Sport training behaviors and emotional responses associated with temporomandibular disorders in student athletes during the COVID-19 Pandemic

Conductas en el entrenamiento deportivo y respuestas emocionales asociadas a los trastornos temporomandibulares en estudiantes deportistas durante la pandemia

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Abstract

Introduction: The consequences of the SARS-CoV-2 coronavirus pandemic could affect on the physical activity, mental health, and oral health of student athletes.
Objective: To determine the prevalence of Temporomandibular Disorders (TMDs), and associated sport training behaviors and emotional responses in student athletes during COVID-19 isolation.
Methodology: 643 student athletes at a Chilean university sport department (with an average age of 22.05 ±2.94 years) were evaluated using an online survey to register TMDs and review sport training behaviors and emotional responses during COVID-19 isolation.
Results: 40% of student athletes reported inadequate training materials, 70% felt their physical condition improved, and over 50% reported difficulty sleeping. Lack of concentration, irritability and anxiety were also experienced. 65.47% showed the presence of TMDs. The most frequently experienced symptoms were feeling tense or nervous (35.15%), increased frequency of headaches (31.73%), TMJ clicking while chewing or opening the mouth and clenching or grinding the teeth (25.97%). Statistically significant correlations were found among sports training behaviors, emotional responses, and TMD variables. Notably, psychological impact was strongly associated with TMD symptoms ($r = 0.416$, $p < 0.001$), while behavioral issues showed moderate correlation with psychological impact and a weak inverse correlation with the prevalence of TMD.
Conclusions: Anxiety, irritability, and sleep disturbances were strongly linked to increased TMD symptoms during COVID-19. A moderate association with behavioral difficulties highlights the need to address both psychological and behavioral domains in future sport and health interventions, especially during lockdowns.

Keywords

Athletes; behavior; COVID-19; emotions; physical activity; students; temporomandibular disorders.

Resumen

Introducción: Las consecuencias de la pandemia coronavirus SARS-CoV-2 podrían afectar la actividad física, salud mental y salud oral de los estudiantes deportistas. Objetivo: Determinar la prevalencia de Trastornos Temporomandibulares (TTM), asociado a conductas al entrenamiento deportivo e impacto psicológico en estudiantes deportistas durante el aislamiento del Covid-19. Metodología: 643 estudiantes deportistas de una universidad chilena (22,05 ±2,94 años) fueron evaluados mediante una encuesta online para registrar los trastornos temporomandibulares, comportamiento deportivo e impacto psicológico durante el aislamiento Covid-19. Se realizaron análisis descriptivos e inferenciales para analizar los datos obtenidos.
Resultados: El 40% de los estudiantes deportistas reportaron materiales de entrenamiento inadecuados, el 70% percibió mejoría en su condición física y más del 50% tuvo dificultades para dormir, además de falta de concentración, irritabilidad y ansiedad. El 65,47% presentó TTMs, siendo los síntomas más frecuentes sentirse tenso o nervioso (35,15%), dolores de cabeza frecuentes (31,73%) y chasquido de la ATM, apretar o rechinar los dientes (25,97%). Se hallaron correlaciones significativas: el impacto psicológico se asoció fuertemente con los síntomas de TTM ($r = 0,416$, $p < 0,001$), mientras que las conductas relacionadas al entrenamiento mostraron correlación moderada con el impacto psicológico y débil e inversa con la prevalencia de TTM.
Conclusiones: La ansiedad, irritabilidad y trastornos del sueño están asociadas fuertemente con el aumento de síntomas de TTM durante la COVID-19. El comportamiento y el impacto psicológico mostraron una asociación moderada, destacando la necesidad de abordar ambos factores en intervenciones futuras.

Palabras clave

Atletas; actividad física; comportamiento; Covid-19; desordenes temporomandibulares; emociones; estudiantes.

Introduction

COVID-19, caused by the SARS-CoV-2 coronavirus, is a serious and dangerous disease that affected and still continues to affect the health of people all around the world. The World Health Organization (WHO, 2023) announced the disease's status as a global pandemic in 2020 and proposed various guidelines, restrictions and rules to manage the situation, such as social distancing, canceling crowded group events and closing public spaces, as well as quarantine and isolation for an undetermined length of time. In 2023, the WHO declared an end to COVID-19 as a global health emergency; however, the risk of new variants and the management of the disease continues, as well as recovery from the undesired phycological, economic and social consequences.

