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Original

Fatigue and conformist traits in the performance of young swimmers



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ABSTRACT

Objective: Determine the relationship between the fatigue of adolescent swimmers in high-level competitions during two continuous periods of maximum performance and the degree that swimmers conform to norms during these periods.

Methods: We evaluated the conformist trait and three areas of fatigue in two consecutive competitive periods, in 25 young elite swimmers. The measures were evaluated before (_B) and after (_A) of pre (t1; t3) and pos (t2; t4) competition in each period. Millon Adolescent Clinical Inventory was applied for identifies the more adherens (AD; n=12) or detached from the norm (DN; n=13) conformist traits. Wingate test, Heart rate variability (RMSSD; SDNN), WISC-V, and Stroop test were evaluated.

Results: DN group present lower fatigue in t1 but an increase in t2, t3, and t4. AN present higher RMSSD_B and SDNN_B in t1. In t3, the mental fatigue of DN was correlated negatively with RMSSD_B; SDNN_B. Both groups had more SDNN_B than SDNN_A in t4.

Conclusions: Physical fatigue was an important condition in both groups, however, the DN group may be more sensitive to physiological and mental fatigue directly affecting the sports performance.

Keywords: State of fatigue; Personality trait; Sports performance; Heart rate variability

Fatiga y rasgo conformista en el rendimiento de jóvenes nadadores

RESUMEN

Objetivo: Determinar la relación entre la fatiga de los nadadores adolescentes en competencias de alto nivel, durante dos períodos continuos de máximo rendimiento, y el grado en que los nadadores se ajustan a las normas durante estos períodos.

Métodos: Evaluamos el rasgo conformista y tres áreas de fatiga en dos períodos competitivos consecutivos, en 25 jóvenes nadadores de élite. Las medidas se evaluaron antes (_B) y después (_A) de pre (t1; t3) y pos (t2; t4) período de competencia. Se aplicó el Inventario Clínico de Adolescentes Millon para identificar los rasgos más (AD) o menos (DN) conformistas. Se evaluó la prueba de Wingate, la variabilidad de la frecuencia cardíaca (RMSSD; SDNN), WISC-V y la prueba Stroop.

Resultados: El grupo DN presenta menor fatiga en t1 pero aumentó en t2, t3 y t4. AN presenta RMSSD_B y SDNN_B más altos en t1. En t3, la fatiga mental de DN se correlacionó negativamente con RMSSD_B; SDNN_B. Ambos grupos tenían más SDNN_B que SDNN_A en t4.

Conclusiones: La fatiga física fue una importante condición en ambos grupos, sin embargo, el grupo DN puede ser más sensible a la fatiga fisiológica y mental, lo cual puede afectar directamente el rendimiento deportivo.

Palabras clave: Estado de fatiga; Rendimiento deportivo; Variabilidad de frecuencia cardíaca

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Fadiga e traço conformista no desempenho de jovens nadadores

RESUMO

Objetivo: Determinar a relação entre a fadiga de nadadores adolescentes em competições de alto nível durante dois períodos contínuos de pico de desempenho e o grau em que os nadadores se conformam às normas durante esses períodos.

Métodos: Avaliamos o traço conformista e três áreas de fadiga em dois períodos competitivos consecutivos, em 25 jovens nadadores de elite. As medidas foram avaliadas antes (_B) e depois (_A) do período pré (t1; t3) e pós (t2; t4) da competição. O Millon Adolescents Clinical Inventory foi aplicado para identificar os traços mais (AD) ou menos (DN) conformistas. Foram avaliados o teste de Wingate, a variabilidade da frequência cardíaca (RMSSD; SDNN), o WISC-V e o teste de Stroop.

Resultados: o grupo DN apresentou menor fadiga em t1, mas aumentou em t2, t3 e t4. AN tem RMSSD_B e SDNN_B mais altos em t1. Em t3, a fadiga mental ND foi negativamente correlacionada com RMSSD_B; SDNN_B. Ambos os grupos tiveram mais SDNN_B do que SDNN_A em t4.

Conclusões: A fadiga física foi um condicionamento importante em ambos os grupos, entretanto, o grupo ND pode ser mais sensível à fadiga fisiológica e mental que afeta diretamente o desempenho esportivo.

