. Lancet. 2016; 5;388(10057):2272-2281.

17. Bonet J, Parrado E, Barahona A, Capdevila L. Desarrollo y aplicación de un sistema de evaluación combinada de ejercicio físico, de alimentación y de variables psicológicas en jóvenes universitarias. Apunts. Medicina de l'Esport. 2016; 51(191): 75-83.

18. Capdevila L, Rodas G, Ocaña M, Parrado E, Pintanel M, Valero M. Variabilidad de la frecuencia cardiaca como indicador de salud en el deporte: validación con un cuestionario de calidad de vida (SF-12). Apunts Medicina de l" Esport. 2008; 43(158): 62-69.

19. González I, Gómez N, Ortiz R, Ibarra V. Ejercicio físico como tratamiento adyuvante de los trastornos mentales. Una revisión narrativa. Anales de la Facultad de Ciencias Médicas. 2018; 51(3): 27-32.

20. Azofeifa-Mora CA. Revisión de los beneficios de la intensidad y modalidades de ejercicio físico sobre el estrés psicológico. Pensar en Movimiento: Revista de ciencias del ejercicio y la salud. 2018; 16(1).

21. Mejía IAO, Morales SC, Orellana PC, Lorenzo AF. Efecto de las actividades físicas en la disminución del estrés laboral. Revista Cubana de Medicina General Integral. 2017; 33(3):342-351.

22. Schaufeli WB, Martínez IM, Marques-Pinto A, Salanova M, Bakker AB. Burnout and engagement in university students: A cross-national study. Journal of Cross-Cultural Psychology. 2002; 33(5):464-481.

23. Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM, et al. American College of Sports Medecine position stand. Quantity and quality of exercise to develop and maintain cardiorespiratory, musculoskeletal and neuromotor fitness in apparently healthy adults: A Guide to Prescribing Exercise. Medicine and science in sports and exercise. 2011; 43(7):1334-1359.

24. Pérez LVM, Almirall HPJ, Pérez BA. The variability of the heart frequency, an unquestionable indicator of the unit bio psychosocial. Invest Medicoquir. 2015;7(2):292-312.

25. Bonet J, Parrado E, Capdevila L. Efectos agudos del ejercicio físico sobre el estado de ánimo y la HRV / Acute Effects of Exercise on Mood And HRV. Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte. 2017; 17(65): 85-100.

26. Albinet CT, Boucard G, Bouquet CA, Audiffren M. Processing Speed and Executive Functions in Cognitive Aging: How to Disentangle Their Mutual Relationship? Brain and Cognition. 2012; 79: 1-11.

27. Silva-Piñeiro R, Mayán-Santos JM. Beneficios psicológicos de un programa proactivo de ejercicio físico para personas mayores. Escritos de Psicología (Internet). 2016; 9(1): 24-32.

28. Leiva AP, Márquez PGO, Rodríguez CG, Navas JMM, Bozal RG. Ejercicio físico y calidad de vida en estudiantes universitarios. International Journal of Developmental and Educational Psychology. 2017; 2(1): 437-446.

29. Han HT, Ching YY, Chien TS, Chiou JC, Shu MP, Ruey YC. The Effects of Exercise Program on Burnout and Metabolic Syndrome Components in Banking and Insurance Workers. Industrial Health. 2013; 51(3):336-346.

30. De Vries JD, van Hooff MLM, Geurts SAE, Kompier MAJ. Exercise as an Intervention to Reduce Study-Related Fatigue among University Students: A Two-Arm Parallel Randomized Controlled Trial. PLoS ONE. 2016;11(3): e0152137. doi:10.1371/journal. pone.0152137

31. Eskilsson T, Slunga LJ, Malmberg HG, Stigsdotter AN and Boraxbekk CJ. Aerobic training for improved memory in patients with stress-related exhaustion: a randomized controlled trial. BMC Psychiatry. 2017; 17:322.

32. Gerber M, Ingibj€org H, Jonsdottir EA, Lindwall M, Lindegard A. Promoting graded exercise as a part of multimodal treatment in patients diagnosed with stress-related exhaustion. Journal of Clinical Nursing. 2015; 24: 1904–1915.

33. Stenlund T, Birgander LS, Lindahl B, Nilsson L, Ahlgren C. Effects of Qigong in patients with burnout: a randomized controlled trial. Journal of rehabilitation medicine. 2009; 41(9): 761-767.

34. De Vries JD, Madelon LM, van Hooff ML, Sabine AE, Geurts SA., Michiel AJ. Exercise to reduce work-related fatigue among employees: a randomized controlled trial. Scand J Work Environ Health. 2017; 43(4): 337–349.

35. Gómez-Alcaina B, Montero-Marín MMP, Demarzo JP, García-Campayo J. Utility of biological markers in the early detection and prevention of burnout syndrome. Psychopathology. Clinical. 2013; 18 (3): 245-253

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Editor:
Prof. Dr. Felipe Villela Gomes

Received: jul 01, 2020
Approved: jun 01, 2021