Isolation during the COVID-19 pandemic led to several negative consequences, such as irritability, emotional changes, anxiety, stress, depression, fear and confusion, as well as less frequent or deficient physical activity, among others. Several studies have assessed the mental states of different groups of subjects, including student athletes, during isolation (Cerqueira et al., 2021; Grubic et al., 2021; Jurecka et al., 2021; Samaranayake, 2022). Overall, the temporary closure of sports facilities negatively impacted student athletes' mental health, affecting their exercise quality and psychological state. However, the mental health of athletes is generally better than that of non-athletes, and the positive effects of sport on mental health continued during isolation (Casali et al., 2021). Quarantine and isolation worsen existing mental health pressures on student athletes, and reduced training intensity during lockdown is associated with lower sleep quality and higher instances of insomnia in elite athletes (Carnevale Pellino et al., 2022; Eather et al., 2023).

Physical activity may have protected mental health, and the overall positive effect of sport on mental health continued during isolation. Young adults were a risk group during COVID-19 isolation, particularly females under 28.5 years old who are single, less educated and living in Europe (Carnevale Pellino et al., 2022; Costa et al., 2020; Lopes Soares et al., 2022; Romdhani et al., 2022; Vitale et al., 2021). In addition, during lockdown, athletes faced challenges that reduced their motivation, this being exacerbated by a lack of competition. Home practice and competition could help athletes and coaches improve their self-regulation capabilities, such as metacognitive abilities and motivation, but psychological assistance is also important (Jurecka et al., 2021; Vitale et al., 2021; Waddington, 2021; Washif et al., 2022; Wolf et al., 2021).

Isolation did not just affect mental health but also had consequences on general and oral health. One of the common oral manifestations was Temporomandibular disorders (TMDs), which is the general term for several clinical problems related to disorders of the jaw muscles, temporomandibular joint (TMJ), ligaments, and the nerves related to chronic facial pain (Al-Moraissi et al., 2023). The TMJ, like any other joint, is susceptible to disorders that cause signs and symptoms such as joint pain and/or clicking, pain in the muscles used for chewing, limitations in normal mouth opening (or maximum opening), or in the eccentric movement of the jaw, as well as dental signs such as wear due to bruxism, and sleep disorders (Al-Moraissi et al., 2023; Lobbezoo et al., 2018). TMDs and sleep-related disorders may be linked to anxiety, stress and depression. Patients with bruxism and TMDs often experience increased hostility and stress sensitivity. Accordingly, TMDs are a multifactorial matter with a need for diagnostics, potentially influencing medical disorders like Parkinson's, dementia, epilepsy, night terrors, sleep apnea, ADHD (Attention-Deficit/Hyperactivity Disorder) and others. Evidence of the relationship between TMDs and psychosocial factors is increasing, but the conclusiveness of such relationship remains uncertain (Di Giacomo et al., 2021; Fluerașu et al., 2022; Osses-Anguita et al., 2023).

The diagnosis of TMDs is classified according to the level of certainty of their occurrence, as either possible (self-reporting), probable (clinical examination/findings), or definite (instruments or equipment). The Fonseca Anamnestic Index (FAI) (Nomura et al., 2007; Sánchez-Torrelo et al., 2020) is a simple and quick self-administered questionnaire used for screening TMDs. It assesses the degree of severity of TMD symptoms and is an easily applied alternative TMD assessment tool that has been found to be a reliable diagnostic tool in detecting TMD-related symptoms and severity even in asymptomatic individuals (Nomura et al., 2007; Yap et al., 2022). The FAI has been validated in various languages, including Chinese, Spanish and Turkish, and has been found to have good psychometric properties (Sánchez-Torrelo et al., 2020).

According to several studies, the prevalence of TMDs during and after the COVID-19 pandemic has increased, with rates as high as 30% of the population (Osses-Anguita et al., 2023; Winocur-Arias et al., 2022). Increased levels of oral parafunctional habits during the COVID-19 pandemic may have resulted in an increased prevalence of orofacial pain and TMDs in student-athletes.

It can be concluded from the available scientific literature that further research and information about the consequences of the SARS-CoV-2 coronavirus pandemic on the physical activity, mental health, and oral health of student athletes is still required. For this reason, the aim of this study was to investigate the prevalence of TMDs, together with sport training behaviors and emotional responses during COVID-19 isolation periods in student athletes.