Palavras-chave: Status de fadiga; Desempenho atlético; Variabilidade da frequência cardíaca

Introduction

Swimming is a cyclic sport that involves the development of different technical movements that require a high degree of concentration by swimmers.¹ Fatigue is an inevitable factor in this sport, which is often exacerbated by the commitment of athletes to strive to the limit of their abilities.² In the early stage of an athlete's development, it is important that coaches understand the factors that influence the state of fatigue in athletes, and adopt an approach based on the physical, physiological and psychological aspects of the individual young swimmer, especially in the first years of competitive swimming.³

When fatigue is managed optimally, a balance between stress and positive adaptation to training is achieved, with the result of better sports performance.⁴ However, during periods of competition, it is difficult to distinguish between appropriate and inappropriate training when a small imbalance between the athlete's preparation and recovery can have important consequences on performance.⁵ The technical staff and coach are responsible for managing fatigue, but the personality of the swimmer, which changes with age and experience, must also be considered.⁶ Competitive swimming is recognized as a highly structured sport requiring high levels of self-control, discipline, and well-defined rules, which are key to the psychological development of adolescent swimmers.⁷

We know that the most characteristic trait of swimmers is extroversion⁸. It has been observed that extroverted swimmers have a greater capacity to withstand psychic load and tolerance to fatigue.⁹ They develop a trait of dominance that improves their athletic performance.¹⁰ However, novice swimmers are more introverted and conformist than experienced ones.¹¹ It is important to consider these traits in adolescent athletes since they are in a period of age-specific changes, where psychological traits

can directly affect their athletic performance. Although no personality trait is critical in identifying better swimmers,¹⁰ we believe it is important to know the characteristics that control more individualized strategies in managing fatigue in swimmers, especially in young swimmers. This feature has been related to more adherence to the rules set by the coach, which can be important in the training and performance of athletes.¹² The aim of this study was to evaluate the fatigue of adolescent swimmers in high-level competitions during two continuous periods of maximum performance and to relate this to the degree that swimmers conform to norms during these periods. This study hypothesizes that the fatigue perceived by young swimmers can be affected by athletes' tendency to conform to norms.

Methods

Experimental Design

This study was observational (longitudinal with four observations) and was conducted over three months, in which two consecutive competitive periods occurred, the Patagonian Tournament and the National Swimming Championships, the latter being the more important for young swimmers. The study design is represented in [Figure 1](#).

Subjects

Twenty-five healthy young athletes (age: 13.5±1.4 years; 12 boys and 13 girls), members of the Regional Training Centre (CER) of the Magallanes and the Chilean Antarctica Region volunteered for the study. To be included, they had to meet the following criteria: i) systematic training for more than 3 years, for at least three times a week, ii) uninterrupted training prior to their

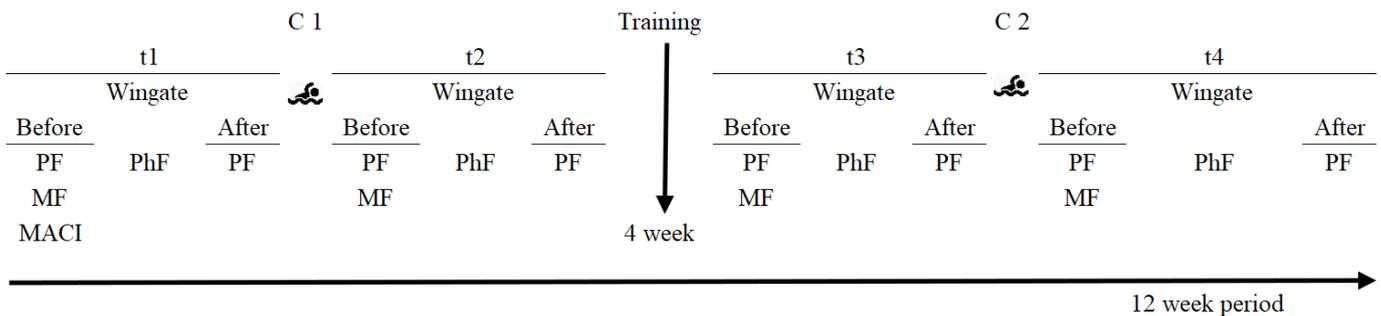


Figure 1. Study design. Two consecutive periods of competition are described in the figure (C1; C2). PhF: Physical fatigue was evaluated in each time (t1; t2; t3; t4) for Wingate test. PF: Physiological Fatigue was evaluated with heart rate variability (RMSSD; SDNN). MF: Mental Fatigue was measurement with two subtests of the WISC-V and Stroop color recognition test. Conformist trait was evaluated only in one time with MACI (Millon Adolescent Clinical Inventory).

inclusion in the study for ≥ 6 months, iii) with an absence of musculoskeletal injuries, iv) find yourself preparing competitions or federated swimming tournaments. Later, to be included in the final analysis, only the participants who successfully completed the evaluations of anthropometric measurements, body composition and physical performance variables were included. [Table 1](#) shows the baseline and anthropometric data of the swimmers in the study. The study was approved by the local research ethics committees (N^o 141/CEC/2018) and conducted in accordance with the World Medical Association and Helsinki Declaration concerning the ethical principles of human experimentation. All swimmers and their parents were given general information in personal interviews. All parents provided written informed consent prior to participation in this study, and athletes provided informed assent.

Table 1. Baseline and anthropometric data for the group

	Male (n= 12)	Female (n=13)	DN (n= 13)	AN (n= 12)
HR rest (bpm)	66.5 ± 14.7	78.2 ± 11.6	77.3 ± 11.1	68.2 ± 15.7
Fat (%)	17.8 ± 3.0	30.0 ± 3.7	23.9 ± 7.1	24.4 ± 7.4
Body weight (kg)	54.6 ± 10.5	55.3 ± 9.4	55.0 ± 10.4	54.9 ± 9.5
Height (cm)	163.3 ± 8.3	158.1 ± 4.0	161.9 ± 7.5	159.3 ± 6.2
BMI (kg/m ²)	20.3 ± 2.3	22.1 ± 3.3	20.9 ± 2.9	21.5 ± 3.1
Experience (age)	6.0 ± 2.4	5 ± 1.7	5.5 ± 2.4	5.1 ± 2.0

Baseline and anthropometric measurements are presented in two classifications: Gender (Male or female) and adherence condition (DN, Detached from the Norm; AN, Adhering to the Norm). BMI: body mass index. All data are mean ± standard deviation. bpm: Beats per minute.

Instruments

•*Conformist trait:* self-reporting questionnaire was applied called the Millon Adolescent Clinical Inventory (MACI), which evaluates adolescent personality styles, psychological concerns and psychopathology.¹³ This test identifies on three scales swimmers that are more or less conformist, separating the athletes into two groups: the more conformist grouped as Adhering to the Norm (AN) and the less conformist grouped as Detached from the Norm (DN).

•*Anthropometric measurements:* Were registered to body weight in kg with an electronic scale (Scale-tronix, USA; accuracy: 0.1 kg) and height in cm with a stadiometer (Seca 220, Germany; accuracy: 0.1 cm). It was also evaluated using the Segmental Body Composition Analyzer. The percentage of fat mass was evaluated by means of an electrical scale of bioelectric impedance (TANITA, BC-558 IRONMAN®) with a concordance of 89.3% compared to the Dual X-ray Absorption test¹⁴ using standard measurement protocol.¹⁵

•*Physical fatigue:* was assessed through the Wingate anaerobic exercise test, which is used to evaluate the maximal power and fatigue index of young athletes.¹⁶

•*Physiological fatigue:* was evaluated based on heart rate variability (HRV), as measured by a Polar V800 sports watch (Polar®, Finland). The beat-to-beat heart rate (RR interval) of every swimmer was registered at least 5 minutes before (_B) and after (_A) the Wingate test. While being measured, the swimmers remained supine on a stretcher for ten minutes, with only the last 5 minutes being considered for analysis. All tachograms were visually inspected to exclude artifacts and ectopic heartbeats,¹⁷ which did not exceed 3% of the recorded data. Data were analyzed using Kubios HRV® free software (University of Eastern Finland).