Method

Participants

This study used a quantitative, descriptive, cross-sectional approach, with a non-experimental design. 643 student athletes, with a mean age of 22.05 ±2.94 years, from a Chilean private university with three campuses (Andres Bello University: Santiago- 287 athletes / Viña del Mar- 171 athletes / Concepción- 185 athletes) were evaluated during 2020-2021 by way of an online survey. The participants were female 42.3% and male 57.7%, with a civil status of single 97.8%, in a relationship 1.2% and married 1.1%). All participants were in good health (no systemic conditions or medication were recorded). The sampling method used was census sampling. A questionnaire was completed containing questions related to epidemiological data, sleep disorders, emotional factors, and reactivity in the context of the COVID-19 pandemic, as well as manifestations of TMDs. All participants received an explanation of the purpose and methods of the study. Digital informed consent was obtained from all subjects in compliance with the Helsinki Declaration. The approval of the Ethics Committee of the Health Sciences Faculty was obtained beforehand (Nr. PI 006-19).

Procedure

For this study, sociodemographic data was collected: sex, age, civil status, level of competition, sports played and number of training hours per week during quarantine.

Additionally, behavior related to sports training (BIST) in the context of the COVID-19 isolation was assessed with an Ad Hoc scale of 7 questions to measure the behavior of university athletes during lockdown in relation to their sports training. Each item had five Likert-like response options, ranging from 1 = never to 5 = Always. The sum of the individual item scores gave a total score, where a higher value indicated better management of training from home. The questions were evaluated by 5 professionals specializing in methodology, psychology and sports, who stated that all the items were suitable for the established purposes, with an Aiken V value of 1 for all the items. The reliability of the questionnaire was adequate (α = .65; ω = .67).

Also, psychological impact in sports training (PIST) in the context of the COVID-19 isolation was evaluated using an Ad Hoc scale of 8 questions to measure the psychological impact on university athletes during isolation. Each item had five Likert-like response options, ranging from 1 = never to 5 = Always. The sum of the individual item scores gave a total score, where a higher value indicated a more unfavorable psychological impact. The questions were evaluated by 5 professionals specializing in methodology, psychology and sports, who stated that all the items were suitable for the established purposes, with an Aiken V value of 1 for all the items. The reliability of the questionnaire was adequate (α = .76; ω = .79).

The prevalence of TMDs in the study group was assessed based on 10 questions using the Fonseca Anamnestic Index (FAI). They were answered with “yes”, “no” or “sometimes” with only one answer to be marked for each question. The total score was classified as severe, moderate, mild, or non-TMD (Nomura et al., 2007; Sánchez-Torrelo et al., 2020).

Data analysis

After completing the questionnaires, the data collected was initially processed using Microsoft Excel (Microsoft Office) and Jamovi (Stats Open now). Descriptive analyses were carried out on all the variables and presented in frequencies and through the percentage distribution table. The internal consistency of the scales was evaluated through Cronbach's alpha coefficient (Cronbach, 1951) and the omega coefficient (McDonald, 1999). A value greater than .65 was considered adequate (Katz, 2006). Mean and Sd were used for age and for the total score of each questionnaire. Correlations between behavioral sport, psychological impact and presence of TMDs were examined using Pearson's correlation coefficients. Additionally, the magnitude of the impact of the correlation between three variables was considered to measure the effect size. In the evaluation of these correlation impact sizes, Cohen's (1988) criteria were considered, with reference values for small, moderate, and large effects proposed, which were .10, .30, and .50, respectively.

Results

The study evaluated 643 student athletes from the Andres Bello University (Santiago- 287 athletes (44,6%) / Viña del Mar- 171 athletes (26,6%) / Concepción- 185 athletes (28,8%) Campus- Chile) during the COVID-19 isolation period. Men's football men was the sport most played (11,7%, 75 students), then women's Volleyball (9.8%, 63 students) and men's Volleyball (8.9%, 57 students). Lesser played sports were women's Judo (0.5%, 3 students), women's Tennis (0.6%, 4 students) and women's Athletics (0.8%, 5 students). In relation to the number of training hours per week during quarantine, most participants (34.2%, 220 students) trained an average of 5-7 hours per week and in contrast, just 3% (19 students) trained more than 16 hours. General data such as gender, age, civil status, sport played, level of competition and hours spent playing is presented in Table 1.