The time-domain parameters considered for the analysis were the square root of the mean squared differences of successive RR intervals (RMSSD, expressed in ms), which reflects the parasympathetic influence¹⁸ and standard deviation of RR intervals (SDNN), which is thought to reflect total variability (i.e., both the sympathetic and parasympathetic contribution).¹⁹ During the HRV recording, we visually surveyed the volunteers' breathing

frequency for accuracy. The breathing rate was kept higher than 12 cycles per minute.

•*Mental fatigue:* was evaluated twice, both times before competitions (t1 and t3). The evaluation was made by a psychologist through two subtests of the WISC-V (the abbreviated Chilean version), namely the digit retention and the letter-number sequencing tests,²⁰ as well as and the Stroop color recognition test.²¹ We then created a representative mental fatigue index based on the mean of standardized scores from the data collected from the tests.

Procedure

The swimmers were monitored at four experimental intervals during a twelve-week period. The first four experimental intervals were evaluated before and after the first (t1 and t2, respectively), and second competition (t3 and t4, respectively). During the week before t1, interviews were held with each athlete and his/her legal guardians and the baseline and anthropometric measurements were evaluated. The procedure was carried out with a qualified professional and each participant could be spoken to verbally to ensure both parties were satisfied with the requirements prior to data collection. Protocols were applied in the experimental intervals to determine the fatigue of swimmers during competitive cycles. Each evaluation was carried out after 24 hours of physical training. All standardized tests were performed in a closed room and performed by the investigator who was blinded from the study participants at the time of the evaluations. Among the conditions of clothing, participants were asked to wear a shirt, shorts, and footwear. Prior to the evaluations, all participants were instructed to (a) rest adequately the night before, sleeping 8 or more hours, (b) not consume stimulant drinks prior to the measurements, (c) consume ~ 2 liters of water during the day above, (d) eat regularly without making modifications to the diet. During the day of the tests, the participants were instructed to give their maximum effort during the tests. Heart rate, body weight, and height were measured before each fatigue protocol. Fatigue was evaluated in three areas: physical, physiological, and mental.

Statistical analysis

The data are presented as means and standard deviations (\pm SD). The normality of the data was verified through the Shapiro-Wilk test and Pearson's correlation was used to compare the relationship between the swimmers and HRV parameter, conformist traits, and the fatigue index. After this analysis, the means were analyzed with the student t test to compare the AN and DN groups. The probability of a type I error (alpha) was established at 5% and a confidence level of 95%. We set statistical significance at $p < 0.05$.

Results

[Table 2](#) lists the HRV (before and after physical fatigue), the Wingate test (Maximal power and fatigue index) and the mental fatigue results of AN and DN groups from the different experimental intervals.

With the swimmers as a whole, there is a positive correlation between the fatigue index and RMSSD_B $r_{(n=25)} = 0.47$, $p = 0.021$ and SDNN_B, $r_{(n=25)} = 0.41$, $p = 0.047$ in t1.

There was a positive correlation between the conformist traits of all swimmers in t1 with SDNN_A $r_{(n=24)} = 0.48$; $p = 0.019$, RMSSD_A, $r_{(n=24)} = 0.53$; $p = 0.007$, but a negative correlation with RMSSD_A in t2, $r_{(n=24)} = -0.44$; $p = 0.032$ and RMSSD_A in t3, $r_{(n=24)} = -0.41$; $p = 0.047$.

With the DN group in t1 there was a negative correlation between mental fatigue and RMSSD_A $r_{(n=12)} = -0.61$; $p = 0.035$ and

Table 2. Heart rate variability, the Wingate test, and mental fatigue for two experimental groups

	DN (n=13)				AN (n=12)			
	t1	t2	t3	t4	t1	t2	t3	t4
RMSSD_B (ms)	88 ± 32	54 ± 37	58 ± 33	51 ± 24	106 ± 60*	79 ± 62	69 ± 59	43 ± 38
RMSSD_A (ms)	56 ± 43	86 ± 57	71 ± 55	42 ± 32	71 ± 44	53 ± 41	51 ± 41	44 ± 31
SDNN_B (ms)	49 ± 24	53 ± 26	56 ± 22	59 ± 35*	77 ± 39*	67 ± 46	60 ± 43	48 ± 34*
SDNN_A (ms)	50 ± 23	75 ± 43	64 ± 37	41 ± 28	60 ± 32	52 ± 31	112 ± 213	40 ± 19
Maximal Power (W)	270 ± 121 ^a	315 ± 165	314 ± 141*	348 ± 152	263 ± 100 ^b	292 ± 88	310 ± 99*	318 ± 80
Fatigue Index (%)	21 ± 6 ^b	6 ± 20	28 ± 13	29 ± 14	28 ± 12*	28 ± 12 ^a	20 ± 9	22 ± 9
Mental Fatigue	6 ± 1		6 ± 2		7 ± 1		6 ± 1	

The results of the Wingate test, and Mental Fatigue assessments. RMSSD (the root of the mean squared differences of successive RR intervals) and SDNN (standard deviation of RR intervals) are presented in two periods: before (_B) and after (_A) the fatigue protocol. Mental fatigue is based on the mean of a standardized score. Significant differences are described according to the following codes: * for $p < 0.05$ between group; ^a for $p < 0.05$ in comparison with SDNN_A in the same interval and group; ^b for $p < 0.05$ in comparison with t4 in the same group; ^c for $p < 0.05$ in comparison with t2 in the same group; ^d for $p < 0.05$ in comparison with t3 in the same group. All data are mean ± standard deviation

SDNN_A $r_{(n=12)} = -0.63$; $p=0.027$. As well, in t3 there was a negative correlation between mental fatigue and RMSSD_B $r_{(n=12)} = -0.68$; $p=0.021$, SDNN_B $r_{(n=12)} = -0.75$; $p=0.007$, and Maximal Power $r_{(n=12)} = -0.73$; $p=0.007$.

With the AN group in t1, there was a positive correlation between the fatigue index and RMSSD_B, $r_{(n=13)} = 0.58$, $p=0.039$. Nevertheless, there was at the same time a negative correlation in mental fatigue and the fatigue index $r_{(n=13)} = -0.68$, $p=0.010$ and RMSSD_A and Maximal Power $r_{(n=13)} = -0.65$, $p=0.023$. In t3, this group had a positive correlation between mental fatigue and the fatigue index $r_{(n=13)} = 0.68$, $p=0.016$.

Figure 2 shows the responses of the two groups to the fatigue index, with details on behavior and significant differences in each of the experimental intervals.

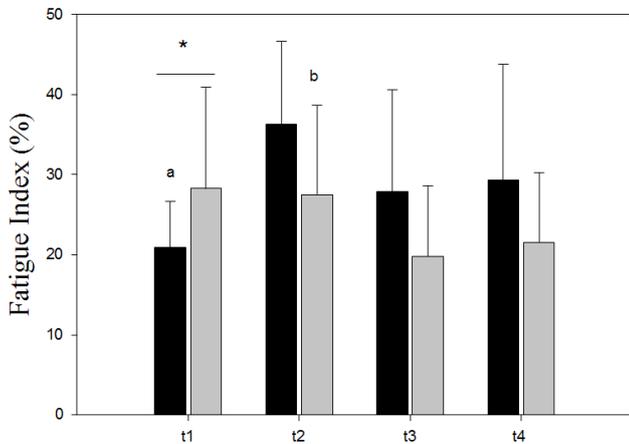


Figure 2. Fatigue index for the experimental groups, the DN group (black bar) and the AN group (grey bar), and intervals. Significant differences are described according to the following codes: a, for t1 vs t2 in the DN group, $p=0.021$; b, for t2 vs t3 in the AN group, $p=0.034$; *, for DN and AN in t1, $p=0.05$.

Discussion

This research is the first to our knowledge that has studied the role of personality traits in the fatigue response of adolescent swimmers. Previous studies have studied adult swimmers⁶ and compared them with novice swimmers.²² However, we believe that the study of these traits at an early age is important to better address the development of swimmers in their first years of regular competition, especially the DN group that may be more sensitive to physiological and mental fatigue directly affecting the performance.

In the literature, there is a correlation between the number of years of experience of a swimmer and the presence of conformist traits.⁶ These features have a stronger presence in less experienced swimmers. However, this difference was not evident in our study. The members of the two groups, AN and DN, have similar years of experience, indicating that there is no relationship between regulatory features and years of experience. The

presence of these traits in the athletes participating in this study may be due to social aspects characteristic of isolated areas with extreme weather that influence the social development of individuals, which should be analyzed in future research.