Table 1. General characteristics of the total sample of student athletes in the context of the COVID-19 pandemic (n= 643)

Variables		Frequency	Percentage (%)
Sex	Female	273	42,3
	Male	370	57,7
Age		22,05	±2,94*
Civil Status	Single	629	97,8
	In a relationship	7	1,2
	Married	7	1,1
Level of competition	University	411	64,2
	National	169	26,3
	International	35	5,5
	No competing	28	4,4
Sports	Athletics Women	5	,8
	Athletics Men	6	,9
	Handball Women	28	4,4
	Handball Men	40	6,2
	Basketball Women	35	5,4
	Basketball Men	47	7,3
	Fencing	8	1,2
	Football Women	54	8,4
	Football Men	75	11,7
	Futsal Women	14	2,2
	Futsal Men	16	2,5
	Hockey Women	15	2,3
	Judo Women	3	,5
	Judo Men	9	1,4
	Swimming Women	24	3,7
	Swimming Men	21	3,3
	Rugby	49	7,6
	Taekwondo Women	13	2,0
	Taekwondo Men	19	3,0
	Tennis Women	4	,6
	Tennis Men	11	1,7
	Table Tennis Women	10	1,6
	Table Tennis Men	17	2,6
	Volleyball Women	63	9,8
	Volleyball Men	57	8,9

Number of training hours	Less than 5	136	21,2
per week during quarantine	5-7.	220	34,2
	8-10.	153	23,8
	11-13.	68	10,6
	14-16	30	4,7
	More than 16	19	3,0
	Not applicable	17	2,6

*Mean ±standard deviation

The responses to behavior related to sports training of all the athletes in the context of COVID-19 isolation are shown in Table 2. Approximately 40% (rarely 28,8% -never 13,1%) of all the participants affirmed that they did not have the materials to train adequately during isolation, despite their coaches having sent keep-fit training plans to over three quarters (85,6%) of the student athletes, although just 53,7% received a follow-up from their coach. Just 13,2% were frequently tested to assess their fitness condition. Almost 95% of the participants followed the applicable rules during quarantine. The mean total score was 26.2 (± 4.21, minimum 11, maximum 35) (Table 2).

Table 2. Behavior related to sports training in the total sample of athletes in the context of COVID-19 isolation (n= 643)

Questions	Likert Scale n (%)				
	Never	Rarely	Sometimes	Often	Always
1. They have materials to train properly during quarantine	84 (13,1)	185(28,8)	161(25)	120(18,7)	93(14,5)
2. Coaches have sent training plans to keep them fit	8 (1,2)	27(4,2)	58 (9,0)	109(17,0)	441(68,6)
3. They had a follow-up by their coach	28(4,4)	31 (4,8)	85(13,2)	154 (24,0)	345 (53,7)
4. The team informed them about the situation of the sport	17(2,6)	51(7,9)	93(14,5)	151(23,5)	331(51,5)
5. Organizational capacity to train	20 (3,1)	93(14,5)	159(24,7)	207(32,2)	164(25,5)
6. Following the rules during quarantine	0	8(1,2)	15(2,3)	149(23,2)	471(73,3)
7. Having fitness checks	234(36,4)	169(26,3)	155(24,1)	53(8,2)	32(5,0)
Total Score	26.2 ±4.21*				

*Mean ±standard deviation

Results of the psychological impact in sports training of all the student athletes in the context of COVID-19 isolation are shown in Table 3. These emphasize that all the participants had some difficulties sleeping (19,6% always and 24,4% often), with 59,6% affirming that they slept between 4-8 hours and 8,2% between 0-4 hours. Lack of concentration (45,4% sometimes, 24,6% often) and increased irritability (37,5% sometimes, 28,5% often) and anxiety (36,7% sometimes, 28,8% often, 14,3% always) were experienced by the athletes during quarantine. They also recorded having arguments for insignificant reasons, between 1-2 times (40,1%), 3-4 times (15,6%) and more than 4 (17,1%). Further 30,3% of the participants were afraid of a family member dying; 28% recognized the appearance of occasional or unusual disorders or rituals and 48.9% recorded that they had difficulty staying motivated (often 34,4% and always 14,5%). 34,8% of all the student athletes said sometimes they were eating more than usual. The mean total score was 24.7 (± 5.57, minimum 10, maximum 40) (Table3).