A high degree of autonomic activity was observed among the swimmers before the stress test, related to a higher fatigue index in t1. After the first physical test, athletes with more pronounced conformist traits responded better to physiological fatigue based on higher regulation RMSSD_A and SDNN_A in the same experimental interval. However, in t2 and t3 this compensatory reaction to fatigue did not act in the same way in these athletes, presenting a negative correlation between conformist traits and the parasympathetic response observed in RMSSD_A. It is presumed that the accumulated physical fatigue of subjects with greater regulation did not allow the physiological response to be optimal after the first competition.²³

The AN group showed greater autonomic modulation and parasympathetic response than the DN group in the stress test in t1. However, the group had a higher fatigue rate during the stress test, indicating greater physical fatigue during this period. The DN group had less mental fatigue, which is associated with a lower autonomic and parasympathetic response after exercise, reflecting a physiological response closely associated with the mental activity of the athletes. The lower mental fatigue of this group is related to what has been observed in extroverted swimmers that have a greater capacity to withstand psychic load and fatigue than swimmers with more introverted features.⁹ At the end of the first cycle of competition, both groups had a higher maximum power in t2 than t1. However, DN had a higher rate of physical fatigue than before the competition.

In the second cycle of competitions, both groups had less mental fatigue at the beginning of the competition cycle (t3). With the AN group, this decrease is related to greater physical fatigue, although it was significantly less than in t2. Meanwhile, with the DN group, this decrease in mental fatigue only correlates with a lower autonomic response prior to the stress test.

At the end of the last cycle of competitions, it can be seen in t4 that the AN group has a higher maximum power index, following the same physical response of the previous cycle, which shows that the members of the group increase their physical power after competitions, compared to moments before them. Both groups have greater autonomic responses in t4 prior to making the physical effort, compared to the subsequent regulation, reflected in the SDNN values. This response shows that the physiological response to fatigue in both groups is compensatory for the effort they made, presumably due to the accumulated fatigue of the athletes after two cycles of competition. Pérez et al. observed that the personality traits of the swimmers require different stress management strategies in the post-competitive periods, especially with introverted swimmers, which may be highly associated with the traits of the AN group in our study.⁹

Although no set of personality traits can be used to identify the best swimmers,¹⁰ it is important to know how these traits influence fatigue in young swimmers, since it can be a very important factor in the development of the training of physical and psychophysiological qualities of athletes, which will then have a

direct impact on their adult development in sports. The findings of this study suggest that the training plans of young swimmers should include strategies that evaluate conformist traits, having a greater sympathy with those closer to DN. In these athletes, as they are more sensitive to physiological and mental fatigue, longer recovery times and supercompensation should be considered, avoiding mental overtraining. These strategies should be a routine part of every coach's psychological considerations, especially in the early stages of the sport.

Among the strengths of this study are: the longitudinal design of the study, which measured four times, increasing internal consistency; the follow-up period that considered real and not simulated competitions; the type of measurement instruments that considered validated surveys and objective measurements that can be used in other contexts of training with athletes. The main limitations were: not controlling the rest and the hours of sleep that could influence the physical and psychological fatigue of the athletes; the number of participants that could affect the results. Despite this, this study reports novel information on variables that are little studied and that affect the performance of swimmers.

This study was able to conclude that regulation accounts for different responses to fatigue among adolescent swimmers. Physical fatigue seems to have been the most important conditioning in both competition cycles of the athletes, however, when we relate fatigue to the degree that swimmers conform to norms, the DN group may be more sensitive to physiological and mental fatigue directly affecting the physical performance of athletes, so it is necessary to address this behavior in training models for young swimmers.