Table 3. Psychological impact of sports training in the total sample of athletes in the context of the COVID-19 pandemic (n= 643)

Questions	Likert Scale n (%)				
	Never	Rarely	Sometimes	Often	Always
1. Having sleep difficulties	91 (14,2)	107(16,6)	162(25,2)	157(24,4)	126(19,6)
2. Lack of concentration	22(3,4)	116(18)	292(45,4)	158(24,6)	55(8,6)
3. Increased irritability	33(5,1)	123(19,10)	241(37,5)	183(28,5)	63(9,8)
4. Feeling anxious	43(6,7)	87(13,5)	236(36,7)	185(28,8)	92(14,3)
5. Fear of a family member dying	61(9,5)	136(21,2)	149(23,2)	102(15,9)	195(30,3)
6. Appearance of manias and rituals	232(36,1)	168(26,1)	180(28,0)	51(7,9)	12(1,9)
7. Difficulty staying motivated	39(6,1)	90(14,0)	200(31,1)	221(34,4)	93(14,5)
8. Eating more than usual	62(9,6)	157(24,4)	224(34,8)	129(20,1)	71(11,0)
Total Score	24.7 ±5.57*				

*Mean ±standard deviation

The numbers and percentages of student athletes with different levels of TMD dysfunction based on the FAI, according to gender, age and sports teams are presented in Table 4. Self-evaluated TMDs were iden-

tified in 65.47% of the participants, with differing severities. The main manifestation of TMDs was reported as TMJ clicking whilst chewing or when opening the mouth with the teeth not articulating well, 25.97%. Feeling tense or nervous was identified as a common clinical sign of bruxism and TMD. 40.28% of participants were classified as having mild dysfunction, whereas only 6.53 % were classified as having severe dysfunction. The majority (43,54%) of female participants were classified by the FAI as having mild dysfunction, with 28.04% classified as having moderate dysfunction. In contrast, 47,03% of male participants were classified as having no dysfunction. 40,80% of young adults (18-25 years old) were classified as having mild dysfunction, whilst 33,51% presented no dysfunction. 19.27% had moderate dysfunction and only 6,42% had severe dysfunction. 43.28% of adults (26-44 years old) were classified as having no dysfunction, 35.82% had mild dysfunction and only 7.46% had severe dysfunction. Also shown in Table 4 and Figure 1 are results according to the respective sports teams, where Athletics (45.45%), Rugby (51.02%) and Ping-pong (44.44%) showed the highest percentage of no dysfunction in their athletes, with Handball (51.47%) and Futsal (56.67%) showing mild dysfunction, followed by Judo (33.33%) with moderate dysfunction and finally, Swimming (13.33%) with severe dysfunction. The mean total score was 29.2 (±21.6, minimum 0, maximum 100), which would be interpreted as Mild dysfunction (Table 4).

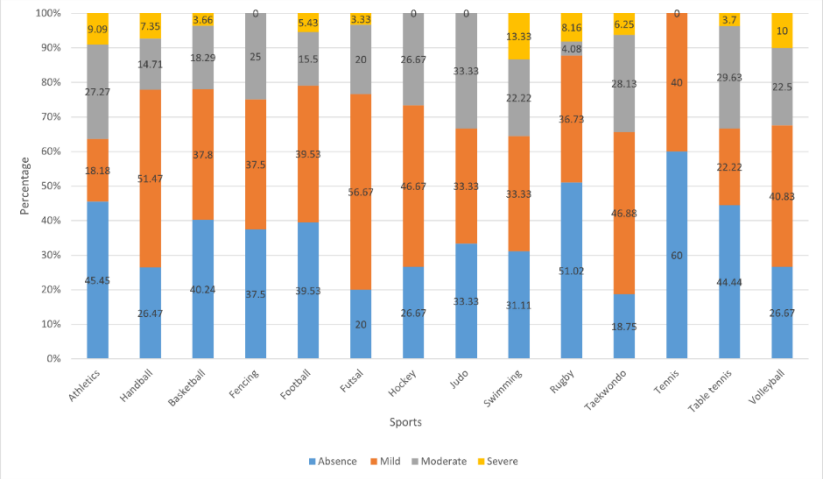
Table 4. Distribution of the Fonseca index in the total sample of athletes (n= 643) according to level of severity, gender, age, and sports team in the context of the COVID-19 pandemic.

		Fonseca's anamnestic index n (%)			
Variables		Absence	Mild	Moderate	Severe
Total sample of student-athletes		222 (34,53)	259(40,28)	120(18,66)	42(6,53)
Sex	Male	174 (47,03)	140(37,84)	44(11,62)	13(3,51)
	Female	48(17,71)	119((43,54)	76(28,04)	29(10,70)
Age	18 - 25 years	193(33,51)	235(40,80)	111(19,27)	37(6,42)
	26 - 44 years	29(43,28)	24(35,82)	9(13,43)	5(7,46)
Sports	Athletics	5(45,45)	2(18,18)	3(27,27)	1(9,09)
	Handball	18(26,47)	35(51,47)	10(14,71)	5(7,35)
	Basketball	33(40,24)	31(37,8)	15(18,29)	3(3.66)
	Fencing	3(37,5)	3(37,5)	2(25)	0
	Football	51(39,53)	51(39,53)	20(15,5)	7(5,43)
	Futsal	6(20)	17(56,67)	6(20)	1(3.33)
	Hockey	4(26,67)	7(46,67)	4(26,67)	0
	Judo	4(33,33)	4(33,33)	4(33,33)	0
	Swimming	14(31,11)	15(33,33)	10(22,22)	6(13,33)
	Rugby	25(51,02)	18(36,73)	2(4,08)	4(8,16)
	Taekwondo	6(18,75)	15(46,88)	9(28,13)	2(6,25)
	Tennis	9(60)	6(40)	0	0
	Table Tennis	12(44,44)	6(22,22)	8(29,63)	1(3,7)
	Volleyball	32(26,67)	49(40,83)	27(22,5)	12(10)
Total Score		29.2 ±5.57*			

*Mean ±standard deviation

Figure 1 shows the distribution of the Fonseca index according to level of severity and sports team in the context of the COVID-19 pandemic.

Figure 1. Distribution of the Fonseca index according to level of severity and sports team



Student athletes' responses to Fonseca's 10 questions are presented in Table 5. Among the "yes" responses, the most frequently reported TMDs problem was the participant considering themself to be a tense or nervous person (29.24%). It being hard to move the mandible from side to side (4,51%) was the least frequently reported problem. Among the "sometimes" responses, frequent headaches (31,73%) and the participant considering themself to be a tense or nervous person (35,15%) were the most frequently reported problems. It being hard to move the mandible from side to side (11,98%) and it being hard to open the mouth (17,42%) were the least frequently reported problems (Table 5).

Table 5. Distribution of responses of the participants to Fonseca's 10 questions (N =643)

Questions	Fonseca's anamnestic index n (%)		
	Yes	Sometimes	Not
1. Is it hard for you to open your mouth?	29 (4,51)	112(17,42)	502(78,07)
2. Is it hard for you to move your mandible from side to side?	28(4,35)	77(11,98)	538(83,67)
3. Do you get tired/experience muscular pain while chewing?	66 (10,26)	176(27,37)	401(62,36)
4. Do you have frequent headaches?	148(23,02)	204(31,73)	291(45,26)
5. Do you have pain on the nape or a stiff neck?	92(14,31)	192(29,86)	359(55,83)
6. Do you have earaches or pain in the craniomandibular joints?	64(9,95)	129(20,06)	450(69,98)
7. Have you noticed any TMJ clicking while chewing or when you open your mouth?	167(25,97)	153(23,79)	323(50,23)
8. Do you clench or grind your teeth?	135(21)	192(29,86)	316(49,14)
9. Do you feel your teeth do not articulate well?	167(25,97)	122(18,97)	354(55,05)
10. Do you consider yourself a tense/nervous person?	188(29,24)	226(35,15)	229(35,61)

Correlations among the variables are presented in Table 6. The correlational analysis revealed statistically significant associations among the three core variables: Behavioral Issues Related to Sports Training (BIST), Psychological Impact in Sport Training (PIST), and the Fonseca Anamnestic Index (FAI), which assesses TMD symptoms.

A moderate positive correlation was observed between BIST and PIST ($r = 0.213$, $p < 0.001$), indicating that athletes with higher behavioral challenges related to their sports training also reported greater psychological impact. In contrast, a weak but statistically significant negative correlation was found between BIST and FAI ($r = -0.129$, $p < 0.01$), suggesting that increased behavioral issues were associated slightly with lower self-reported TMD symptoms. A strong positive correlation was identified between PIST and FAI ($r = 0.416$, $p < 0.001$), demonstrating that greater psychological distress during training was significantly associated with a higher prevalence of TMD symptoms.

Table 6. Correlation between variables of the study: Behavioral issues related to sports training (BIST), Psychological impact in sport training (PIST), Fonseca index (FAI).