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References

- Sweetenham B, Atkinson J. Championship swim training. Champaign, IL: Human Kinetics; 2003.
- [Kenttä G, Hassmén P, Raglin JS. Mood state monitoring of training and recovery in elite kayakers. Eur J Sport Sci. 2006; 6:245-53.](#)
- Gould D, Dieffenbach K. Overtraining, under recovery, and burnout in sport. Kellmann M, editor. Enhancing recovery: Preventing underperformance in athletes. Champaign, IL: Human Kinetics; 2002.
- [Meeusen R, Duclos M, Gleeson M, Rietjens G, Steinacker J, Urhausen A. Prevention, diagnosis and treatment of the Overtraining Syndrome. ECSS position statement "task force." Eur J Sport Sci. 2006;6:1-14.](#)
- [Thomas DT, Erdman KA, Burke LM. American College of Sports Medicine Joint Position Statement. Nutrition and Athletic Performance. Med Sci Sport Exerc. 2016;48:543-68.](#)
- [Behrman RM. Personality differences between nonswimmers and swimmers. Res Q Am Assoc Heal Phys Educ Recreat. 1967;38:163-71.](#)
- [Turp M. The role of physical exercise in emotional well-being: A psychodynamic perspective. Psychodyn Couns. 1997;3:165-77.](#)
- [Cattell RB, Wagner AA, Cattell MD. Adolescent personality structure, in O-data, Checked in high school personality questionnaire. Br J Psychol. 1970;61:39-54.](#)
- Pérez S, Govea P, González G, Rodríguez E. Rasgos de personalidad en nadadores de la Universidad de Colima. Educ Física Argenmex temas y posiciones. 2010.
- [Newman EN. Personality traits of faster and slower competitive swimmers. Res Q Am Assoc Heal Phys Educ Recreat. 1968;39:1049-53.](#)
- [Cavallera GM, Passerini A, Pepe A. Personality traits and the role of gender in swimmers at the leisure level. Soc Behav Pers. 2013;41:693-703.](#)
- [Vučković I, Aleksandar G, Željko S, Kukrić A. Conformity of athletes: roles of type of sports, gender and competition experience. HOMO Sport. 2012;12-6.](#)
- Vinet E, Brio C, Correa P, Díaz P, Diez M, Echeverría M, Salazar D, Vargas A. MACI, traducción y adaptación chilena para usos exclusivo en investigación (Proyecto de Investigación DIDUFRO 9966) Temuco: Universidad de La Frontera. Temuco; 1999.
- [Mialich MS, Martinez EZ, Jordão Jr. AA. Comparative study of instruments for the analysis of body composition in a sample of the Brazilian population. Int J Body Compos Res. 2011;9:19-24.](#)
- Loría Calderón T, Rodríguez Hernández M. Efecto de un programa de 18 semanas de actividad física sobre la capacidad aeróbica, la fuerza y la composición corporal en personas adultas mayores. Rev Pensam Actual. 2018;18.
- Oded Bar O. Test Anaeróbico Wingate [Internet]. México: Universidad Autónoma de Ciudad de Juárez; 1993 [cited 2021 August 05]. Available from: <http://www3.uacj.mx/ICB/redcib/Publicaciones/Actividad%20Fisica%20y%20Recreacin/Test%20Anaer%C3%B3bico%20Wingate.pdf>
- [Heart rate variability: standards of measurement, physiological interpretation and clinical use. Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Circulation. 1996;93\(5\):1043-65.](#)
- [Buchheit M, Chivot A, Parouty J, Mercier D, Al Haddad H, Laursen PB, et al. Monitoring endurance running performance using cardiac parasympathetic function. Eur J Appl Physiol. 2010;108:1153-67.](#)
- [Berntson GG, Bigger JT, Eckberg DL, Grossman P, Kaufmann PG, Malik M, et al. Heart rate variability: Origins, methods, and interpretive caveats. Psychophysiology. 1997;34:623-48.](#)
- Rosas R, Pizarro M. WISC-V Manual de Administración y Corrección. Santiago de Chile: CEDETI-UC; 2018.
- Golden CJ. Stroop: test de colores y palabras: manual. Madrid: TEA Ediciones; 1994.
- [Meredith GM, Harris MM. Personality traits of college women in beginning swimming. Percept Mot Skills. 1969;29:216-8.](#)
- [Michael S, Graham KS, Oam GMD. Cardiac Autonomic Responses during Exercise and Post-exercise Recovery Using Heart Rate Variability and Systolic Time Intervals — A Review. Front Physiol. 2017 ;8:301.](#)