Variables	BIST Total	PIST Total	FAI Total
BIST Total	—		
PIST Total	-0.213 ***	—	
FAI Total	-0.129 **	0.416 ***	—

Statistical significance: * p < .05, ** p < .01, *** p < .001

Discussion

This study evaluated sports training behaviors and emotional responses in relation to the presence of temporomandibular disorders (TMDs) during the COVID-19 lockdown in a sample of 643 Chilean/Latin-American student athletes. A high prevalence of mild to moderate TMDs was observed, as well as symptoms of feeling tense or nervous, experiencing temporomandibular joint (TMJ) clicking, and feeling that the teeth did not articulate well. Psychological symptoms such as sleep disturbances, irritability, lack of concentration, and anxiety were frequently reported. Statistically significant correlations were found among behavioral, psychological, and TMD variables. Notably, a psychological impact was strongly associated with TMD symptoms, while behavioral issues showed moderate correlation with the psychological impact and a weak inverse correlation with TMD symptoms.

Nearly 70% of student athletes experienced a reduction of 5–7 training hours per week during the pandemic. These findings corroborate those of Facer-Childs et al. (2021), who reported decreased frequency and duration of training sessions among sub-elite and elite athletes during lockdown. Tayech et al. (2020) emphasized the challenges athletes faced in maintaining physical, physiological and mental fitness during confinement. Reduced training volume is associated with under-training, potentially impairing athletic performance and mental health (Romdhani et al., 2022; Vitale et al., 2021). Despite coaches providing structured fitness plans for home-based training, as was evidenced, limited access to equipment and space hindered some athletes, necessitating resilience and adaptation (Rosa et al., 2023). This disruption likely affected training quality and highlights the importance of developing tailored remote training plans to mitigate the impact of resource limitations during prolonged confinement.

Sleep disturbances were frequently reported, with some athletes noting longer sleep durations (8–12 hours) but poorer quality. These findings are consistent with Facer-Childs et al. (2021) and Vitale et al. (2021), who observed changes in sleep parameters and physical activity during the pandemic. Sleep disruptions were closely linked with decreased training and elevated levels of stress, anxiety, and emotional distress, reinforcing the role of lifestyle changes in sleep quality during lockdown.

The most frequently reported emotional responses were fear, irritability, lack of concentration, decreased motivation and anxiety. Many athletes admitted to increased arguments for insignificant reasons. These findings are consistent with previous studies reporting heightened negative emotions during the pandemic (Carnevale Pellino et al., 2022; Cerqueira et al., 2021; Jurecka et al., 2021; Lopes Soares et al., 2022; Romdhani et al., 2022; Şenışık et al., 2021). The transition to remote learning and confinement negatively impacted daily routines and, in some cases, worsened living conditions increasing the emotional responses (Cerqueira et al., 2021). In contrast, Solmi et al. (2024) observed lower depressive symptoms among individuals who adopted new training strategies—such as walking, home exercises, increased internet use and maintaining social contact. Similarly, Wolf et al. (2021) concluded that increased physical activity was associated with reduced anxiety and depression during the pandemic.

During lockdown, student athletes reported episodes of fear, mood instability, and engagement in ritualistic behaviors—such as superstitious or religious practices—often linked to reduced motivation. These rituals, commonly observed before high-stakes events, have been shown to alleviate anxiety and restore a sense of control under stress (Hobson et al., 2018; Daprati et al., 2019). These findings align with studies noting reduced motivation and emotional disturbances in athletes during lockdown, although home-based training programs may mitigate some of these effects (Jia et al., 2023; Leyton-Román et al., 2021; Vitale et al., 2021; Solmi et al., 2024).

Altered eating habits were also reported, including increased food intake and weight gain during isolation, reflecting global trends during the pandemic. Studies have shown increases in the prevalence and

severity of eating disorders, linked to psychological distress and disruptions to daily structure (Linardon et al., 2022; Petrie & Moore, 2023; Taheri et al., 2023; Li et al., 2024). Emotional eating, driven by stress, loneliness or anxiety, may compromise both nutritional habits and body image.

The majority of individuals reported heightened TMD symptoms in association with a deteriorating psychological state. 65.47% of the participants self-evaluated their TMDs severity. The most frequently noted TMD symptoms that participants cited were, in order of prevalence, being a tense or nervous person, TMJ clicking while chewing or opening the mouth, feeling that the teeth do not articulate well, an increased frequency of headaches, clenching or grinding of the teeth and fatigue. This study also found links between TMDs, and psychological factors experienced during the COVID-19 pandemic. These outcomes demonstrate that TMDs can be accentuated by psychological factors, notably stress and anxiety, as has previously been posited (Cerqueira et al., 2021; Colonna et al., 2021; Di Giacomo et al., 2021; Flueraşu et al., 2022; Osses-Anguita et al., 2023; Saczuk et al., 2022; Winocur-Arias et al., 2022). Based on these results, student athletes should understand the impact of TMDs and adopt proactive measures to manage stress and anxiety.

Female athletes were found to have a higher prevalence of mild to moderate TMDs compared to males, consistent with previous studies indicating a greater incidence of anxiety, poor sleep quality, and sedative use among women during lockdown (Gui et al., 2024; Bigalke et al., 2020). Pillay et al. (2020) showed that 52% of athletes confirmed adverse emotional states, with a marked preponderance of depression reported, principally among female participants. Casali et al. (2021) also observed higher psychological distress and body dissatisfaction in female athletes. In contrast, no major differences in TMD prevalence were observed between the younger (18–25) and older (26–44) participants or in the type of sports played, suggesting that psychological stress levels—rather than age and sport type—may be the more critical determinant.

Conversely, the moderate correlation between behavioral issues and psychological impact (BIST–PIST) aligns with existing literature emphasizing the role of behavioral regulation and emotional response under stressful conditions, particularly in athletic populations affected by disrupted routines, uncertainty and social isolation.

Interestingly, the inverse relationship between behavioral issues and TMD symptoms (BIST–FAI) may suggest a compensatory or adaptive behavioral response in some athletes, potentially linked to resilience or modified training habits. These findings are consistent with previous research by Şenışık et al. (2021), Taheri (2023), and Li et al. (2024), who reported a negative correlation between health-related physical activity goals and psychological mood indicators. This evidence highlights the complex interrelationship between physical activity and mental well-being. The mental health benefits of regular exercise have been well documented, particularly in university student populations, where aerobic exercises of low to moderate intensity have shown the greatest effectiveness in preventing and alleviating depressive symptoms (Herbert, 2022). Furthermore, physical activity may play a protective role in mental health by mitigating psychological stressors that contribute to the development or exacerbation of TMDs. However, further studies are necessary to explore potential mediators.

The strong positive correlation between psychological impact and TMD symptoms (PIST–FAI) reinforces the psychosomatic nature of TMDs. Emotional distress and anxiety—common psychological consequences of the pandemic—are well-established contributors to muscular tension and orofacial pain (Colonna et al., 2021; Daltaban & Aytekin, 2022; Winocur-Arias et al., 2022). Our results support the hypothesis that psychological burden can significantly influence the onset or aggravation of TMDs in student-athletes.

This study was conducted under COVID-19 isolation conditions and has certain limitations. The use of self-reported data may introduce bias and affect accuracy. Although the ad hoc questionnaires demonstrated reliability and validity as in a previous study (Caycho-Rodríguez et al., 2023), future studies should include psychometric evaluation. Also, clinical assessments such as polysomnography and masticatory muscle electromyography are crucial for more accurate TMD diagnosis. Additionally, personal factors (e.g. sleep quality, diet, parafunctional habits, and history of musculoskeletal disorders, etc.) should be considered in future studies to enhance the accuracy of predictive models for behavioral, psychological, and TMD-related outcomes.

Prioritizing physical and mental health, resource management, and environmental factors is essential in sports planning. Early intervention programs are critical for supporting athletes' emotional well-being during high-stress situations, such as lockdowns, when mental health issues and TMD symptoms may intensify (Wolf et al., 2021; Barbosa-Granados et al., 2022).

This study highlights the complex relationship between TMDs and mental health, reinforcing the need for multidisciplinary approaches in prevention and management. Health authorities should prioritize student athletes' well-being by developing strategies that support training continuity and promote integrated health, including preventive programs focused on mental health, sports and academic performance, and sleep quality.

Conclusions

This study highlights the significant interplay between psychological distress, behavioral changes and the presence of temporomandibular disorder (TMD) symptoms among student athletes during COVID-19 lockdown. The findings suggest that emotional challenges—such as anxiety, irritability, and sleep disturbances—were strongly associated with increased TMD symptoms, reinforcing the psychosomatic dimension of these disorders. While most athletes experienced reduced training volume and motivation, some demonstrated adaptive coping behaviors, indicating variability in psychological resilience. The moderate association between behavioral difficulties and psychological impact also emphasizes the importance of addressing both domains in sport and health interventions. These results should therefore serve a useful purpose in potential lockdown scenarios in the future.

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